International Symposium for Interface Oral Health Science 2022

-20years of IOHS: from oral health to well-being society-
-Satellite Symposium for Tohoku University 115th Anniversary Event-

PROGRAM and ABSTRACT

CAMPUS Asia Plus
Inter-University Exchange Project 2021-2026, MEXT, Japan

January 15 (Sat) ~ 16 (Sun), 2022
Tohoku University, Sendai, Japan

Tohoku University Graduate School of Dentistry, Sendai, Japan

PROGRAM

January 15 (Sat)

10:00−10:30   **Opening Ceremony**

         Dean and Professor **Nobuhiro TAKAHASHI**

             Graduate School of Dentistry, Tohoku University, Japan

         Executive vice-president **Keiichi SASAKI**

             Tohoku University, Japan

         Dean and Professor **Chuan-Bin GUO**

             School of Stomatology, Peking University, China

         Dean and Professor **Ho-Beom Kwon**

             School of Dentistry, Seoul National University, Korea

         Dean and Professor **Pornchai Jansisyanont**

             Faculty of Dentistry, Chulalongkorn University, Thailand

10:30−12:00   **Keynote I:** CAMPUS Asia Plus

         Chairpersons: Professor **Guang HONG**

             Graduate School of Dentistry, Tohoku University, Japan

K1-1 **Multimodal Education at Tohoku University Graduate School of Dentistry**

         Professor **Guang HONG**

             Graduate School of Dentistry, Tohoku University, Sendai, Japan

K1-2 **Current status of education and research at PKU-SS**

         Professor **Chuan-Bin GUO**

             School of Stomatology, Peking University, Beijing, China

K1-3 **A brief 100 year history of SNUSD and future perspectives**

         Professor **Gehoon CHUNG**

             School of Dentistry, Seoul National University, Seoul, Korea

K1-4 **Innovation-Driven Dental Education: Our challenge and chance**

         Professor **Jie-Fei Shen**

             West China School of Stomatology, Sichuan University, Chengdu, China

K1-5 **Introduction of the CAMPUS Asia programs in Yonsei University**

         Professor **Jung-Seok LEE**

             College of Dentistry, Yonsei University, Seoul, Korea

K1-6 **Innovative Dental Curriculum Structures: Moving Toward Global Dental Workforce**

Professor **Pornchai Jansisyanont**

Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand

K1-7 **Integrating Interprofessional Education and Practice in Dental Education: Universitas Indonesia Experience**

Professor **Melissa Adiatman**

Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia

12:20−13:20 **e-Poster Session I**

Chairpersons of P1-1~P1-12: **Dr. Shigeki SUZUKI**

Chairpersons of P2-1~P2-12: **Dr. Atsuhiro NAGASAKI**

Chairpersons of P3-1~P3-12: **Dr. Masatoshi TAKAHASHI**

Chairpersons of P4-1~P4-12: **Dr. Ryuji SHIGEMITSU**

Chairpersons of P5-1~P5-12: **Dr. Phoonsuk LIMRAKSASIN**

Graduate School of Dentistry, Tohoku University, Japan

13:20−14:00 **Lunch Break**

14:00−15:00 **Symposium I:** Young Researchers Invited Lecture

Chairpersons: Associate Professor **Masahiro YAMADA**

Graduate School of Dentistry, Tohoku University, Japan

S1-1 **Coriander Vs Candida, a new regimen for oral candidiasis treatment**

Dr **Kittipong Laosuwan**

Faculty of Dentistry, Chiang Mai University, Chiang Mai, Thailand

S1-2 **The identification and regulation of skeletal-related mesenchymal stem cells in bone development and homeostasis**

Dr. **Yu SHI**

West China School of Stomatology, Sichuan University, Chengdu, China

S1-3 **Dispersion of aerosols and droplets in different dental procedures**

Dr. **Jun WATANABE**

Graduate School of Dentistry, Tohoku University, Sendai, Japan

15:00−16:30 **Keynote II:** Shoku-gaku Research

Chairpersons: Professor **Hiroyasu KANETAKA**

Graduate School of Dentistry, Tohoku University, Japan

K2-1 **Shoku-gaku: Transdisciplinary Science of Eating, Food, and Nutrition**
   – Promoting lifelong health and wellbeing through right eating and right food –
   Professor **Nobuhiro TAKAHASHI**

   Graduate School of Dentistry, Tohoku University, Sendai, Japan

K2-2 **The novel visualization and evaluation methods for swallowing process and dynamic food bolus properties**
   Dr. **Tetsu KAMIYA**

   NAGASE & Co., Ltd., Tokyo, Japan

K2-3 **Chemical biology of bioactive molecules**
   Professor **Minoru ISHIKAWA**

   Graduate School of Life Science, Tohoku University, Sendai, Japan

K2-4 **New challenges in geriatric dentistry: Prescribing food with appropriate physical properties for older adults with difficulty eating**
   Dr. **Yasue TANAKA**
   Graduate School of Dentistry, Tohoku University, Sendai, Japan

16:30–17:40   **Keynote III:** Bigdata Analysis in Health and Social Science
   Chairpersons: Professor **Ken OSAKA**

   Graduate School of Dentistry, Tohoku University, Japan

K3-1 **Sociocultural context and oral health in Thailand**
   Dr. **Piyachat Patcharanuchat**

   Faculty of Dentistry, Khon Kaen University, Khon Kaen, Thailand

K3-2 **The results of cohort studies of a highly generalizable population and nationwide big data studies, and the future of epidemiological research using real-world data**
   Dr. **Kenji TAKEUCHI**

   Graduate School of Dentistry, Tohoku University, Sendai, Japan

K3-3 **Integrating Oral Health Care Transformation and Health Services Research**
   Dr. **Teoh Khim Hean**

   National Dental Research Centre Singapore, Singapore

January 16 (Sun)

10:00-11:30   **Keynote IV**: Biological Interface-Microbiome

Chairperson: Professor **Nobuhiro TAKAHASHI**

Graduate School of Dentistry, Tohoku University, Japan

K4-1 **Oral Microbiome-*Beyond Bacteria***

Professor **Xue-Song HE**

The Forsyth Institute, Boston, USA

K4-2 **Metabolic functions of the oral microbiome: How does the oral microbiome function and contribute to our health?**

Dr **Jumpei WASHIO**

Graduate School of Dentistry, Tohoku University, Sendai, Japan

K4-3 **Oral Microbiome-systemic Link: Current Limitations and Future Artificial Intelligence-based Approaches**

Dr **Jaya Seneviratne**

National Dental Research Institute Singapore, Singapore

K4-4 **The twists and turns of periodontal disease: etiological insights and a novel treatment approach**

Professor **Rory Watt**

Faculty of Dentistry, The University of Hong Kong, Hong Kong, China

11:30-12:40   **Keynote V**: Periodontium-the Biological interface between Periodontal Regeneration and Periodontal Repair

Chairperson: Professor **Minoru WAKAMORI**

Graduate School of Dentistry, Tohoku University, Japan

K5-1 **Wnt5a, released from mechanically stimulated periodontal ligament cells, promotes neurite elongation and branching in peripheral neurons**

Professor **Minoru WAKAMORI**

Graduate School of Dentistry, Tohoku University, Sendai, Japan

K5-2 **Mechanical force and the control of periodontal ligament cell behaviors**

Professor **Thanaphum Osathanon**

Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand

K5-3 **Root Cementum, the Biological Interface between Periodontal Regeneration and Periodontal Repair**
　　　　　Professor **Axel Spahr**

　　　　　　School of Dentistry, The University of Sydney, Sydney, Australia

12:40−13:10　　**Lunch Break**

13:10−14:30　　**e-Poster Session II**
　　　　　Chairpersons of <u>P6-1~P6-12</u>: **Dr. Kunimichi NIIBE**
　　　　　Chairpersons of <u>P7-1~P7-12</u>: **Dr. Yoshio YAHATA**
　　　　　Chairpersons of <u>P8-1~P8-13</u>: **Dr. Hiroko OKAWA**
　　　　　Chairpersons of <u>P9-1~P9-13</u>: **Dr. Lu SUN**
　　　　　Chairpersons of <u>P10-1~P10-12</u>: **Dr. Tadasu SATO**
　　　　　　Graduate School of Dentistry, Tohoku University, Japan

14:30−15:30　　**Symposium II:** Young Researchers Invited Lecture
　　　　　Chairpersons: Associate Professor **Takashi NAKAMURA**
　　　　　　Graduate School of Dentistry, Tohoku University, Japan

S2-1 **Digital approach to Orthodontics: Research and Treatment**
　　　　　Professor **Kyung-Min LEE**
　　　　　　School of Dentistry, Chonnam National University, Gwangju, Korea

S2-2 **Occlusal disharmony, a potential factor for promoting rat models of depression**
　　　　　Dr **Si-Hui ZHANG**
　　　　　　School of Stomatology, Fujian Medical University, Fuzhou, China

S2-3 **Oral Medicine Research of Universitas Indonesia: Exploring Special Need Dentistry Awareness and Interdisciplinary Oral Health Care**
　　　　　Dr **Masita Mandasari**
　　　　　　Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia

15:30-18:00　　**Keynote VI**: Biomaterial Interface
　　　　　Chairperson: Professor **Osamu SUZUKI**
　　　　　　Graduate School of Dentistry, Tohoku University, Japan

K6-1 **Application of synchrotron radiation for the analyses of biological specimens**

Professor **Motohiro UO**

School of Dentistry, Tokyo Medical and Dental University, Tokyo, Japan

K6-2 **Biomaterials with Multicomponent Functionalization for Dentin-Pulp Regeneration**
Professor **Yu-Chih Chiang**

School of Dentistry, National Taiwan University, Taopei, Taiwan

K6-3 **Possibility of Ultrasonic and Photoacoustic Imaging of Oral Cavity**
Professor **Yoshifumi SAIJO**

Graduate School of Medical Engineering, Tohoku University, Sendai, Japan

K6-4 **Incorporation of novel bioactive components for functional dental materials**
Dr **Jae-Sung KWON**

College of Dentistry, Yonsei University, Seoul, Korea

K6-5 **Bioactive properties of newly developed bone substitutes induced by a materials-cells interaction**
Professor **Osamu SUZUKI**

Graduate School of Dentistry, Tohoku University, Sendai, Japan

18:00−18:20   **Closing Ceremony**

Vice-Dean and Professor **Minoru WAKAMORI**
Graduate School of Dentistry, Tohoku University, Japan
Dean and Professor **Euiseong KIM**
College of Dentistry, Yonsei University, Korea
Dean and Professor **Ling YE**
West China School of Stomatology, Sichuan University, China
Professor **Melissa Adiatman**
Faculty of Dentistry, Universitas Indonesia, Indonesia

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Dr. Hai-sheng Wang
Sichuan University, China

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Dr. Yuta Shinohara
Tohoku University, Japan

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Treatment with hydrogen peroxide photolysis inhibits tooth demineralization caused by *Streptococcus mutans* biofilm

Dr. Midori Shirato
Tohoku University, Japan

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Bifacial aspects of ethanol: antibacterial effect and carcinogenic effect by metabolism to acetaldehyde depend on ethanol concentration

Dr. Ryo Tagaino
Tohoku University, Japan

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Asiaticoside stimulates osteogenic differentiation of hPDL through Wnt pathway

Dr. Piyamas Sumrejkanchanakij
Chulalongkorn University, Thailand

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Dr. Napatsorn Imerb
Chiang Mai University, Thailand

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Dr. Boontida Changkhaokham
Prince of Songkla University, Thailand

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Dr. Alba Natalia García Limón
Université de Paris, France

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Osteopontin induces osteogenic differentiation by human periodontal ligament cells via calcium binding domain-ALK-1 interaction

Dr. Daneeya Chaikiewkeaw
Chulalongkorn University, Thailand

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Dr. Ting He
Sichuan University, China

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Dr. Hang Yuan
Tohoku University, Japan

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Dr. Ping Lyu
Sichuan University, China

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Dr. Ze He
Sichuan University, China

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Dr. Zhi-wei Cao

Sichuan University, China

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Dr. Liang-liang Fu

Wuhan University, China

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Dr. Ye Zhang

Tianjin Medical University, China

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Dr. Yan-yun Pang

Tianjin Medical University, China

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Dr. Dan-yang Lu

Tianjin Medical University, China

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Dr. Fan Liu

Sichuan University, China

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Dr. Zhao-song Meng
Tianjin Medical University, China

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Dr. Yi-yin Chen
Sichuan University, China

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Dr. Yan-jun Zhang
Sichuan University, China

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Dr. Mefina Kuntjoro
Airlangga University, Indonesia

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Dr. Yi-chen Hsu
National Yang-Ming Chiao-Tung University, Taiwan

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Dr. Zhao-kun Zhu
Sichuan University, China

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Dr. Zi-yi Wang
Tianjin Medical University, China

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Dr. Agustin Wulan Suci-Dharmayanti
Jember University, Indonesia

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Dr. Wei-wei Xiao
Wuhan University, China

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Dr. Jun-jun Kong
Wuhan University, China

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Dr. Zi-yi Yang
Wuhan University, China

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Dr. Åkerlind Klara and Dr. Tu Linnéa
University of Gothenburg, Sweden

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Dr. Nicolas Dupre
Université de Paris, France

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Dr. Shun-hao Zhang
Sichuan University, China

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Dr. Margot Riou
Université de Paris, France

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Dr. Xing-tong Mu
Tianjin Medical University, China

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Dr. Muhammad Dimas Aditya Ari
Airlangga University, Indonesia

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Dr. Ze-ling Ye
Sichuan University, China

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Dr. Keiju Ashida
Tohoku University, Japan

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Dr. Vankalayya Yastriza Dayusmara
Airlangga University, Indonesia

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Dr. Chang Shu

Peking University, China

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Dr. Xin Ling
Wuhan University, China

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Dr. Ping-ping Cai
Fujian Medical University, China

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Dr. Wei Zou
Xi'an Jiaotong University, China

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Dr. Waleerat Sukarawan

Chulalongkorn University, Thailand

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Dr. Siriporn Songsiripradubboon
Chulalongkorn University, Thailand

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Dr. Wannakorn Sriarj
Chulalongkorn University, Thailand

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Dr. Jing-ou Liang
Sichuan University, China

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Dr. Shunichi Shishido
Tohoku University, Japan

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Dr. Arata Ito
Tohoku University, Japan

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Dr. Hiromitsu Morishima
Tohoku University, Japan

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Dr. Shi-bo Liu

Sichuan University, China

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Dr. Suhartini

Jember University, Indonesia

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Dr. Yao Liu

Sichuan University, China

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Dr. Yin Shi

Shanghai Jiaotong University, China

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Dr. Song-hang Li

Sichuan University, China

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Dr. Fei Bi

Sichuan University, China

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Dr. Li-nan Liu
Sichuan University, China

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Dr. Peng-cheng He
Sichuan University, China

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Dr. Jeeranan Manokawinchoke
Chulalongkorn University, Thailand

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Dr. Pongsakorn Poovarodom
Chiang Mai University, Thailand

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Dr. Karina Mundiratri
Airlangga University, Indonesia

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Dr. Wan-meng Wang

Tianjin Medical University, China

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Dr. Yi-ming Chen
Peking University, China

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Dr. Mei-lin Hu
Tianjin Medical University, China

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Dr. Liang-yu Xing
Tianjin Medical University, China

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Dr. Yayoi Okuyama
Tohoku University, Japan

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Dr. Mai Kameda
Tohoku University, Japan

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Dr. Xiao-xia Su
Sichuan University, China

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Dr. Xiao-hui Lyu

Sichuan University, China

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Dr. Zhi-wu Wu

Sichuan University, China

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Dr. Shu-xing Yu

Sichuan University, China

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Dr. May Thwe Kyaw Soe Win

Chulalongkorn University, Thailand

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Dr. Zhao-han Yu

Sichuan University, China

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Dr. Ya-zhuo Li
Wuhan University, China

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Dr. Zu-yi Chen
Wuhan University, China

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Dr. Ravipha Suwittayarak
Chulalongkorn University, Thailand

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Dr. Anna Wakui
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Niigata University, Japan

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Dr. Yang Chen
Sichuan University, China

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Dr. Ze-ning Feng
Sichuan University, China

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Dr. Yi-ping Liu
Tianjin Medical University, China

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Dr. Tomona Otake
Tohoku University, Japan

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Dr. Haruki Otani
Tohoku University, Japan

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Dr. Jia-jun Li
Tohoku University, Japan

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Dr. Bi-na Yang
Sichuan University, China

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Dr. Yu-yao Huang

Sichuan University, China

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Dr. Zheng Wang

Sichuan University, China

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Dr. Ya-lan Deng

Sichuan University, China

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Dr. Ya-xin Xie

Sichuan University, China

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Dr. Hazem Abbas

Tohoku University, Japan

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National Yang-Ming Chiao-Tung University, Taiwan

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Dr. Fa-tzu Tsai
National Yang-Ming Chiao-Tung University, Taiwan

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Dr. Imam Safari Azhar
Airlangga University, Indonesia

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Tianjin Medical University, China

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Dr. Yu Hao
Sichuan University, China

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Dr. Ittetsu Uchigasaki
Tohoku University, Japan

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Dr. Primanda Nur Rahmania

Airlangga University, Indonesia

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Chiang Mai University, Thailand

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Dr. Suthinun Suksutthiphan
Prince of Songkla University, Thailand

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Dr. Yasuhiko Nara
Tohoku University, Japan

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Dr. Porntip Tangtanawat
Prince of Songkla University, Thailand

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Dr. Hao Li
Sichuan University, China

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Dr. Shi-yu Liu
Sichuan University, China

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Dr. Xiao Guo
Sichuan University, China

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Dr. Yu Fan
Sichuan University, China

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Dr. Yan-nan Huang
Sichuan University, China

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Dr. Yu-juan Tian
Tianjin Medical University, China

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Dr. Ming-yue Wang
Peking University, China

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Dr. Wen-hui Wang

Wuhan University, China

Multimodal Education at Tohoku University Graduate School of Dentistry

Guang Hong, MD, DDS, Ph.D.

Director, The Office of International Affair, Liaison Center for Innovative Dentistry
Professor and Chair, Division for Globalization Initiative
Tohoku University Graduate School of Dentistry, Sendai, Miyagi, Japan

In today's globalized society, it is necessary to develop learning, research and professional practices based on international cooperation with multicultural perspectives. The leading universities have a responsibility to nurture human resources who can play an active role in the sustainable development of their own national, regional and global society. In Asia, with the rapid development of the economy and social infrastructure, the demand for dental care has expanded remarkably, and an improvement in oral health that contributes to one's quality of life has become a common interest among the general public. Therefore, in this region requires collaboration and partnerships among top research comprehensive universities to foster regional leaders for dental education and research, clinical dentistry, and oral health. In addition, Asian people have a similar morphology of the oral cavity and teeth, disease structures, cultures, and views on health and ethics, and their needs for dentistry, dental care, and oral health has a similar nature. Thus, it is highly desirable to conduct education, clinical practices, and evaluations based on common regional standards (Asian standards). We are aiming to establish Asian-Model Dentistry based on "Asian standards" in dental education and research and clinical dentistry appropriate to national and regional demands.

From now, the concept of dental education should be based on multimodal research and instruction, cultivating professionals in the oral health sciences who can adapt and respond appropriately to various situations that demand cultural sensitivity. Such education requires globalization, interdisciplinary alliances, and community cooperation. To develop such students, we should develop different advanced education programs to establish an organization for accepting overseas students, focusing on joint education through collaboration with core universities all over the world.

In 2021, Tohoku University was accepted to Inter-University Exchange Project. This project aims to establish and disseminate "Asian-Model Dentistry": dental education, research, and clinical dentistry based on common Asian standards that meet the needs of Asian clients and societies. In this project, top comprehensive research universities in Japan, China, Korea, Thailand and Indonesia will collaborate in region-wide mutual student exchanges, joint instruction and supervision. We will emphasize diverse and inclusive Asian values based on mutual understanding and regional perspectives.

This presentation will share the information and experience of those dental educators from different countries, to prepare for the future demand for dental education. And also, will outline our efforts toward the future of dental education through an interdisciplinary and global approach.

CURRICULUM VITAE
December 13th, 2021

Guang HONG, MD, DDS, PhD.
Professor, Division for Globalization Initiative, Liaison Center for Innovative Dentistry,
Tohoku University Graduate School of Dentistry
Address: 4-1, Seiryo-machi, Aoba-ku, Sendai, 980-8575, JAPAN
Tel: +81-22-717-8259 / Fax: +81-22-717-8278 / E-mail: hong.guang.d6@tohoku.ac.jp

Education:

July. 1997	MD. and DDS.	Yanbian University School of Medicine, China
Mar. 2003	Ph.D.	Hiroshima University Graduate School of Dentistry, Japan

Academic Appointments:

2003-2009   Assistant Professor, Hiroshima University Graduate School of Biomedical Sciences
2009-2013   Assistant Professor, Tohoku University Graduate School of Dentistry
2013-2019   Associate Professor, Tohoku University Graduate School of Dentistry
2019-   Professor and Chair, Division for Globalization Initiative
            Director, The Office of International Affairs; General Manager, Overseas Liaison Office
            Tohoku University Graduate School of Dentistry
2018-   Adjunct Professor, Airlangga University Faculty of Dental Medicine, Indonesia
2021-   Guest Professor, School & Hospital of Stomatology, Wuhan University, China

Awards and Honors:

2003   Japan Prosthodontics Society Oral Presentation Award
2003   Japanese Society for DMD Research Encouragement Award
2019   Tohoku University The Presidential Prize for Educational Excellence

Memberships, Officers, and Committee Assignments:

2015-   Committee Member of International Standardization Accelerated Project Japanese Ministry
            of Economy, Trade and Industry
2020-   Chairman of Committee for Guideline Development, ADEAP
2021-   Committee Member of Committee for the Promotion of Internationalization of Education,
            Japanese Dental Education Association

Research Theme:

Dr. Hong is Executive board member of Japanese Society for Dental Materials and Devices and Director of The Japan Denture Care Society. He also is expert of ISO (International Organization for Standardization) and DIN (German Institute for Standardization). His research is the elucidation of the rheology properties of dental materials, and development of functionality new dental materials. At present, his research is mainly concerned with international standard institution; improvement and development of oral care and denture care materials, metal-free dental implant materials and development of dental materials according to the Industry-Academia-Government (IAG) collaboration.

Current status of education and research at PKU-SS

Chuan-Bin GUO, Peking University

Peking University School and hospital of Stomatology has stayed true to its spirit of openness, and has been a pioneer in the field of stomatology (Dentistry). It has produced many notable "firsts" in Chinese stomatology, including the first DDS/Ph.D. combined program graduate, the first Chinese eight-year dental training program (Bachelor Degree and Doctor Degree in succession), and the first professional degree program.

The School boasts a team of renowned faculty members, 32 of them being laureates of national talent programs and awardees of the National Science Fund for Distinguished Young Scholars. Its alumni include two members of the Chinese Academy of Sciences and two members of the U.S. National Academy of Medicine.

The School is home to more than ten national centers, including the National Center of Stomatology, the National Engineering Research Center of Oral Biomaterials and Digital Medical Devices, the National Clinical Research Center for Oral Diseases and so on. As a key stakeholder in China's dental sector, the School serves as a think-tank that provides critical feedback on dental legislation, public health policy-making, standard and protocol development, professional examinations, and quality control. It has built itself into an integrated system of innovation, spanning basic research, clinical translational research, medical device testing, clinical quality assessment and monitoring, new drug development, stem cell clinical trials and popular science education , with particular strengths in digitalization, biomaterials, stem cells and regenerative dentistry, saliva and microorganisms, and oral and maxillofacial functional reconstruction. It has received 127 awards across national and provincial levels. Its proprietary products are available in 120 countries and regions, including the world's first tooth preparation robot, which has been licensed to Israeli partners and represents yet another achievement for 'Create in China'.

Peking University School and hospital of Stomatology is proudly the home of four prestigious international training centers, including IAOMS International Training Centre, based at the Department of Oral and Maxillofacial Surgery, AOCMF Fellowship Centre, based at the Department of Oral and Maxillofacial Surgery, ITI Scholarship Centre, WHO Collaborating Centre for Research and Training in Preventative Dentistry and the school has signed the memorandum of academic cooperation and understanding with 47 dental schools in other countries and regions.

Curriculum Vitae

Professor Chuanbin GUO

`Professor of oral and maxillofacial surgery ;`

`Dean of School and Hospital of Stomatology`

`Peking University ;`

President of Chinese Stomatological Association

Professor GUO is engaged in clinical and laboratory study on oral and maxillofacial surgery and is highly experienced in the diagnosis and treatment of oral tumors and tumors in parapharyngeal space and infratemporal fossa and tumors involving the skull base. His research interests are: Bifidobacterium Adolescentis as a delivery system for gene therapy of oral cancers and digital technique application in the management of head and neck surgery. Currently he is leading a team to develop two robot systems for cranial facial surgery. He has 213 papers published, among them 86 published in international medical journals. His achievements in scientific and clinical studies were awarded eight times at different levels.

A brief 100 year history of SNUSD and future perspectives

Gehoon Chung

The beginning of SNUSD dates back to April 1922 under the name of Kyungsung Dental College. It was the first dental school in Korea, started as a 2-year night-time program. The college constructed a modern four- story building for schooling and the affiliated hospital in June 1927. It ran a 4-year program starting from 1929 and, taking advantage of its location at the center of politics, economy, and foreign affairs, had opportunities to introduce new techniques afforded by overseas countries and missionary doctors.

The year 1946 saw the reorganization of Seoul National University (SNU) on August 22, into which Kyungsung Dental College was merged. It was then renamed to Seoul National University College of Dentistry. At that time, many other schools, including medical colleges, were also merged into Seoul National University. Dr. Myung Jin Park became the first dean. The College introduced an American dental education system and moved forward.

A two-year pre-dental course was introduced from the year 1959. In 1969, the College moved to its current location, Daehak-ro. The location was the very venue where Kyungsung Dental College had been established 47 years before. With a new spacious seven-story building, the College gained strong momentum and made great strides in dental education, research and patient care. Since then, there have been numerous collaborative opportunities of with the medical school within the same campus.

In April 1980, the Dental Research Institute was founded as a dedicated facility for strengthening dental research. The dental hospital was moved to a new building, which was constructed on the site of an old elementary school. The Dental Museum opened in August 1994, marking the first of its kind in Korea. In 1995, the Dental Library was opened as a branch of SNU Library, which was also the first of its kind. In 1999, the Education and Training Center for Dentistry was opened for providing continuing education.

The academic program has changed into a graduate school system with four-year curriculum in 2005 and the College was renamed to its present form, SNUSD (School of Dentistry). In 2014, a combined BS-DDS course was additionally introduced, which consists of a three-year pre-dental curriculum prior to the DDS program. The Dental Biomaterial and Education buildings were constructed in between. In March 2015, the Gwanak dental campus was launched and has brought new hope for another era of advancement.

The Core Facility Center at the Dental Research Institute, Seoul National University opened in 2001 to enforce the research competence of the institute through the shared use of high-technology equipment. Depending on the function, it is sub-sectioned into a Bacteria bank, Flow cytometry lab, Biomolecular analysis lab, PCR lab, Biomaterial analysis lab (I, II, III), Multi-property simulation testing lab, X-ray diffraction analysis lab, Histology lab, Con focal microscopy lab, Digital imaging lab, and Electron microscopy lab. All equipment can be used after making a reservation through the website and are available not only to the members of Dental Research Institute, but also to extramural universities or companies. Five full-time staffs with specific expertise are in charge of the maintenance of the equipment and training the users. They also provide technical supports for the acquisition and analysis of data using major equipment so that researchers can obtain optimal results.

In 2022, SNUSD will celebrate its 100th anniversary. SNUSD has gained a reputation as a leading international dental school, which contributes partners to be the world's renowned universities. We have partnerships with 37 international universities and SNUSD continues to strengthen international cooperations

Curriculum Vitae

Personal Information

Gehoon Chung DDS PhD
Associate Professor Department of Oral Physiology & Program in Neurobiology
Seoul National University School of Dentistry
Bldg 86, 1 Gwanak ro, Gwanak gu Seoul 08826, South Korea

Educational Background

- 2006-2011: Ph D Oral Physiology Graduate School Seoul National University
- 1997-2003: D D S College of Dentistry Seoul National University

Professional Career

- 2021-2022: Associate Dean of Planning and Coordination School of Dentistry, Seoul National University, Seoul Korea
- 2015 Present: Associate Professor Department of Oral Physiology, School of Dentistry, Seoul National University, Seoul Korea
- 2015-2017: Visiting Scholar Department of Biology, School of Arts and Sciences, University of Pennsylvania, USA
- 2011-2015: Assistant Professor Department of Oral Physiology, School of Dentistry, Seoul National University, Seoul Korea
- 2009-2011: Teaching Assistant Department of Oral Physiology, School of Dentistry, Seoul National University, Seoul Korea
- 2008-2009: Special Research Student Department of Oral Physiology Graduate School of Dentistry Osaka University, Osaka Japan
- 2003-2006: Dentist Public Health Center Goesan, Chungbuk Korea

Awards and Honors

- Best Paper Award (2013): Korean Academy of Oral Biology KAOB
- Best Paper Award (2012): Korean Academy of Oral Biology KAOB
- 58th Annual Meeting Travel Award (2011): Japanese Division of International Association of Dental Research JADR
- Bumho New Scientist Award (2007): Korean Division of International Association of Dental Research KADR

Editorial Board

- 2021-2023: Editorial Board Molecules and Cells
- 2018 Present: Review Editor Frontiers in Molecular Neuroscience
- 2018-2019: Associate Editor International Journal of Oral Biology

Innovation-Driven Dental Education: Our challenge and chance

Jie-Fei Shen

West China School of Stomatology, Sichuan University

Contemporary dental school education evolves at an accelerating pace in recent years. This evolution has been largely driven by innovation in science and technology. It should be noted that such progress is also defined by the transforming nature of the dental, oral and maxillofacial diseases. In the most recent National Survey on Oral and Dental Epidemiology (NOHES) of China, significant changes of the nature above were reported and studied. In this presentation, we focused on the occurrence and treatment rate of caries, periodontal diseases and edentulism in various age and regions. The outcome was compared with previous NOHES and underlying socioeconomic determinants were discussed. Therefore, the challenge for nowadays dental education is to deliver a new system of comprehensive thinking, not only on the scientific and technological aspects, but also on the understanding of the progress of our society.

Curriculum Vitae

Dr. Jie-Fei Shen is currently a professor in prosthodontics and the associate dean of the West China School and Hospital of Stomatology, Sichuan University. His research focused on the neural sensory function in the oral and maxillofacial regions, as well as the digital technology in prosthetic and implant dentistry. Dr. Shen serves as the Vice Chair of the Committee of Dental Equipment, and the Board Member of Committee of Prosthodontics, Chinese Stomatological Association, the Councilor and the Vice Chair, Committee of Prosthodontics, Sichuan Stomatological Association. He is also a fellow of the International College of Dentists and the Royal College of Physicians and Surgeons of Glasgow. Dr. Shen has published over 50 papers in international journals and 5 books or book chapters.

Introduction of the CAMPUS Asia programs in Yonsei University

Jung-Seok Lee

Associate professor
Director of International Affairs, Yonsei University College of Dentistry
Chair, Department of Periodontology, Yonsei University College of Dentistry

Yonsei University College of Dentistry is the oldest dental school in Korea. In the year of 1915, one Christian missionary, Dr. Scheifley, had opened the dental educational system and the first dental center was established. Since the beginning of the dentistry in Korea, Yonsei University has been developing with the advances of the other dental schools in Asian countries. In addition, now we are expanding our academic networks with the Asian, European, and American dental schools in various fields of dentistry, and the global leaders in some dental fields (dental development and anatomy, dental implant, the taste, cancer, and etc.) are working at Yonsei University. By your choice of Campus Asia Yonsei, you can meet and collaborate with these distinguished researchers. We will provide two types of Campus Asia program; a short term (2 weeks to 1 month) and a long term program (over 3 months).

In the short-term course of our program, the student will participate in a class for the language of Korean, Korean culture experience, visit and a specific course from the Korean commercial partners (Dentium, Osstem, etc.). In addition, you can choose the specific programs in every department from the fundamental to the clinical departments. With this opportunity, you can experience a short life in Korean dental lab and a dental clinic. In the long-term course, you can try double degrees from two countries and make a long-term collaboration in the research fields.

Curriculum Vitae

1. General Information

Name	**Jung-Seok Lee, DDS, MSD, PhD**
Born	September 23, 1979, Seoul, Republic of Korea
Nationality	Republic of Korea
Married status	married
Home Address	78-9, Yonheero-11-Magil, Seodaemungu, Seoul, South Korea. Phone: +82-2-2631-2923 Mobile: +82-10-8897-2923
Office Address	612 Yonsei University Dental Hospital, 50-1 Yonseiro, Seodaemoongu, Seoul, South Korea. Phone: +82-2-2228-3187 Fax: +82-2-392-0398 e-mail: cooldds@gmail.com / cooldds@yuhs.ac

2. Education and Career

1998-2003	DDS, Yonsei University College of Dentistry, Seoul, Korea
2004	Internship, Dental Infirmary, Yonsei University College of Dentistry
2005 ~ 2007	Residency, Department of Periodontology, Dental Hospital, Yonsei University College of Dentistry
2007	Changing residency, Department of Periodontology, University of Heidelberg, Germany
2008 ~ 2010	Naval dental surgeon (officer), The Korean Armed Forces Capital Hospital
2011	Research fellow, Department of Periodontology, Dental Infirmary, Yonsei University College of Dentistry
2012 ~ 2015	Clincal Assistant Professor, Department of Periodontology, Dental Infirmary, Yonsei University College of Dentistry
2014 ~ 2015	Associate director of Publishing Affairs, The Korean Academy of Oral & Maxillofacial Implantology
2015 ~ 2016	Associate director of Academic affairs, Korean Academy of Periodontology
2016 ~2017	Assistant Professor, Department of Periodontology, Yonsei University College of Dentistry
2016 ~2018	Associate director of General affairs, Korean Academy of Periodontology
2018 ~	Associate Professor, Department of Periodontology, Yonsei University College of Dentistry

Innovative Dental Curriculum Structures: Moving Toward Global Dental Workforce

Pornchai Jansisyanont, Chulalongkorn University

The Faculty of Dentistry, Chulalongkorn University, had developed several approaches to strengthen the ability of the dental workforces, preparing them for the challenge of global health education. Dual degree training, international and intercultural collaboration training, and module-based training, are the three key of this approach.

The main curriculum of dental training focuses on clinical dental skills and knowledge. However, oral health cannot be isolated from the other systems. Dental workforces must be well-versed in other knowledge such as oral health disparities, care access, health information/management and holistic treatment plan. These aspects constructively build an outstanding dental workforce in order to effectively promote better oral health care for patients and community. The interprofessional education program structure must be innovatively designed to enhance multidisciplinary skills for dental personnel and to equip them with the necessary skills and knowledge to lead oral health promotion, prevention, and treatment. The Faculty of Dentistry, Chulalongkorn University, articulates the dual Doctor of Dental Surgery (DDS) and Master of Public Health (MPH) degree as the human resource development plan in dentistry. To be launched in 2022, qualified students have the opportunity to pursue a dual-degree of Doctor of Dental Surgery degree (DDS) from the Faculty of Dentistry and Master of Public Health (MPH) from the College of Public Health Science, Chulalongkorn University. With the innovatively designed curriculum structure, students could complete their DDS and MPH within the normal educational timeframe (6 years). This program curriculum values inter-professional collaboration and grooms future leaders in the field of dentistry.

Another aspect to develop dental workforce for global health challenge is the international and intercultural collaboration training. Students can experience and appreciate the difference in training methods and culture through exchange and collaboration program. Our school adopted both short- and long-term student exchange with numerous dental institutions around the world, including United States, Korea, Japan, and China. With collaboration with Tohoku University Graduate School of Dentistry, we developed the Chulalongkorn-Tohoku double degree PhD program to foster talented dentist/scientists, enabling them to conduct frontier research and innovation in dentistry. Through this double degree program, students can explore the critical thinking strategy, innovative idea, and constructive communication in the intercultural environment.

Lastly, the strategy to prepare dental workforce with up-to-date knowledge and furthered their educational advancement. We evaluate the potential to establish module-based programs for dental specialty training to be offered concurrent with the conventional in-person full program training. This module-based structure will allow dentist to continue their practice in both public and private sectors while advancing their knowledge and collecting credit toward the completion of training certification. With module-based curriculum, the inter-specialty training can be easily formulated to serve the diverse training needs of dental personnel.

K1-6

Curriculum Vitae
Name   Pornchai Jansisyanont
Position   Professor and Dean
Work address Faculty of Dentistry, Chulalongkorn University
                    34 Henri-Dunant Road, Wongmai
                    Pathumwan, Bangkok 10330 Thailand
                    Department of Oral and Maxillofical Surgery,
Email   pornchai.j@chula.ac.th

Professor Jansisyanont earned his bachelor's degree Doctor of Dental Surgery from Chulalongkorn University, Thailand and completed Oral and Maxillofacial Surgery Certification and Master of Science in Oral and Maxillofacial Pathology from University of Maryland, Baltimore, USA. He obtained the Diplomate Certification of American Board of Oral and Maxillofacial Surgery and Thai Board of Oral and Maxillofacial Surgery. Professor Jansisyanont also graduated Doctor of Philosophy in Development Administration. He was the President of the Royal College of Dental Surgeons of Thailand. He currently serves as the Dean of the Faculty of Dentistry, Chulalongkorn University, Bangkok Thailand.

Selected Publications
1. Deesricharoenkiat N, Jansisyanont P, Chuenchompoonut V, Mattheos N, Thunyakitpisal P. The effect of acemannan in implant placement with simultaneous guided bone regeneration in the aesthetic zone: a randomized controlled trial. Int J Oral Maxillofac Surg. 2021 Aug 21:S0901-5027(21)00270-8.
2. Vu NB, Chuenchompoonut V, Jansisyanont P, Sangvanich P, Pham TH, Thunyakitpisal P. Acemannan-induced tooth socket healing: A 12-month randomized controlled trial. J Dent Sci. 2021 Mar;16(2):643-653.
3. Benjaphalakron N, Jansisyanont P, Chuenchompoonut V, Kiattavornchareon S. Evaluation of the maxillary sinus anatomical variants related to maxillary sinus augmentation using cone beam computed tomography images. J Oral Maxillofac Surg Med Pathol 2021; 33(1):18-25.
4. Kamolratanakul P, Jansisyanont P. A review of antibiotic prophylaxis protocols in oral and maxillofacial surgery. J Oral Maxillofac Surg Med Pathol 2018; 30(5): 395-404.
5. Suwanwela J, Puangchaipruk D, Wattanasirmkit K, Kamolratanakul P, Jansisyanont P. Maxillary Sinus Floor Augmentation Using Xenograft: Gene Expression and Histologic Analysis. Int J Oral Maxillofac Implants. 2017 May/Jun;32(3):611-616.
6. Jansisyanont P, Tiyapongprapan S, Chuenchompoonut V, Sangvanich P, Thunyakitpisal P. The effect of acemannan sponges in post-extraction socket healing: a randomized trial. J Oral Maxillofac Surg Med Pathol 2016; 28(2): 105-110.
7. Jansisyanont P, Kasemsai W, Bamroong P. Factor related to the treatment outcome of maxillofacial fascia space infection. J Oral Maxillofac Surg Med Pathol 2015; 27(4):458-464.

More Publications

K1-7

Integrating Interprofessional Education and Practice in Dental Education: Universitas Indonesia Experience

Melissa Adiatman

Department of Dental Public Health and Preventive Dentistry
Head of International Affairs Unit, Faculty of Dentistry, Universitas Indonesia

Interprofessional education happens when students, or members from two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes and services. Interprofessional education is a crucial step in before entering intercollaborative practice in healt care settings. Efforts needed to be made educate and prepare the students to equipped them with competencencies thet will help them to work and provide team-based care. Collaborative practice happens when multiple health workers from different professional backgrounds work together with patients, families, caregivers, and communities to deliver the highest quality of care.

Universitas Indonesia implemented IPE modules since 2013 and ICP since 2015. Many factors contributed to the success of the implementation, and many obstacles needed to be tackled. IPE allows dental students to strengthen their education while also inspiring them to serve as leaders in the promotion of collaborative practice and team-based care. The modul itself opens windows of opportunity to collaborate between different health specialties and collaborate with international istitutions. International exchange provides opportunity to make a positive impact on the oral health of our global community while enriching and diversifying dental education experience.

MELISSA ADIATMAN, DDS, PhD

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Phone : +62 21 31927410   Mobile: +62 8111 682 494

POSITION AND APPOINTMENTS

2013 – NOW
LECTURER IN THE DEPARTMENT OF DENTAL PUBLIC HEALTH AND PREVENTIVE DENTISTRY, FACULTY OF DENTISTRY, UNIVERSITAS INDONESIA

2018 – NOW
HEAD OF INTERNATIONAL AFFAIRS UNIT, FACULTY OF DENTISTRY, UNIVERSITAS

2014 – 2018
HEAD OF PUBLIC RELATIONS AND INTERNATIONAL AFFAIRS, FACULTY OF DENTISTRY, UNIVERSITAS INDONESIA

2019 – 2022
NATIONAL COMMITTEE ON ORAL HEALTH OF INDONESIA, THE MINISTRY OF HEALTH OF INDONESIA

EDUCATION

2008-2012
PhD IN ORAL HEALTH PROMOTION
GRADUATE SCHOOL OF MEDICAL AND DENTAL SCIENCES
TOKYO MEDICAL AND DENTAL UNIVERSITY, JAPAN

2001 – 2007
DOCTOR OF DENTAL SURGERY (DDS)
FACULTY OF DENTISTRY, UNIVERSITAS INDONESIA

RESEARCH INTEREST

- Dental Public Health
- Oral Health Promotion
- Statistics and Research Methodology
- Inter-professional Education/Inter-
- Geriatric Oral Health
- Preventive Dentistry
- Behavioral Dentistry
- Global Oral Health

ORGANIZATION

- 2019 – now : Member of National Committee on Oral Health (Indonesia)
- 2017 – 2019: Core team of 2018 Indonesia National Oral Health Survey
- 2018 – now : Chairman of Indonesian Society of Gerodontology
- 2018 – now : Chair of Collaboration and Venture division, Indonesian Society of Dental Public Health
- 2013 – now : Member of Indonesian Dental Association
- 2011 – now : Member of International Association of Dental Research

Shoku-gaku: Transdisciplinary Science of Eating, Food, and Nutrition
– Promoting lifelong health and wellbeing through right eating and right food –
Creating a new science for health and wellbeing as the mission of dentistry

Nobuhiro TAKAHASHI

Division of Oral Ecology and Biochemistry

Tohoku University Graduate School of Dentistry

What is "Shoku-gaku (食学)"? It is the world's first new transdisciplinary science that integrates oral science with the existing disciplines of food science and nutrition science. In 2020, Tohoku University Graduate School of Dentistry, in collaboration with Tohoku University Graduate School of Agricultural Science and Miyagi University School of Food Industrial Sciences, launched the concept of "Shoku-gaku" and establish the Innovative Research and Education Center as a base for conducting this new science. The goal is to realize lifelong health and wellbeing by right eating and right food.

The topics covered in "Shoku-gaku" are: 1. Oral function science: sensing of eating (chewing, swallowing, etc.) and tasting (taste, smell, texture, etc.), 2. Food science: functional foods and disaster foods, 3. Nutrition science: new functional food molecules and personalized nutrition, 4. Microbiome science: food-induced modification of oral/intestinal microbiome and modification of food components and new functions by oral/intestinal microbiome, 5. Data science of eating, health and wellbeing. Based on these transdisciplinary activities, we will develop new functional foods that bring about health and wellbeing, and create "eating programs" for lifelong health and wellbeing. To utilize these results in society, social co-creation, including industry-academia collaboration, social demonstration, and social implementation, is essential.

In 2002, Tohoku University Graduate School of Dentistry created the concept of "Interface Oral Health Science", that was the redefinition of oral cavity. In the past 20 years, the role of dentistry has been expanding from the prevention and treatment of oral diseases to the promotion of oral and systemic health. Since eating is the most important factor for the promotion of health and wellbeing, dentistry has the responsibility to conduct "Shoku-gaku", as a discipline of the oral cavity, the gateway to food. From these perspectives, "Shoku-gaku" will be one of the redefinitions and a new mission of dentistry in the future, which aims to promote oral and systemic health and wellbeing. At the same time, it will also be a great opportunity to finally include food science and nutrition science, which have not been included in dentistry and medicine in Japan, into the curricula of dentistry and medicine. "Shoku-gaku" will shift medical and dental care to more proactive prevention, pre-disease control, and health promotion, enabling the revitalization of the super-aging society that humanity will soon face around the world.

In this presentation, I will talk about the concept of "Shoku-gaku", as well as its background and current activities. This will be followed by three speakers who will give lectures on their respective areas of expertise: oral function, food science, and nutrition science.

CV (December 13, 2021)

Nobuhiro TAKAHASHI, D.D.S., Ph.D.

Professor, Division of Oral Ecology and Biochemistry, Tohoku University
Graduate School of Dentistry
Address: 4-1 Seiryo-machi, Aoba-ki, Sendai, 980-8575, Japan
Tel: +81 22 717 8294 / Fax: +81 22 717 8297 /
E-mail: nobuhiro.takahashi.a5@tohoku.ac.jp

Education and Career

1978. 4 – 1984. 3	Tohoku University School of Dentistry (D.D.S.)
1984. 4 – 1988. 3	Tohoku University Graduate School of Dentistry (Ph.D.)
1986. 4 – 1988. 3	Research Fellow, the Japan Society for the Promotion of Science
1988. 4	Resident, Tohoku University Dental Hospital (Oral and Maxillofacial Surgery)
1988. 5 – 1990. 4	Visiting Assistant Professor, University of Minnesota School of Dentistry, USA
1990. 5 – 1998. 3	Assistant Professor, Tohoku University School of Dentistry
1998. 4 – 2001. 2	Associate Professor, Tohoku University School of Dentistry
2001. 3 to present	Professor, Tohoku University Graduate School of Dentistry
2004. 1 to 2020. 3	Vice-Dean, Tohoku University Graduate School of Dentistry
2010. 4 to 2020. 3	Education and Research Councilor, Tohoku University
2020. 4 to present	Dean, Tohoku University Graduate School of Dentistry

Academic Activity

2010. 4 to 2014. 3	President, Cariology Today in Japan
2010. 10 to present	Associate Editor, Caries Research
2013. 1 to 2014.12	President, Japanese Division of IADR (JADR)
2015. 6 to present	Associate Editor, Japanese Dental Science Review
2020. 1 to present	President, Japanese Society of Functional Foods for Oral Health (JaSFFOH)
2020. 6 to present	President, Tohoku Dental Society
2021. 7 to present	IADR Regional Board Member (Asia-Pacific Region)

Research Activity

Dr. Takahashi focuses on the research about oral biofilm, particularly bacterial metabolisms associated with dental caries, periodontitis, oral malodor, and aspiration pneumonia, from biochemical, microbiological and ecological perspectives. He has determined the metabolic pathways and their biochemical regulation of oral anaerobic bacteria such as *Streptococcus*, *Actinomyces*, *Lactobacillus*, *Bifidobacterium*, *Scardovia*, *Veillonella*, *Prevotella* and *Porphyromonas*, and elucidated the interaction between bacterial metabolism-based pathogenicity and their environments. He is also a pioneer of the metabolomic analysis of oral biofilm. He applied his technology of monitoring pH at the interface between bacteria (oral biofilm) and the tooth surface to a new method of evaluating cariogenicity of foods, antimicrobial effect of biomaterials, and bacteria-induced deterioration of biomaterials. He is also applying his research resources to understand the metabolism of cancer cells. Among his publications, a series of review papers about dental caries and its association with bacterial metabolisms has been must-read articles for current understanding of the caries etiology, one of which was ranked #26 among the most cited articles in the 100-year history of the Journal of Dental Research (2019). He has been honored by Yngve Ericsson Prize (2019) and several academic awards.

The novel visualization and evaluation methods for swallowing process and dynamic food bolus properties.

Tetsu Kamiya, Ph.D.
Nagase & CO. LTD

Background

Due to the oral process is the complex action with fast movement and configuration changes, it is difficult to visualize the accurate bolus behavior and hard to evaluate numerically using physical quantities (such as force, shear rate, velocity, energy and work) during oral and swallowing process by conventional medical images and measurements. Physical quantities on human organ during oral and swallowing process are considered as important information for the development of the appropriate food product for not only elderly persons and swallowing difficulties but also infants and all generation. Thus, the novel visualization and evaluation methods for swallowing process and dynamic food bolus properties are required.

Purpose

To clarify the biomechanics of swallowing and develop easy-to-swallow food products, information of the relationship between the food bolus and the human organ is considered useful. The purpose of this presentation is to introduce a novel computer simulation method and dynamic bolus evaluation system for the estimation of the physical properties of food bolus and force on human organ during oral and swallowing process coupled with food bolus configuration, position and time.

Methods

a. Computer simulation

The originally developed three-dimensional (3D) swallowing simulator "Swallow Vision®" implements a kinetic biomechanical and a property model of food bolus. The result of the 3D swallowing simulator was validated concerning to the bolus flow configuration during swallowing. In order to compare difference of force on each organ, the healthy young person and the mild aspirated patient model were used for numerical simulation.

b. Dynamic bolus flow measurement

In order to simplified measurement, we have developed"F-bology® analyzer" (FBA) which contained inclined plate with customized wet PVA sheet (pseudo organ sheet). This pseudo organ sheet has similar specific wetting properties of human organ surface. The food sample was supplied on the sheet of FBA by the piston pump, and it became bolus. The bolus flow down and the velocity on the sheet was measured by the disruption signal of laser sensors located on the upper and lower position of side wall of FBA. The changes of the diffusion area of food bolus were calculated from movies recorded by the high

speed micro scope set on the vertical direction from the sheet. Physical quantities which include tribology properties on the sheet were calculated from these measured values.

Result and conclusion
a. Computer simulation
For both simulation models, the magnitude and the variation in the extracted forces from each human organ, such as hard palate, soft palate, tongue, pharynx, and larynx, were discussed and explained the basis of food bolus configuration, position and time. And through the parameter studies, Swallow Vision® could find out physical properties of the food bolus not to aspirate on the mild aspirated patient model. From these results, it is considered that Swallow Vision® is helpful tool to understand the detailed biomechanics of oral and swallowing process.

c. Dynamic bolus flow measurement
Differences of physical quantities such as shear stress, energy density and diffusion area have been observed under the different viscosity, density and drying condition of pseudo-organ sheet. The behavior of the bolus flowing down on FBA was considered as similar to human oral and swallowing process qualitatively.

The information obtained from this study might be utilized for the development of appropriate food products for dysphasia patients and the elderly.

<Curriculum Vitae>

1998   Graduated from Chiba Univ. (M. Eng.)
       Meiji Dairy Co. Ltd, R&D
2010   Graduated from Yokohama National Univ. (Ph.D.)
2021   NAGASE & CO. LTD, New Value Creation Office.

Chemical biology of bioactive molecules

Minoru Ishikawa

Graduate School of Life Sciences, Tohoku University

Bioactive compounds in foods have been gaining interest for sustaining human health. For example, many studies have suggested that introduction of an appropriate diet can reduce the risk of Alzheimer's disease, a neurodegenerative disorder. Although the exact relationship between food bioactive ingredients and risk reduction of Alzheimer's disease is not fully understood, several food bioactive ingredients have been reported to possess promising biological activities including inhibition of amyloid beta aggregation. As another example, personalized nutrition is an emerging field that bears great promise for the maintenance of health and prevention against diseases. Individuals can receive diets tailored to their personal biology including genetic profile and microbiome composition. Under such situation, target identification, the process of identifying the direct molecular target, is important for the comprehensive inference of the mechanism of action of food bioactive ingredients. However, there is no universally successful method for target identification due to the issues of protein stability, solubility of compounds, weak binding affinity, and so on. In addition, we sometimes encounter the result that the compound binds to the identified target protein but not modulates its protein functions. In this symposium, I will present our studies on chemical biology, that is, targeted protein degradation utilizing silent ligands of food ingredients, and target identification of bioactive molecules. In recent years, a strategy has been developed for the degradation of target proteins based on the use of hybrid molecules composed of a ligand for the target protein and a ligand for ubiquitin ligase (E3). These hybrid molecules recruit E3 to the target protein, leading to selective degradation by the ubiquitin-proteasome system. We reported the first small hybrid molecule consisting of an E3 ligand and vitamin A as a ligand for cellular retinoic acid binding protein (CRABP). Although CRABP is associated with migration of neuroblastoma, CRABP inhibitors have never been reported. We showed that this small hybrid molecules induced decrease of CRABP in living cells, and inhibited migration of neuroblastoma cells. These results indicate that CRABP degraders may be effective for therapy of CRABP-overexpressing cancers. Next, we applied this targeted protein degradation technology to neurodegenerative disorders. We focused on the aggregation-prone nature of neurodegenerative proteins, and utilized an aggregate binder as a ligand. The small hybrid molecule by linking E3 ligand with the aggregate binder reduced the neurodegenerative proteins in cells. Finally, I will discuss our recent efforts on target identification of vitamin A by utilizing targeted protein degradation.

<u>Curriculum Vitae</u>
Minoru ISHIKAWA (male)

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WORK EXPERIENCE

2019/Apr - current	Professor	Tohoku University, JAPAN
2013/Apr - 2019/Mar	Associate Professor	The University of Tokyo, IMCB, JAPAN
2012/Oct - 2013/Mar	Lecturer	The University of Tokyo, IMCB, JAPAN
2008/Jul - 2012/Sep	Assistant Professor	The University of Tokyo, IMCB, JAPAN
1996/Apr - 2008/Jun	Researcher	Meiji Seika Kaisha. Ltd., JAPAN

EDUCATION

2006/Dec	Ph.D. Pharm.	The University of Tokyo, JAPAN
1994/Apr - 1996/Mar	M.Eng.	Tokyo Institute of Technology, JAPAN Graduate School of Bioscience and Biotechnology
1990/Apr - 1994/Mar	B.Eng	Tokyo Institute of Technology, JAPAN School of Bioscience and Biotechnology

AREA OF RESEARCH
Chemical biology, Medicinal chemistry, Bioorganic chemistry

AWARDS (representative)
Journal of Medicinal Chemistry Highly Read Perspective of 2011
Journal of Medicinal Chemistry Highly Cited Perspective of 2011

PUBLICATIONS (representative)
1． Protein knockdown using methyl bestatin-ligand hybrid molecules: Design and synthesis of inducers of ubiquitination-mediated degradation of cellular retinoic acid-binding proteins
   Journal of the American Chemical Society **2010**, *132*, 5820-5826.
2． Improvement in aqueous solubility in small molecule drug discovery programs by disruption of molecular planarity and symmetry
   Journal of Medicinal Chemistry **2011**, *54*, 1539-1554.
3． Discovery of small molecules that induce degradation of huntingtin
   Angewandte Chemie International Edition **2017**, *56*, 11530-11533.
4． PROTACs and other chemical protein degradation technologies for the treatment of neurodegerative disorders
   Angewandte Chemie International Edition **2021**, *60*, 3346-3354.

New challenges in geriatric dentistry: Prescribing food with appropriate physical properties for older adults with difficulty eating

Yasue Tanaka

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Chronic malnutrition, which is a frequent problem in older adults, has adverse impacts on health outcomes and quality of life. In general, nutrition is taken orally; thus, there is no doubt that oral health plays an important role in the prevention of malnutrition. Dentists are used to maintaining oral health by treatments that restore oral morphology, such as filling dental cavities, treating periodontal disease, and making prostheses. However, with the aging of the population, the number of older people with frailty who cannot sufficiently maintain their eating ability by restoring morphology alone is increasing. Prescribing exercise to recover oral function and selecting food with appropriate physical properties that can be safely consumed for such people would represent new functions of dentistry.

Under such circumstances, the Japanese Society of Gerodontology published a position paper entitled "Oral hypofunction in the older population: Position paper of the Japanese Society of Gerodontology in 2016," which proposed criteria for the diagnosis of oral hypofunction. In this paper, seven conditions (poor oral hygiene, oral dryness, reduced occlusal force, decreased tongue-lip motor function, decreased tongue pressure, decreased masticatory function, and deterioration of swallowing function) were selected to diagnose oral hypofunction. Testing methods and initial thresholds to be used as diagnostic criteria for these conditions have been established. Currently, the management and testing of oral hypofunction is covered by national medical insurance in Japan, and early intervention for older adults with declining oral function is much easier to detect. Currently, these criteria are used for both clinical and research purposes.

However, to date, no method has been developed to select food based on objective functional data, such as the results of tests used for the diagnosis of oral hypofunction. In Japan alone, there are several classification systems for foods for people with dysphagia, such as "Universal Design Food," which was established by the Japan Care Food Conference, "Smile Care Foods," from the Ministry of Agriculture, Forestry, and Fisheries of Japan, and "Japanese Dysphagia Diet 2021," from the JSDR dysphagia diet committee. These classification systems categorize foods based on their physical properties, but their relationship with oral functions, especially masticatory function, remains ambiguous. Matching the physical properties of food with oral function is the next challenge in geriatric dentistry in a super-aging society.

Although not included in the diagnostic criteria for oral hypofunction, sensory function is an important oral function that must be investigated. Decreased intraoral sensations could lead to decreased appetite and nutritional intake. The intraoral sense involves texture perception and taste. Food texture is defined as "all the mechanical, geometrical, and surface attributes of a product perceptible by means of mechanical, tactile, and, where appropriate, visual and auditory receptors (ISO)." For older people with impaired swallowing function, texture perception is especially important because it

is related to the ability to detect physical properties of food boluses. A person with impaired texture perception can mistakenly detect the physical properties of food boluses and initiate swallowing before the bolus is ready to be swallowed. Unlike the sense of taste, there are few studies on texture perception, and its testing methods have not been established. In a previous study, we developed a method to evaluate texture perception. We are now accumulating evidence on the relationship between texture perception and other modalities of oral function. Sensory function should be evaluated along with motor and secretory function, when dentists select food properties for older adults with difficulty eating.

<Curriculum Vitae>
Yasue Tanaka, DDS, PhD
2015-present   Assistant Professor, Tohoku University Graduate School of Dentistry
2018-2020   Visiting Assistant Professor, University of British Columbia
2013-2015   Assistant Professor, Tohoku University Hospital
2007-2011   PhD, Tohoku University Graduate School of Dentistry

Sociocultural Contexts and Oral Health in Thailand

Patcharanuchat P.

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Sociocultural contexts affected oral health in Thailand in many ways. Similar to every society, a complex phenomenon of oral health appeared as an ultimate outcome from web of interrelation of particular social and cultural elements. Sociocultural contexts influenced in peoples' circumstances and conditions of living which were dynamic, changeable, and varied from society to society. After an adoption of Social Sciences and Medical Anthropology in Dentistry in Thailand, numbers of oral health phenomena were clarified for dental professional. Some of them will be mentioned in this presentation.

Thailand was a sweet tooth society. Sugar consumption in 2001 was 29.05 kgs/year/person, in which it was 3 times overconsumption that WHO recommended. Twenty years before, there was a health advocacy to promote sweet enough society in Thailand. Numbers of strategies and health projects were launched to educate Thai people through the Reduced Sugar Consumption Campaign as 'Sweet Enough Thailand'. By the messages of body image and health reasons, at the present time, sugar-free, low sugar, unsweetened drinks and products were more available in convenience stores' shelves in Thailand. In addition, in 2016 sugar tax policy was passed in Thailand's parliament and forced in control over sugar-sweetened beverages. However, commercial advertising of sweets was still problematic in schools.

There were feelings of faith and confidence, obedience and respect for doctors, dentists and other health professional among Thai people. Perceived image of health personnel was knowledgeable, helpful and merciful, as a result in power imbalance in doctor-patient relationship. To propose Laser Dentistry in one community, for example, was not difficult to convince people to accept an innovative treatment. In the other hand, it was a pressure among Schools of Health Sciences to design lessons of 'Sympathy for Patients'. In Khon Kaen University, Thailand the subject of Integrated Health Sciences Field Work, the so-called 'COMMED KKU', was created for health science students to understand the ways of living of vulnerable people in rural areas by using methods of Medical Anthropology.

Social norms of beauty and cleanliness affected 'Perfect Smile' by the time. 400 years before, black-colored teeth were fashionable and meaningful among upper-class Thai women. Nowadays, while white and bright mean cleanliness, black-colored teeth of children from Silver Diamine Fluoride were unacceptable among Thai parents. Moreover, teenagers' teeth with braces were more popular even though no treatment need, and this often ended up with dispute in dental clinic. Other phenomenon was that some of people's beliefs needed to be concerned. For example, sweet food was common among Thai children, so was deciduous tooth decay. 'That's why we do nothing'-was a reason of such people. Tooth extraction affected the brain and nervous system as 'Prasart sia' in Thai words, resulting in avoiding to receive dental services in hospital in some rural areas.

For another phenomena, application an understanding of sociocultural contexts could fulfil activities in Oral Health Promotion and Prevention. For example, evidence of Muslim society in South part of Thailand displayed religious faith through personal hygiene and cleanliness before pray, focusing on tooth brushing. Similarly, one rural area in North-East part set up 'Community Rules' as healthy public policy to inhibit toddlers' milk bottles at bedtime by community participation. The remarkable application for health promotion in Thai society was to create new social norms as: alcohol greetings equal in giving curse; stop drinking alcohol during Buddhist Lent. Finally, a complicated health behavior of individual was a result from 'how people live in particular society'. Therefore, creating healthy behaviors and supportive environment in a society could be achieved by an understanding of sociocultural contexts as a whole in such society.

Curriculum Vitae

Assistant Professor Dr Piyachat Patcharanuchat

Division of Dental Public Health,

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Faculty of Dentistry, Khon Kaen University, Thailand

Education

Doctor of Dental Surgery (DDS.)   Khon Kaen University, Thailand

Master of Art (M.A) Medical and Health Social Sciences   Mahidol University, Thailand

Doctor of Philosophy (PhD)   The University of Sydney, Australia

Professional experience

- Lecturer and Researcher in Qualitative Research, Dental Public Health, and Oral Health Promotion (Supported by Thai Health Promotion Foundation)

- Researcher in Lasers in Dentistry Research Group (LDRG, KKU)

- Committee of Lion Oral health Award Thailand

- Committee of Thai Society for Public Health Dentistry

- Director of Master of Sciences Program in Dental Public Health, Khon Kaen University

- Director of Integrated Health Sciences Field Work Project, Khon Kaen University

The results of cohort studies of a highly generalizable population and nationwide big data studies, and the future of epidemiological research using real-world data

Kenji Takeuchi

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Abstract:
One of the important purposes of epidemiological studies is to provide basic information for the development of policies that contribute to improving the population's health, such as disease prevention and control. From a public health perspective, the generalizability of the study population is important in order to apply the results of epidemiological studies to practice and contribute to disease prevention and health promotion at the population level. We have previously evaluated the association between oral health and various general health in Hisayama residents, a population with high generalizability that has maintained a distribution almost identical to the average age distribution of the Japanese population for more than 50 years. Among the research findings, one that examined the association between oral health and non-communicable diseases showed that the risk of developing all-cause dementia and Alzheimer's disease increases as the number of remaining teeth decreases in old age. Another is that as the severity of periodontal disease increases, the risk of developing chronic obstructive pulmonary disease increases. In addition, we are working on a research project called Japan Gerontological Evaluation Study (JAGES) project, which is based on big data specific to the older adults. Our findings indicate that few teeth without dentures was associated with higher risk of dementia onset. Also, we reported that having more remaining teeth was independently associated with a lower risk of mortality and functional disability and a shorter life expectancy with disability. Furthermore, through a large Internet survey study called the Japan coronavirus disease 2019 (COVID-19) and Society Internet Survey (JACSIS), we have evaluated the impact of the COVID-19 outbreak on oral health. Our findings showed that worsened socioeconomic conditions due to the COVID-19 pandemic were associated with dental pain among the Japanese population. Lastly, we will discuss the future development of epidemiological studies using real world data such as Tohoku Medical Megabank.

CURRICULUM VITAE

Kenji Takeuchi, D.D.S., Ph.D.

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EDUCATION
04/2003-03/2009   **B.S. in Dentistry**, TOHOKU UNIVERSITY, Sendai, Japan
04/2009-03/2013   **Ph.D. in Dentistry**, TOHOKU UNIVERSITY, Sendai, Japan

PROFESSIONAL EXPERIENCE
04/2009-03/2010   **Dentist**, Center for Postgraduate Clinical Training, TOHOKU UNIVERSITY HOSPITAL, Sendai, Japan
04/2013-02/2019   **Assistant Professor**, Section of Preventive and Public Health Dentistry, Faculty of Dental Science, KYUSHU UNIVERSITY, Fukuoka, Japan
03/2019-11/2021   **Associate Professor**, Department of Preventive Medicine, NAGOYA UNIVERSITY Graduate School of Medicine, Nagoya, Japan
11/2021-Present   **Associate Professor**, Department of International and Community Oral Health, TOHOKU UNIVERSITY Graduate School of Dentistry, Sendai, Japan **Specially-appointed Professor**, Division of Regional Community Development, Liaison Center for Innovative Dentistry, TOHOKU UNIVERSITY Graduate School of Dentistry, Sendai, Japan

HONORS & AWARDS
05/2019 The Japanese Society for Oral Health Academic Award "LION Award"
06/2016 The J. Morita Post-doctoral Award for Junior Investigators for Geriatric Oral Research (First Prize), The 94th IADR General Session & Exhibition
07/2014   The Best Presenter Award, The 36th General Meeting of Kyushu Society for Oral Health

CURRICULUM VITAE

DR TEOH KHIM HEAN
MDS (Prostho) BDS FAMS

DEPUTY DIRECTOR
CLINICAL & REGIONAL HEALTH
NATIONAL DENTAL CENTRE SINGAPORE

Dr Teoh is currently Deputy Director, Clinical & Regional Health of National Dental Centre Singapore and Academic Vice-Chair, Clinical Service of SingHealth Duke-NUS Oral Health Academic Clinical Program. He is also Senior Consultant at the Department of Restorative Dentistry, Clinical Associate Professor of the NUS Faculty of Dentistry as well as Adjunct Associate Professor of SingHealth Duke-NUS Oral Health Academic Clinical Program.

Dr Teoh began his career as a dental officer after graduating with Bachelor of Dental Surgery at the Faculty of Dentistry, National University of Singapore in 1988. He received his Master of Dental Surgery in Prosthodontics in 1994. He is a Fellow in the Academy of Medicine Singapore. He was awarded Fellowship to pursue further training in the subspecialty of Maxillofacial Prosthetics at the Memorial Sloan-Kettering Cancer Centre in New York in 2001 proved to be a turning point in his career. He was inspired to stay on and makes contributions in public health by working in collaboration with SGH Speech Therapy Department to establish Prosthetic, Speech and Swallowing Rehabilitation Clinic (PSSR) at NDCS in 2003 and is also a Visiting Consultant at the Singapore National Eye Centre to provide ocular/orbital prostheses to patients with anophthalmic defects. As he continues to build his clinical experience in maxillofacial prosthetics, he was promoted through the ranks to Senior Consultant in 2008.

As the Centre's Deputy Director for Clinical & Regional Health, he oversees the clinical service, its governance and productivity. In 2016-2018, he led the center on a service transformation journey to improve access to care, patient experience and financial sustainability. From 2018 -2021, he oversaw the model of care transformation journey where value driven care pathways were introduced in 6 dental conditions. A clinical quality index (CQI) was developed, with a judicious selection of relevant outcomes measures and service standards for each pathway.

He provides leadership in developing strategies and initiatives to integrate oral healthcare across the continuum with upstream focus and foster strong partnerships and networks in better managing population oral health. He leads a strong NDCS RHS team collaborating with community partners, agencies, Singealth Office of Regional Health and primary healthcare partners for the outreach efforts.

Dr Teoh serves on the Singapore Ministry of Health's Dental Specialist Accreditation Board. He is a Clinical Associate Professor of the National University of Singapore and as an Associate Director for Prosthodontics since 2008; he teaches and was involved in the clinical training of the prosthodontics residents and their research thesis projects. In addition, he serves on numerous committees of the Singapore Health Services group of companies.

Dr Teoh enjoys photography and travelling, as often as his schedule permits.

Presentation Synopsis (Abstract)

Integrating Oral Health Care Transformation and Health Services Research.

Healthcare systems across the world are facing challenges due to aging population, higher chronic disease incidence, rising public expectations and healthcare costs. For sustainability, healthcare systems must transform their model of care to meet such challenges. This presentation will highlight our journey in healthcare transformation using a value-based approach, integrating oral heath as part of general health, and partnering primary care to improve population oral health across the care continuum. Health services research opportunities and future directions will be shared.

Oral Microbiome-*Beyond Bacteria*
Xuesong HE, DDS, PhD.

Associate Member of Staff, Microbiology, The Forsyth Institute
Member of Faculty, Oral Medicine, Infection and Immunity, Harvard School of Dental Medicine

Oral microbiota is an important part of the human microbiota. It has evolved with host and plays a crucial role in human health and disease. Culture-independent sequencing methods have revealed remarkable diversity within oral microbiome. Our ability to identify and isolate oral microbial residents and decipher their extensive interactions has rapidly increased within the past decade. However, our understanding of the oral microbiota as an ecological system with diverse, interactive entities, as well as its impact on host health and disease is still in its infancy. Oral microbiome is composed of diverse conventional bacterial species, fungal and viral (bacteriophage) components, as well as recently identified nano-sized Candidate Phyla Radiation (CPR) organisms. Recently developed techniques provide a more inclusive view of the ecology of the human microbiome. For example, the newly identified parasitic relationship between the CPR group of ultrasmall bacteria and their bacterial hosts represents a novel, while likely common, interspecies interaction within the oral microbiome. Meanwhile, oral bacterial–fungal interactions highlight the importance of interkingdom interactions in the pathogenesis of polymicrobial diseases. Furthermore, the prevalence and diversity of lysogenic and lytic oral phages modulate community structure and functionality of the oral microbiota. With these new knowledge gain, there is an urgent need to promote research for a deep systems-level understanding of oral microbiome ecology on a holistic level. Maintenance of microbial homeostasis is crucial in maintaining health, while dysbiotic oral microbiome often leads to local and systemic diseases. Effective management of oral microbiome-related diseases calls for a more comprehensive understanding of the impact of the oral microbiota on host health and disease, which requires a holistic view of intra- and cross-kingdom interactions among members of the oral microbiome, as well as microbial-host interaction. Such a deep systems-level understanding at the molecular stratum demands expansion of our knowledge from bacterial interspecies interactions to interkingdom interactions among bacteria, CPR, fungi, and viruses. It will be a challenging task that necessitates a systems-level approach and would benefit from close collaborations among different research groups.

CURRICULUM VITAE

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Member of Faculty, Oral Medicine, Infection and Immunity, Harvard School of Dental Medicine
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Education:
1990-1997	D.D.S.	Dentistry	Peking University, China
2000-2006	PhD	Microbiology (Thesis advisor: Dr. Clay Fuqua) Indiana University, USA	

Postdoctoral Training:
1997-1999	Resident	Prosthodontics	Peking University, School of Stomatology, China
2006-2010	Postdoc	Microbiology (PI: Wenyuan Shi)	UCLA school of dentistry

Faculty Academic Appointments:
2010-2016	Adjunct Assistant Professor	Oral Biology	UCLA School of Dentistry
2016-2017	Adjunct Associate Professor	Oral Biology	UCLA School of Dentistry
2017-2017	Associate Professor in Residence	Oral Biology	UCLA School of Dentistry
2018-present	Associate Member of Staff	Microbiology	The Forsyth Institute
2020-present	Member of Faculty	Oral Medicine, Infection and Immunity	Harvard School of Dental Medicine

Major Administrative Leadership Positions:
2019- Associate Program Director for Postdoctoral Training Program   The Forsyth Institute

Honors and Prizes:
2013	Dean's Faculty Seed Grant Award	UCLA School of Dentistry	Research
2019	Forsyth Collaborative grants	Forsyth Institute	Research

Ad hoc Reviewer:
Nature Microbiology; International Society for Microbial Ecology Journal; Proceedings of the National Academy of Sciences of the United States of America; Journal of Dental Research; Journal of Applied Microbiology; Archives of Oral Biology; Applied and Environmental Microbiology; Public Library of Science One Journal; Scientific Reports; Microbial Microbiology; Frontiers in Microbiology; International Journal of Oral Science; Microbial Ecology; ISME J

Narrative Report of Research:
1). "Domestication of yet-to-be cultured microbes"
2). "Understanding the social structure and community functionality of host-associated microbiome"
3). "Studying the ecological importance of individual bacterial species within host-associated microbiome"
4). "Microbial-Host Interaction"
5) "Developing novel antimicrobials in preventing dental caries"

Metabolic functions of the oral microbiome: How does the oral microbiome function and contribute to our health?

Jumpei Washio[1], Gen Mayanagi[2], Yuki Abiko[1], Ryo Tagaino[1,3], Dimas Prasetianto Wicaksono[1,4], Hitomi Domon[1], Kazuko Ezoe[1], Satoko Sato[1], and Nobuhiro Takahashi[1]

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As everyone knows well, the metabolites produced from sugars, proteins and amino acids by oral microbiome (OM) relate to the onset and progress of dental caries and periodontitis. Recently, besides sugars, proteins, and amino acids, the metabolites derived from ethanol and nitrates are also attracting attention. Ethanol and nitrate are frequently taken in as alcohol drinks and green leafy vegetables, respectively. OM can metabolize ethanol to acetaldehyde, which is a potent carcinogen and might contribute to the induction of oral and upper digestive tract cancer. While OM can metabolize nitrate to nitrite, which has two positive effects, antimicrobial effect and vasodilatory effect. These two effects might contribute to the maintenance of the oral and systemic health. The role of OM in maintaining our health may be greater than we expect. As the first topic, I will introduce our recent studies on the ethanol and nitrate metabolism of oral bacteria.

Most previous bacteriological studies on OM have mainly asked "what kinds of bacteria are present in OM". However, it is important to remember that metabolites are the direct cause of health and disease and that even if the targeted bacteria are present, they would not have any effect unless they are metabolically active. Furthermore, bacterial metabolism can be modified by various environmental factors in the oral cavity such as pH, oxygen, nutrients etc. Therefore, in addition to the bacterial composition of OM, it is necessary to understand bacterial metabolic activity in the OM or to answer the question "How do the bacteria function in the OM?". There are two main strategies for analyzing the metabolic activity of bacteria in the OM. One is a conventional method, in which representative bacteria in the OM are allowed to metabolize substrates under conditions that mimic those of the OM, and the metabolic activity and pathways are estimated. The other is the metabolomics of OM, in which metabolites in OM samples are comprehensively analyzed and metabolic activities are estimated by reconstructing metabolic pathways.

The metabolomics of OM samples is thought to be one of the most suitable methods for evaluating the metabolic activity of OM in vivo. However, in fact, the metabolic property in actual human OM remains unclear due to technical limitation. Clinical specimen, such as oral biofilm samples, were too small to be analyzed using conventional analysis of metabolites. In these two decades, the techniques and the devices for "metabolomics" have been developed rapidly, which has helped solve these technical limitations. Hence, we applied the combination devices of capillary electrophoresis and time-of-flight mass spectrometry to metabolomics of actual human OM, and clarified the metabolic network

of carbohydrates and amino acids in the OM. It should be noted that conventional in vitro metabolic studies using representative bacteria were equally important to determine and confirm the metabolic network in OM. These observations suggest that the metabolomics using actual human OM is essential for the development of accurate diagnostic, effective treatments and preventive strategies for OM related oral diseases in future. At the same time, conventional in vitro metabolic studies are necessary as a complemental approach to better understand the metabolism of OM. As the second topic, I will introduce our studies on the metabolomics of OM.

The metabolisms in the OM have been involved in both health and disease; however, the whole picture of metabolic system and network in the OM is still unclear. Further challenge is needed to pioneer new technologies and gain a deeper understanding of OM.

CURRICULUM VITAE

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Education:
2001.3: D.D.S. Tohoku University School of Dentistry
2005.3: Ph.D. Tohoku University Graduate School of Dentistry
2005.4-: Research Assistant Professor, Tohoku University Graduate School of Dentistry
2006.4-2016.9: Assistant Professor, Tohoku University Graduate School of Dentistry
2016.10-present: Lecturer (Junior Associate Professor), Tohoku University Graduate School of Dentistry
Professional Memberships
International association of Dental Research (JADR) / The Japanese Biochemistry Society / Japanese Association for Oral Biology / The Japanese Society for Oral Health / Japanese Society of Oral and Maxillofacial Surgeons / Tohoku Dental Society / Japanese Society of Functional Foods for Oral Health (2021, Board member)
Research interest
My research interest is "oral microbiome", especially its "metabolisms". Until now, I have investigated the metabolism of sugars, amino acids, ethanol, nitrate and nitrite by oral bacteria, and clarified the effects by various environmental factors, food components and drugs on the metabolisms. Furthermore, I was involved in launching a metabolomic technology of oral microbiome, and performed the world's first metabolomic analysis of the oral microbiome. Recently, I am also interested in the metabolism of host cells (normal/cancer) based on this experience. Now, my research group is trying to clarify the interaction between oral bacteria and host cells from metabolic perspectives.

K4-3

Oral Microbiome-systemic Link: Current Limitations and Future Artificial Intelligence-based Approaches

Jaya Seneviratne

National Dental Research Institute Singapore (NDRIS), National Dental Centre Singapore (NDCS), SingHealth Duke NUS

In the past decade, there has been a tremendous increase in studies on the link between oral microbiome and systemic diseases. We analysed past high-throughput sequencing-based studies that examine the oral microbiome-systemic disease link and found inconsistent evidence across studies due to differences in the i) study design ii) data analysis, and iii) interpretation. It is important to understand the limitations of past studies, so that future studies can have a more robust framework. This presentation will provide an overview of possible improvements that can be implemented in the study design, host metadata collection, and analytical tools and propose an artificial intelligence (AI)-based approach for future oral microbiome studies. A brief description of how AI-based machine learning and deep learning approaches have been employed for microbiome studies will also be provided.

CURRICULUM VITAE

Associate Professor Jaya Seneviratne is affiliated to the National Dental Research Institute Singapore (NDRIS), National Dental Centre Singapore (NDCS), SingHealth Duke NUS. He is the Director of Basic and Translational Research at NDCS and leads the Singapore Oral Microbiomics Initiative (SOMI). He obtained his PhD in Oral Microbiology at The University of Hong Kong (HKU) with the Outstanding Research Postgraduate Award. He completed a Diploma in Immunology from Pasteur Institute, HKU and an advanced course in Proteomics Bioinformatics from the European Bioinformatics Institute, UK.

A/Prof Seneviratne has published over 90 journal articles and his research team has received over 20 prestigious awards from the International Association for Dental Research (IADR). His research projects have been supported by local and international funding agencies including Singapore National Medical Research Council (NMRC). A/Prof Seneviratne's research group has ongoing studies on oral microbiome-systemic link with SingHealth partner institutions.

The twists and turns of periodontal disease: etiological insights and a novel treatment approach

Rory Munro WATT, PhD

Oral Biosciences, Faculty of Dentistry, University of Hong Kong

Thousands of different species (phylotypes) of bacteria inhabit the human oral cavity. They live in complex multispecies biofilm communities, within aerobic or oxygen-depleted niches on the hard (mineralized) or soft (mucosal) tissues. Several hundreds of different oral bacterial species have been cultivated in vitro and formally characterized, whilst many others are poorly understood or have yet to be cultivated.

The oral microbiota of several mammalian species (e.g. dogs, cats) have been characterized. They generally share significant similarity to the human oral microbiome, but have many distinct features. By comparing the composition of the oral microbiota in humans and animals, we may get a better understanding of common mechanisms underlying resilient 'healthy' homeostatsis (eubiosis) as well as 'unhealthy' dysbiosis, which may lead to oral diseases such as caries or periodontitis.

In this talk, I will introduce several recent or ongoing projects relating to the oral microbiota in humans and other mammals, and I will discuss how this relates to oral health; with focus on periodontal health. I will discuss our recent attempts to transplant a 'healthy' canine periodontal microbiota into dogs with periodontal disease, to try to improve their periodontal health. I will also discuss our recent investigations into the oral microbiota of children with gingivitis. I will then focus on the clinical distributions and genome biology of oral spirochetes including Treponema denticola and 'Treponema vincentii/Treponema medium-like' bacterial taxa.

By covering these topics, it is hoped that I can highlight some important commonalities and unique features of the bacterial factors that underlie periodontal health versus disease.

CURRICULUM VITAE

Rory Munro WATT, PhD

Education and Training
Doctor of Philosophy, Chemistry, University of Edinburgh, UK 1995-1998
Bachelor of Science (1st class Hons), Chemistry, University of Edinburgh, UK
1991-1995

Present Academic Position
Associate Professor in Oral Biosciences, Faculty of Dentistry, University of Hong Kong (2014-present)

Previous Academic Positions Held
Assistant Professor in Oral Biosciences, Faculty of Dentistry, University of Hong Kong 2008-13
Research Assistant Professor, Chemistry Dept., University of Hong Kong   2006-07
Research Fellow, Chemistry Dept., University of Hong Kong   2004-06
Senior Research Associate, Biochemistry Dept., University of Hong Kong   2001-04
Research Associate, Chemistry Dept., Brown University, Providence RI, USA   1999-2000

Positions and Honors
Director, Central Research Laboratory, Faculty of Dentistry, University of Hong Kong 2009 - present
Associate Dean, Research and Innovation, Faculty of Dentistry, HKU   2020 (Jan-Jun)
Research Theme Leader (Microbiome Innovation), Faculty of Dentistry, HKU   2019-present
Research Theme Leader (Oral Microbiology and Immunology), Faculty of Dentistry, HKU 2008-2019

Description of Relevant Research Experience
Oral Microbiome analysis especially related to periodontal and peri-implant diseases. Proteomics, Genomics, Structural Biology, and Infectious disease diagnostics. Identification and characterization of proteins and molecular pathways involved in bacterial stress resistance, virulence, and biofilm formation; especially relating to peptidases/proteases, polyphosphate metabolism, (p)ppGpp signaling, and nucleotide metabolism. Genomic, phylogenetic and biological analysis of oral bacteria, particularly treponemes (spirochetes).

Research Prizes
Research Award in Microbiology / Immunology / Periodontal Research, 29th International IADR-South-East Asia Annual Scientific Meeting, Bali, 2015
Research Award in Microbiology / Immunology / Periodontal Research, 26th IADR-South East Asia Annual Scientific Meeting, Hong Kong, 2012
Faculty Research Output Prize, Faculty of Dentistry, University of Hong Kong, 2012

Journal Editing / Reviewing
Editorial Board Member: Clinical Oral Implants Research (2021-present)
Review Editor: Frontiers in Cellular and Infection Microbiology (2020-present)
Reviewer for: Journal of Dental Research; Journal of Bacteriology; Scientific Reports; PLoS One; Journal of Periodontal Research; Journal of Periodontology, Journal of Oral Microbiology, Clinical Oral Implants Research, Molecular Oral Microbiology; Archives of Oral Biology, International Journal of Systematic and Evolutionary Microbiology, Journal of Medical Microbiology, BMC Microbiology, Virulence, Microbial Pathogenesis, Frontiers in Cellular and Infection Microbiology

Wnt5a, released from mechanically stimulated periodontal ligament cells, promotes neurite elongation and branching in peripheral neurons

Minoru Wakamori, Kaori Takahashi, and Takashi Yoshida

Division of Molecular Pharmacology and Cell Biophysics, Department of Disease Management Dentistry, Graduate School of Dentistry, Tohoku University, Sendai, Japan

The peripheral sensory nerves must be maintained to sense environmental changes. For example, the size and the number of Ruffini endings in rat periodontal ligament (rPDL) decrease by reducing the mechanical stimulation (Shi et al., 2005), suggesting that daily physiological mechanical stimulations, like occlusal force, contribute to nerve homeostasis directly or indirectly. However, the indirect mechanisms, especially the molecular cues that are released from mechanically stimulated peripheral tissues and their effects on peripheral nerves remain to be elucidated. Here, we demonstrate that Wnt5a, one of the axon guidance proteins, is released from mechanically stimulated rPDL cells and promotes elongation and branching of peripheral nerves. Cyclic mechanical stretching of rPDL cells enhanced *Wnt5a* expression in a Ca^{2+}-dependent manner. Although inhibitors of JNK (SP600125) or nuclear factor-κB (NF-κB) (BAY 11-7082) didn't abolish the increase in *Wnt5a* expression, inhibitors of MEK1/2 (U0126) and PI3K (LY294002) suppressed the phosphorylation of ERK1/2 and Akt, respectively, and consequently abolished the increase in *Wnt5a* expression. Similarly, PF573228, a focal adhesion kinase (FAK) inhibitor, attenuated ERK1/2 and Akt phosphorylation and *Wnt5a* expression. Importantly, the culture medium of stretched PDL cells enhanced neurite elongation and branching of trigeminal ganglion (TG) and trigeminal mesencephalic nucleus (Me5) neurons. Moreover, treatment with a neutralizing anti-Wnt5a antibody, DAPT (a γ-secretase inhibitor used to inhibit Ryk signaling), or strictinin (a Ror1 inhibitor), suppressed these effects. These findings reveal that Wnt5a, which is released from connective tissue in response to mechanical stimulation, induces elongation and branching of the peripheral nerves. Our study suggests that the peripheral tissues regulate peripheral nerve homeostasis and that Wnt5a signaling could be a therapeutic target for the treatment of peripheral nerve disorders.

CURRICULUM VITAE

Minoru WAKAMORI, DDS, Ph.D.
Professor, Division of Molecular Pharmacology and Cell Biophysics, Department of
Disease Management Dentistry, Tohoku University Graduate School of Dentistry
Address: 4-1, Seiryo-machi, Aoba-ku, Sendai, 980-8575, JAPAN

Education:
1987   Graduated from Kyushu Univ., Fac. of Dent., Fukuoka, Japan
1987   Resident at Dept. of Oral Surgery, Kyushu Univ. Dent. Hospital
1988   Ph.D. student at Dept. of Physiol., Grad. Sch. of Med., Kyushu Univ.
1989   Ph.D. student at Dept. of Neurophysiol., Grad. Sch. of Med., Tohoku Univ.
1992   Postdoctoral Fellow at Dept. of Pharmacol. & Cell Biophys., Univ. of
         Cincinnati, Sch. of Med., Cincinnati, OH

Academic Appointments:
1995   Research Associate at Institute of Mol. Pharmacol. & Biophys., Univ. of Cincinnati
1995   Research Associate at Dept. of Information Physiol., National Institute for Physiological Sciences,
         Okazaki, Japan
2001   Associate Professor at Dept. of Physiol., Fac. of Med., Kagoshima Univ., Kagoshima, Japan
2004   Associate Professor at Dept. of Synthetic Chem. & Biol. Chem., Grad. Sch. of Engineering, Kyoto
         Univ., Kyoto, Japan
2007   Professor at Div. of Mol. Pharmacol. & Cell Biophys., Dept. of Disease Management Dent., Grad.
         Sch. of Dent., Tohoku Univ., Sendai, Japan

Research Theme:
The major goal of my research is to elucidate the operating principles of the body at the molecular level to maintain homeostasis. In particular, I am interested in the mechanisms of regulating intracellular Ca^{2+} concentration, and transduction mechanisms of oral sensations. My research targets are TRP channels, and Ca^{2+}-permeable cation channels including voltage-gated Ca^{2+} channels and ligand-gated channels.

K5-2

Mechanical force and the control of periodontal ligament cell behaviors

Thanaphum Osathanon, DDS, Ph.D.
Dental Stem Cell Biology Research Unit, Excellence Center of Regenerative Dentistry,
Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand

Mechanical force modulates many cell responses, especially in periodontal ligament. Periodontal ligament cells sense mechanical stimulation via numerous mechanoreceptors. Different force factors alter distinct cell responses. We demonstrated that the continuous (CCF) and intermittent (ICF) compressive force differentially control gene expression as determined by a high throughput RNA sequencing. Gene-expression profiling of human periodontal ligament cells (hPDLs) after CCF or ICF treatment demonstrated that the upregulated genes were related to extracellular matrix (ECM)-receptor interaction, focal adhesion, and transforming growth factor beta (TGF-β) signaling pathway, while the downregulated genes were involved in calcium signaling pathway. However, the differentially expressed genes in those pathways were different. For TGF-β signaling pathway, TGFB1 mRNA expression was significantly increased in ICF treatments while CCF did not modify this expression. TGFB2 and TGFB3 mRNA levels were decreased by ICF treatment. ICF pretreatment promoted osteogenic differentiation of hPDLs as determined by the upregulation of osteogenic marker genes including OSX and mineral deposition. Inhibition of TGF-β signaling using TGF-β receptor type I inhibitor or TGF-β1 neutralizing antibody resulted in the ICF-induced OSX expression. Further, TGF-β receptor type I inhibitor pretreatment attenuated the ICF-induced mineralization. Beside TGF-β signaling, ICF regulated genes in Wnt signaling pathways. WNT2, WNT2B, WNT5A, WNT5B, WNT9A, WNT10B, and WNT11 mRNA levels were upregulated in ICF treated condition. ICF-induced WNT expression was abolished by pretreated with TGF-® receptor type 1 inhibitor. Exogeneous TGF-®1 treatment in hPDLs enhanced WNT2, WNT5B, WNT10B, and WNT11 mRNA expression in dose dependent manner. In conclusion, this study reveals the effects of ICF on osteogenic differentiation in hPDLs and implicates TGF-β and Wnt signaling as its regulatory mechanisms.

CURRICULUM VITAE

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Position   Professor
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                Dental Stem Cell Biology Research Unit
                Excellence Center in Regenerative Dentistry,
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Professor Osathanon earned his bachelor's degree Doctor of Dental Surgery from Chulalongkorn University, Thailand and further his graduated study Doctor of Philosophy in Oral Biology from University of Washington, USA. He formerly served as Director of Oral Biology Research Center, Faculty of Dentistry, Chulalongkorn University. Currently, Professor Osathanon is an Associate Dean in Research Affairs and Deputy Director of CU Dental Innovation Center at Faculty of Dentistry, Chulalongkorn University, Thailand. He is also a Chairs of Dental Stem Cell Biology Research Unit. He serves as the Senior Expert at the Center for Dental Competency Assessment and Accreditation, the Dental Council of Thailand and the Chair of Biomedical and Dental Science Examination Development Committee, the Dental Council of Thailand. He published more than 80 publications in international research database. His research interests are 1) intracellular pathways modulated stem cell function; 2) mechanical force and osteogenic differentiation; and 3) biomaterials and dentin/dental pulp regeneration.

Selected Publications

1. Manokawinchoke J, Pavasant P, Limjeerajarus CN, Limjeerajarus N, **Osathanon T**, Egusa H. Mechanical loading and the control of stem cell behavior. Arch Oral Biol. 2021 May;125:105092.
2. Manokawinchoke J, Pavasant P, Sawangmake C, Limjeerajarus N, Limjeerajarus CN, Egusa H, **Osathanon T.** Intermittent compressive force promotes osteogenic differentiation in human periodontal ligament cells by regulating the transforming growth factor beta pathway. Cell Death Dis 2019;10(10):761
3. Manokawinchoke J, Pavasant P, **Osathanon T**. Intermittent compressive stress regulates Notch target gene expression via transforming growth factor-β signaling in murine pre-osteoblast cell line. Arch Oral Biol. 2017 Oct;82:47-54.
4. Manokawinchoke J, Sumrejkanchanakij P, Pavasant P, **Osathanon T**. Notch signaling participates in TGF-beta-induced SOST expression under intermittent compressive stress. J Cell Physiol. 2017 Aug;232(8):2221-2230.
5. Kornsuthisopon C, Pirarat N, **Osathanon T**, Kalpravidh C. Autologous platelet-rich fibrin stimulates canine periodontal regeneration. Sci Rep 2020l10(1):1850.
6. Manokawinchoke J, Watcharawipas T, Ekmetipunth K, Jiamjirachart M, **Osathanon T.** Dorsomorphin attenuates Jagged1-induced mineralization in human dental pulp cells. Int Endod J. 2021 Aug 29. doi: 10.1111/iej.13620. Online ahead of print.

More Publications

Root Cementum, the Biological Interface between Periodontal Regeneration and Periodontal Repair

Alex Spahr, DMD, Ph.D.

Professor, Director of Oral Rehabilitation & Head Discipline of Periodontics
Head of Department of Periodontics Sydney Dental Hospital
School of Dentistry, The University of Sydney, Sydney, Australia

Considerable advances have been made in recent years in regenerating lost tooth supporting tissues due to the development of new methods and materials for periodontal regeneration. Therapy of marginal periodontitis is aimed at complete regeneration of lost periodontal tissues (restitutio ad integrum) rather than merely preventing further attachment loss. So far, attempts of periodontal regeneration have been made by using various non-resorbable and resorbable membranes according to the principles of guided tissue regeneration (GTR) as well as different types of bone grafts or bone substitutes. However, all these strategies are based on a more or less mechanistic philosophy. In 1995, the introduction of a rather different and innovative approach took place, when European authorities and the FDA approved an enamel matrix protein preparation (EMD) as biological based device for periodontal regeneration. Opposed to the other GTR concepts mentioned before, the application of EMD focused specifically on the regeneration of root cementum. Root cementum was considered as the key tissue for and initiator of periodontal regeneration.

The objective of this presentation is to outline and evaluate past and current concepts of periodontal regeneration with a specific focus on the role of root cementum and the involvement of enamel matrix proteins in development and regeneration of root cementum and periodontal tissues.

CURRICULUM VITAE

Alex Spahr, DMD, PhD., MRACDS (Perio)
Professor, Director of Oral Rehabilitation & Head Discipline of Periodontics. The University of Sydney School of Dentistry, Faculty of Medicine and Health, Sydney, Australia. Head, Department of Periodontics Sydney Dental Hospital, Sydney, Australia. Priv.-Doz. (Associate Professor) University of Ulm, Germany

Education:

1994	Degree in Dentistry (equivalent to a D.M.D./D.D.S.)
1989-1994	Study of Dentistry at the University of Ulm, Ulm, Germany
1997	Dr. med. dent. with the grade "magna cum laude" from the University of Ulm, Ulm, Germany (equivalent to a Ph.D. in one of the Oral and Dental Sciences offered by an accredited university in the United States). Thesis: Total mercury burden of people measured in scalp hair in relation to the number or surface of amalgam fillings

Academic Appointments:

2020- Present	Director of Oral Rehabilitation, The University of Sydney School of Dentistry, Faculty of Medicine and Health, Sydney, Australia
2019- Present	Deputy Head of School, The University of Sydney School of Dentistry, Faculty of Medicine and Health, Sydney, Australia
2018- Present	Head, Discipline of Restorative and Reconstructive Dentistry & Subject Area Periodontics. The University of Sydney School of Dentistry, Faculty of Medicine and Health, Sydney, Australia
2014- Present	Course Coordinator DClinDent-Perio, University of Sydney, Sydney, Australia
2011	Admitted as a member of the Royal Australasian College of Dental Surgeons in the Special Field of Periodontics. MRACDS (Perio)
2011- Present	Head, Discipline of Periodontics, University of Sydney, Sydney, Australia
2010- Present	Head, Department of Periodontics, Sydney Dental Hospital (SDH), Sydney, Australia Clinical Associate Professor, University of Sydney, Sydney, Australia

Memberships, Officers, and Committee Assignments:

2014-2015	Secretary of the Periodontal Research Group, International Association of Dental Research (IADR)
2015-2016	President-elect of the Periodontal Research Group, International Association of Dental Research (IADR)
2016-2017	President of the Periodontal Research Group, International Association of Dental Research (IADR)
2017-2018	Immediate Past President of the Periodontal Research Group, International Association of Dental Research (IADR)

Awards

2000	Education-Award of the University of Ulm for extraordinary performance in teaching and education.
2009	Walther Engel Award. Award of the Dental Academy of Karlsruhe and the dental federation of Baden-Württemberg for extraordinary achievements in dental research and dental education.

K6-1

Application of Synchrotron Radiation for The Analyses of Biological Specimens
Motohiro UO

Tokyo Medical and Dental University

Synchrotron radiation (SR) generates wide range electromagnetic waves (from infrared to X-ray), which are extremely bright, focused, and polarized. Therefore, SR lights are applied for various scientific studies. For example, X-ray fluorescence with SR light enables the trace element detection and X-ray absorption spectroscopy provides the information of the chemical state and local structure of the target element. Eight synchrotron facilities are opened to the researchers in Japan and the next generation synchrotron "Synchrotron Light in Tohoku, Japan (SLiT-J)" is under construction in the Tohoku University and will be opened in 2023. Therefore, the analyses using SR becomes familiar for the research in various fields.

We have been applied the synchrotron radiation X-ray fluorescence (SR-XRF) analysis for the detection of the eroded metallic elements from the dental restoratives and implants into oral mucosa and trace element accumulation in the sequestra of the anti-resorptive agent related osteonecrosis of the jaw (ARONJ). The trace elements distributions could be visualized in the mucosa of the oral lichen planus adjacent to the metallic restoration. It suggested the relation of the lesion to the dissolved metallic ions. In case of ARONJ, characteristic copper accumulation in the sequestra along the edge of the trabecular bone was visualized.

In addition, the chemical state and the local structure of the elements derived from the composite resins (CRs) and implants have been estimated with using the X-ray absorption spectroscopy (XAS) using SR. Strontium (Sr) ion released from the fillers of CRs are absorbed in the tooth and improve the acid resistance of the tooth. XAS suggested that Sr was incorporated to Ca site of tooth hydroxyapatite. In case of the dental implant, titanium (Ti) accumulation was observed in the surrounding mucosa, and the chemical state of Ti was estimated as metallic Ti or TiO_2 by XAS.

In this lecture, the details of above research results with SR will be introduced.

CURRICULUM VITAE

1992	:	Ph.D., Faculty of Engineering, The University of Tokyo
1992-1994	:	Research Associate in the Department of Metallurgy, Faculty of Engineering, University of Tokyo
1994-2001	:	Research Associate in the Department of Dental Materials and Science, School of Dentistry, Hokkaido University
2001-2011	:	Associate Professor in the Department of Biomedical Materials and Science, Graduate School of Dental Medicine, Hokkaido University
2011-present	:	Professor and chair in the Department of Advanced Biomaterials, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University

Biomaterials with Multicomponent Functionalization for Dentin-Pulp Regeneration

Yu-Chih Chiang, DDS, MS, PhD

1) School of Dentistry, National Taiwan University, No.1, Changde St., Taipei, Taiwan
2) Biomedical Molecular Imaging Center, National Taiwan University, Taipei, Taiwan

Tissue engineering based on the combination of isolated cells, scaffolds, and growth factors is widely used; however, the manufacture of cell-preloaded scaffolds faces challenges. Herein, I would like to introduce two approaches to promote the dentin-pulp regeneration. One approach is that we synthesized a nanocrystalline calcium sulfate to carry growth factors (TGF-β1, FGF-2 and VEGF) and mixed with hydroxyapatite. The alkaline phosphatase and migration assay showed human dental pulp stem cells (hDPSC) grew and proliferated well on the functional compound and great potential to promote dentin-pulp regeneration. Another approach is that we fabricated a multicomponent scaffold with multiple component accommodations, including growth factors (FGF-2 and Wnt3a), and living cells of hDPSC within one scaffold construct. We report an innovative fabrication process based on vapor-phased construction using iced templates for vapor sublimation. Simultaneously, the vaporized water molecules were replaced by vapor deposition of poly-p-xylylene, forming a three-dimensional and porous scaffold matrix. Additionally, the fabrication and construction resulted in a multicomponent scaffold product comprising the devised molecules, cells, and vapor-polymerized poly-p-xylylene as the scaffold matrix. The clean and dry fabrication process did not require catalysts, initiators or plasticizers, and potentially harmful solvents, and the scaffold products were produced in simple steps within hours of the processing time. The ability of inducing the odontoblast differentiation was determined by labeling the osteocalcin (OCN) and dentin sialophospho-protein (DSPP) expression, and were confirmed by immunofluorescence staining. The multicomponent functional poly-p-xylylene scaffold could also applied to the bone regeneration. The reported scaffold construction technology represents a prospective tissue engineering scaffold product to enable accommodable and customizable versatility to control the distribution and composition of loading delicate bioactive molecules and living stem cells in one scaffold construct and demonstrates multiple functions in tissue engineering repair and regenerative medicine applications.

Curriculum Vitae. Yu-Chih Chiang (姜昱至)

Yu-Chih Chiang ,
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Tel: +886-2-23123456 ext 67866   E-mail: munichiang@ntu.edu.tw

Education and Experiences:
PhD., Ludwig-Maximilians-University Munich, Germany, Oct 2009
M.S., National Taiwan University, Taiwan, June 2005
D.D.S., Chung Shan Medical University, Taiwan, June 1997

Deputy director of Biomedical Molecular Imaging Center, National Taiwan University, 2020-Present
President of Taiwan Academy of Operative Dentistry (TAOD), 2015-2019
Chair of Oral Biomaterials Core Lab, National Taiwan University, 2010-Present
Specialist of Operative Dentistry, 2010-Present
Specialist of Endodontology (Endodontic specialist), 2006-Present

Professional specialties：
Dentine Bonding Mechanism
Dental Composite
Dental Ceramics, Bioceramics
Adhesive and Restorative Dentistry
Endodontology

Main research interests：
Material Science in Dentistry
-- Composite resin and bonding agents
-- Fracture mechanics
-- Bioglass, Bioceramics
Endodontics
-- Pulp capping biomaterials
-- Dentin-Pulp regeneration (Vital Pulp Therapy)
Cariology
-- Demineralization and Remineralization
-- Anti-caries biomaterials
Micro-and Nano-Computed Tomography
-- Image reconstruction, processing and registration

International Honors and Awards:
1. 1st Place Best Poster Award (2018), ConsAsia, Sharjah
2. Joseph Lister Awards in Oral Disease Prevention (2014): IADR-SEA, Malaysia
3. Pulp Biology and Regeneration Group Travel Award (2014): IADR, Cape Town, South Africa.
4. Unilever Hatton Divisional Award (2010): IADR, Barcelona, Spain
5. Senior Robert Frank Award (2009): Basic Science, 1st Prize. IADR-CED, Munich, Germany.
6. Paffenbarger Award (2008): Academic of Dental Material (ADM), Würzburg, Germany.

Possibility of Ultrasonic and Photoacoustic Imaging of Oral Cavity
Yoshifumi Saijo, MD, PhD

Graduate School of Biomedical Engineering, Tohoku University

Ultrasound imaging is multi-scale and functional imaging. Because the wavelength and beam width are inversely proportional to the frequency of ultrasound, higher frequency ultrasound (HFUS) provides higher resolution imaging. In clinical dentistry, the frequency of the ultrasound was ranged around 10 MHz to provide macroscopic B-mode image of tongue or oral masses. Today higher resolution B-mode images are provided with a 70 MHz clinically available ultrasound machine. We are developing several types of functional ultrasound imaging which can be easily applied in clinical dentistry. The first is the speckle tracking of the B-mode image for quantitative observation of shoulder joint movements. The second is visualization of the propagation of the vibration applied by a vibrator to assess tissue elasticity. The third is the visualization of blood flow of the small vessel in the thyroid by application of singular value decomposition method, one of the spatio-temporal filtering techniques.

If the frequency is increased more, acoustic microscopy provides microscopic image with the resolution between 1 to 15 m. The image of a single-layered cell cultured on a dish is obtained by the 350 MHz an acoustic microscope. We have developed an optical-acoustical hybrid microscope to simultaneously obtain the optical and acoustic microscope images. Because the square of sound speed is proportional to bulk elastic module, cellular biomechanics is assessed by the sound speed distribution. In comparison with scanning laser microscopic image of C2C12 cell, change of actin polymerization is observed. The current system is big for oral cavity, the principle can be applied.

Photoacoustic (PA) imaging is combination of ultrasound and optics. The principle of PAI is that nano-second pulsed laser caused the transient temperature rise and expansion of the target to generate ultrasound. we have developed an optical resolution photoacoustic microscopy (OR-PAM) system using a high NA objective lens and a single-mode fiber to achieve sub-micron lateral resolution. This OR-PAM has achieved the lateral resolution of <700 nm, and the characteristic shape of a single red blood cell and melanoma cell are visualized.

CURRICULUM VITAE

Yoshifumi Saijo received the MD and the PhD degrees in 1988 and 1993 from Tohoku University. He had been trained as a cardiologist in Sendai Kosei Hospital and Tohoku Welfare Pension Hospital (currently Tohoku Medical and Pharmaceutical University Hospital) and he became a Chief Cardiologist at Fukaya Public Hospital in 1995. He returned to Tohoku University for research on medical ultrasound in 1997. He became a Guest Professor at Aarhus University, Denmark in 1999 and he became an Associate Professor of Institute of Development, Aging and Cancer (IDAC) at Tohoku University in 2004. He is currently a Full Professor of the Biomedical Imaging Laboratory at the Graduate School of Biomedical Engineering of Tohoku University. He is concurrent with Graduate School of Medicine, IDAC and Clinical Technology Department of University Hospital at Tohoku University. He has been Director of Medical Device Innovation Center since 2014.

His main research interests include high frequency biomedical ultrasound imaging, cardiovascular blood flow analysis and photoacoustic imaging. He was awarded in 1997 for his outstanding research paper in Ultrasound in Medicine and Biology, the official journal of the World Federation of Ultrasound in Medicine and Biology. He is a member of IEEE, The Japan Society of Ultrasonics in Medicine, Japanese Society of Echocardiography, Japanese Society for Medical and Biological Engineering and Japan Circulation Society.

Incorporation of Novel Bioactive Components for Functional Dental Materials

Jae-Sung Kwon [1,2]

[1] Department and Research Institute of Dental Biomaterials and Bioengineering, Yonsei University College of Dentistry, Seoul, Korea

[2] BK21 FOUR Project, Yonsei University College of Dentistry, Seoul, Korea

Dental materials and related dental medical devices are being developed and researched at rapid phase due to aging populations and demands for better quality of life. Markets related to dental materials are also expanding with introduction of various new novel materials in order to tackles remaining obstacles such as failure of materials, secondary caries or aid of regenerations. In recent years, we investigated possible applications of novel bioactive materials as component of newly developed dental materials for functionalities that may help to resolve such obstacles.

Nanodiamonds are biocompatible materials that would provide enhanced physical strength to the dental materials. We attempted to incorporate nanodiamond with surface functionalization into materials such as PMMA or 3D printing resins, in order to enhance mechanical properties. It was evident that amination of nanodiamond would further enhance the strength while antibacterial properties were also observed with incorporation of nanodiamonds.

Hydrated calcium silicate have also attracted few attentions especially with application as endodontic materials. However, we focused on use of hydrated calcium silicate in other fields such as resin-based pit and fissure sealants, tooth whitening agents or composite resins. It was evident that the use of hydrated calcium silicate would prevent demineralization by neutralizing acid environment, while such material may even remineralize enamel surfaces.

Bioactive glasses have been thoroughly studies by many of research groups. Compositional changes in bioactive glasses to form novel and functional glasses have attempted by either incorporating zinc or zirconia into glass components. Developed glasses acting as filler of resin based materials would provide antibacterial activities while as bone filler, would result in enhanced physical strength with bioactive tissue regenerations.

Finally, we are currently carrying out ongoing research with development of novel dental materials with incorporation of zwitterionic materials. Zwitterionic materials have unique characteristics of having equal amount of anionic and cationic groups, resulting in overall neutral charge as molecules, but have a high dipole moment. Such structure is known to be biologically phosphatidylcholine membrane of the mammalian cells, with antifouling but biocompatible nature. Initial attempt was to examine various zwitterionic materials; sulfobetaine methacrylate (SBMA), carboxy betaine methacrylate (CBMA) and 2-methacryloyloxyethyl phosphorylcholine (MPC) in different form of dental materials such as fluoride varnish, composite resins or even 3D printing resins. Our more recent work indicated that differences in effective outcome may obtained by use of different form of zwitterionic materials with slight differences in overall charges, while synergetic effects may be obtained by use of zwitterionic materials with material described earlier such as bioactive glasses, as the glass network may be influenced by the material. Furthermore, microbiological analyses indicated that the use of antibacterial or antifouling materials such as zwitterionic materials may be beneficial to oral microbiome as such material would have less disturbance to natural oral flora.

CURRICULUM VITAE

Personal Information
Name: Jae-Sung Kwon

Educations
March, 2013 ~ August, 2016: PhD in Dental Biomaterials and Bioengineering, Yonsei University College of Dentistry, Seoul, Korea
September, 2009 ~ December, 2010 : MMedSci in Medical Education, University of Nottingham, United Kingdom
September, 2001 ~ September, 2007 : BM BS (Equivalent to MD in USA) BMedSci in Medicine, University of Nottingham, United Kingdom

Work Experiences
2019 ~ Current: Assistant Professor/Vice-Chair, Research Institute and Department of Dental Biomaterials and Bioengineering, Yonsei University College of Dentistry, Seoul, Korea
2017 ~ 2019 : Research Professor/Vice-Chair, Research Institute and Department of Dental Biomaterials and Bioengineering, Yonsei University College of Dentistry, Seoul, Korea
2013 ~ 2017 : Teaching/Research Assistant and Researcher, Research Institute and Department of Dental Biomaterials and Bioengineering, Yonsei University College of Dentistry, Seoul, Korea
2010 ~ 2013 : Research Assistant/Research Scientist, Research Center for Orofacial Hard-Tissue Regeneration, Yonsei University College of Dentistry, Seoul, Korea
2008 ~ 2009 : Foundation Year 2 (Senior House Officer), Residency at King's Mill Hospital, Nottingham, United Kingdom
2007 ~ 2008 : Foundation Year 1 (Junior House Officer), Royal Derby Hospital, Derby, United Kingdom

Academic Role
2017 ~ Current: Secretary of International Co-operations Committee and Continuing Quality Assurance Comm, Korean Institute of Dental Education and Evaluation
2019 ~ Current: Committee Member of Korean Academy of Dental Materials
2020 ~ Current: Editor, Korean Journal of Dental Materials
2019 ~ Current: Guest Editor, Materials (MDPI) Special Issue "Titanium and Titanium Based Materials in Biomedical Applications"
2020 ~ Current: Topic Editor, Materials (MDPI)
2020 ~ Current: Associate Editor, Frontiers in Dental Medicine (Dental Materials)
2020 ~ Current: Guest Editor, Frontiers in Dental Medicine Special Issue "Antimicrobial and Biofouling Dental Materials"
2020 ~ Current: Guest Editor, Frontiers in Dental Medicine Special Issue "Nickel Titanium (NiTi) for Endodontic Applications"

Bioactive Properties of Newly Developed Bone Substitutes Induced by a Materials-cells Interaction

Osamu Suzuki[1], Yukari Shiwaku[1,2], Ryo Hamai[1]

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Grafting of autologous bone is still the first choice to fill various bone defects caused by trauma or illness to repair. This is because autologous bone exhibits reliable bone regenerative capacity showing osteoinductive and osteoconductive performances. However, synthetic calcium phosphate materials, such as hydroxyapatite (HA) and biodegradable β-tricalcium phosphate (β-TCP), have widely been used in many clinical situations due to not only their excellent osteoconductive performances but also quality and supply stability as biomaterials. We have been developing some octacalcium phosphate (OCP)-based bone substitute materials so far (*Dent Mater J* **39**:187, 2020) and elucidated the chemical and structural related mechanisms induced by OCP that exhibit higher bone regenerative capacities in comparison with existing materials, such as HA (*Biomaterials* **27**:2671, 2006; *Biomaterials* **30**:1005, 2009; *Sci Technol Adv Mater* **22**:345, 2021; *Appl Mater Today* **26**: 101279, 2022). OCP has been considered a precursor in bone and tooth apatite crystals. One of OCP-polymer composites with collagen was recently approved as a bone defect filling material for the use in combination with dental implants in oral surgery field through a company-led clinical trial (*J Tissue Eng* **11**:2041731419896449, 2020). The superior osteoconductive property of OCP was found first through an onlay graft experiment of OCP granules onto mouse calvaria, using OCP synthesized in a method under bench scale (*Tohoku J Exp Med* **164**:37, 1991). In this presentation, the bioactive properties of OCP and its polymer composite materials will be explained from the view point of a materials-cells interaction.

Findings we obtained so forth, including the materials-cells interaction, were as follows: 1) Mutual chemical interaction takes place between OCP and mineral crystals in autologous bone, if it is placed in bone defects, resulting in promoting possible osteoblastic cell differentiation, based on the evidence in vitro analysis (*Sci Technol Adv Mater* **22**:345, 2021); 2) Inorganic ions delivery from OCP to mesenchymal stem cells (MSCs) is involved in enhancing osteoblastic cell differentiation from mouse bone marrow D1 cells (*Acta Biomater* **88**:477, 2019; *Appl Mater Today* **26**: 101279, 2022), osteocyte differentiation from mouse IDG-SW3 cells (*Acta Biomater* **69**:362, 2018); capillary-like tube formation of human umbilical vein endothelial cells (HUVECs) (*Acta Biomater* **88**:514, 2019), the activities of which were induced during a spontaneous structural conversion from OCP to Ca-deficient HA, an analogue to bone apatite crystals, under physiological environments; 3) OCP enhances early stage of differentiation to pre-osteoblast-like cells from mouse bone marrow stromal ST-2 cells in a dose-dependent manner (*Tissue Eng Part A* **14**:965, 2008); 4) OCP allows macrophages to accumulate around the materials at the initial stage of bone deposition and migrate through the stimulation of calcium ionic dissolution of OCP (*RSC Adv* **6**:57475, 2016); 5) OCP induces formation of tartrate-resistant acid phosphatase (TRAP) and cathepsin-K positive osteoclast-like cells in a co-culture system of osteoblastic cells and bone marrow-derived macrophages together with increasing expression of receptor activator of NF-κB ligand (RANKL) in osteoblasts even in the absence of external RANKL agent (*Tissue Eng Part A* **15**:3991, 2009).

We have reported that OCP enhances bone regeneration more if combined with polymers such as collagen, gelatin, poly (lactic-co-glycolic acid) (PLGA) (*J Tissue Eng* **11**:2041731419896449, 2020; *ACS Appl Bio Mater* **3**: 1444, 2020; *Acta Biomater* **124**:358, 2021). The combination between OCP and such polymer materials improved not only the materials handling properties but also their bone regenerative capacities and biodegradable properties. The details of the bioactive properties of the developed materials in relation to the activation of bone-related cells will be presented and discussed.

CURRICULUM VITAE

Osamu Suzuki

Professor and Chair, Division of Craniofacial Function Engineering, Tohoku University Graduate School of Dentistry

Education

Graduate Student, 1984-1986 Yamagata University Graduate School of Engineering, Yonezawa, Japan, M.Eng.

Ph.D., 1991 Tohoku University Graduate School of Medicine, Department of Orthopedic Surgery, Sendai, Japan

Research & Professional Experience:

1986-1994 Research Associate, Japan Fine Ceramics, Ltd., Research & Development Division, Sendai, Japan.

1992-1994 Visiting Scientist, Forsyth Dental Center, Physical Chemistry Department, Boston, MA, USA.

1994-1998 Associate Researcher, JGC Co., Research Center, Yokohama, Japan.

1999-2004 Senior Researcher, JGC Co., Research Center, Oarai, Japan.

2004-Present Professor, Division of Craniofacial Function Engineering, Tohoku University Graduate School of Dentistry, Sendai, Japan**.**

Other Experience and Professional Memberships:

2018-Present Executive Director, Japanese Society for Biomaterials (JSB)

2018-2020 Executive Director, Japanese Society for Dental Materials and Devices (JSDMD)

2018-2020 Editor-in-Chief, Dental Materials Journal

Award:

2003 JGC Corp Award: The establishment in design basis of anti-fouling furnace tube

2003 Award in the 23rd Engineering Advancement Association (ENAA) of Japan: Engineering team for designing pharmaceutical facility with quantitative evaluation containing potent compound. No.238.

2013 Award in Reviewer for Grants-in-Aid for Scientific Research of Japanese Society for Promotion of Science (JSPS)

2015 Award of Japanese Society for Biomaterials: Elucidation of osteoconductivity and establishment of biomaterial science of OCP bone substitute materials

2020 Fellow, Biomaterials Sciences and Engineering (FBSE)

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S1-1

Coriander Vs Candida, a new regimen for oral candidiasis treatment

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Oral candidiasis is an infectious disease cause by a *Candida spp.* infection in oral cavity. In some conditions such as a decline of host immunity, microbial imbalance, and an improper denture/oral application can cause an overgrowth of *Candida spp.* that results in inflammation of surrounding structure. There are several antiseptics and anti-fungal medicines which can alleviate *candida spp*. and cure candidiasis. However, the ability to reduce inflammatory response and ease the burning sensation during treatment procedure is not achievable with current treatment methods.

Herbal medicines are the current global trend as an alternative or used in combination with modern medicine for disease treatment. Coriander is a common herbal plant widely used throughout the world. The anti-fungal and anti-inflammatory of coriander extract has been proven by several studies. Their components such as Linalool Geraniol, Terpinen-4-ol, Hydrocarbons γ terpinene, R-cymene possess substantial anti-fungal and anti-inflammatory abilities. Therefore, these extracted components have potential as an alternative medicine for candidiasis. Moreover, "electrospun" is a newly developed technology that can carry desired material in a film sheet and let it release slowly at target site, which could prove to be a useful treatment method for oral candidiasis.

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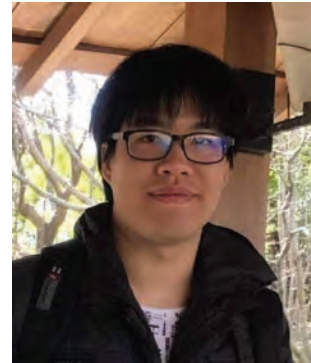
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Home Address	154 Ratchiangsaen road, Haiya district, Chiang Mai city, Chiang Mai, Thailand 50100

CURRENT POSITION

2013-present   Lecturer, Faculty of Dentistry, Chiang Mai University, Thailand

EDUCATION

2013   DDS, Faculty of Dentistry, Chiang Mai University, Thailand

2019   Ph.D., Faculty of Dentistry, The University of Hong Kong, Hong Kong

PAST RESEARCH WORK

1. Chinthakanan, S., **Laosuwan, K.**, Boonyawong, P., Kumfu, S., Chattipakorn, N. and Chattipakorn, S.C., 2018. Reduced heart rate variability and increased saliva cortisol in patients with TMD. Archives of oral biology, 90, pp.125-129.
2. **Laosuwan, K.**, Epasinghe, D.J., Wu, Z., Leung, W.K., Green, D.W. and Jung, H.S., 2018. Comparison of biofilm formation and migration of Streptococcus mutans on tooth roots and titanium miniscrews. Clinical and experimental dental research, 4(2), pp.40-47.

S1-2

The identification and regulation of skeletal-related mesenchymal stem cells in bone development and homeostasis

Dr. Yu SHI

West China School of Stomatology, Sichuan University, Chengdu, China

Abstract :

During aging, osteoporosis is one major disease for human life. Thus, it is critical to investigate bone homeostasis in both bone formation and bone resorption aspects. Our lab has been focusing on osteoblastogenesis and bone formation for a couple of years. Our goal is to identify the key mesenchymal stem cells that give rise to the trabecular bone which is sensitive to osteoporosis and demonstrate the regulation mechanism of how to cure osteoporosis.

Bone formation in mammals requires continuous production of osteoblasts throughout life. A common molecular marker for all osteogenic mesenchymal progenitors needs to be identified. By lineage-tracing experiments in fetal or postnatal mice, we discover that Gli1+ cells progressively produce osteoblasts in all skeletal sites. Most notably, in postnatal growing mice, the Gli1+ cells residing immediately beneath the growth plate termed here "metaphyseal mesenchymal progenitors" (MMPs), are essential for cancellous bone formation. Besides osteoblasts, MMPs also give rise to bone marrow adipocytes and stromal cells in vivo. RNA-seq reveals that MMPs express several marker genes previously assigned to mesenchymal stem/progenitor cells, including CD146/Mcam, CD44, CD106/ Vcam1, Pdgfra, and Lepr. Genetic disruption of Hedgehog (Hh) signaling impairs proliferation and osteoblast differentiation of MMPs. Removal of β-catenin causes MMPs to favor adipogenesis, resulting in osteopenia coupled with increased marrow adiposity. Finally, postnatal Gli1+ cells contribute to both chondrocytes and osteoblasts during bone fracture healing. Thus, Gli1 marks mesenchymal progenitors responsible for both normal bone formation and fracture repair.

For many years, PTH has been demonstrated as an effective pharmaceutical compound for releasing osteoporosis. The commercial drug teriparatide, knowns as PTH (1-34), is the most widely prescribed bone anabolic drug in the world, but its cellular targets remain incompletely defined. As described above, the Gli1+ MMPs are the main source for osteoblasts in postnatal growing mice, but their potential response to teriparatide is unknown. Here, by lineage tracing, we show that teriparatide stimulates both proliferation and osteoblast differentiation of MMPs. Single-cell RNA sequencing reveals heterogeneity among MMPs, including an unexpected chondrocyte-like osteoprogenitor (COP). COP expresses the highest level of Hh target genes and the insulin-like growth factor 1 receptor (Igf1r) among all cell clusters. COP also expresses Pth1r and further upregulates Igf1r upon teriparatide treatment. Inhibition of Hh signaling or deletion of Igf1r from MMPs diminishes the proliferative and osteogenic effects of teriparatide. The study, therefore, identifies COP as a teriparatide target wherein Hh and insulin-like growth factor (IGF) signaling are critical for the osteoanabolic response in growing mice.

Curriculum Vitae

Yu Shi

Dr. Shi received his Ph.D. degree at the Chinese Academy of Science in 2011, Shanghai. Then, he worked with Prof. Fanxin Long as a postdoc in Musculoskeletal Research Center, Washington University in St. Louis, U.S. In 2018, Dr. Shi moved with Prof. Long to the University of Pennsylvania and worked as a Research Associate. In 2019, Dr. Shi became one Principal Investigator in the State Key Laboratory of Oral Diseases, West China College of Stomatology, Sichuan University. Recently, Dr. Shi has published academic papers in several journals, including *Nature Communications*, *PNAS*, *Cell Reports,* and *eLife*. Currently, Shi's lab is focusing on the following topics.

1. Identify the mesenchymal stem cells in vivo by genetic approaches and single-cell techniques.
2. Study the mechanism of the Wnt pathway in regulating bone development and homeostasis.
3. Investigate the regulatory effect of Hedgehog signal on mesenchymal stem cell differentiation and identify novel direct downstream targets by RNA-seq and ChIP-seq.

S1-3

Dispersion of aerosols and droplets in different dental procedures

Jun Watanabe[1,2], Yoko Iwamatsu-Kobayashi[1,3], Tomonari Kajita[4], Hiromitsu Morishima[4], Kensuke Yamauchi[4], Kenji Kikuchi[5], Kaoru Igarashi[1,6], Hiroyasu Kanetaka[3], Hiroshi Egusa[2,3]

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Aerosols and droplets generated during dental treatment have gained attention during the COVID-19 pandemic because severe acute respiratory syndrome coronavirus 2 is present in saliva at concentrations comparable to that in nasal mucus. Dental treatment, which involves the use of rotary instruments in the oral cavity, carries an increased risk of infection owing to aerosol generation. Therefore, a detailed analysis of these aerosols and droplets is required. However, the use of conventional methods is limited. Fluorescent methods cannot be applied to the human body, and particle counting methods are not suited for analyzing droplet range and velocity accurately. Here, we addressed these problems by establishing a novel method of dental aerosols and droplets measurement using the light-emitting diode (LED) laser technique. The objective of this study was to investigate the effect of different treatment sites and instruments on aerosols and droplets generation.

The images of the aerosols and droplets were taken from the lateral side of a dental mannequin with a high-speed camera. Forward scattered light was measured by placing a high intensity LED light on the same axis as the camera. The obtained images were treated with pseudo color processing, and the aerosols and droplets area were measured by Fiji software. The results showed that aerosols and droplets generation was affected by the treatment site and the instruments used. This novel method could be used to elucidate aerosols and droplets dynamics in different dental procedures.

Jun Watanabe, D.D.S, Ph.D.

Assistant Professor, Tohoku University Hospital, Sendai, Japan

[Research Interest] Aerosol dynamics, Infection Control,

Redox biology, Stem cell Biology

S2-1

Digital approach to Orthodontics: Research and Treatment

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With the growing trend of digital dentistry, I would like to introduce the digital diagnosis and treatment using digital technologies including intraoral scanners, cone-beam CT scans, 3D facial scans, and 3D printing, and how to utilize them in orthodontic researches. Three kinds of imaging modalities, such as intraoral-scanned dental image, cone-beam CT, and 3D facial scans are properly blended and used for patient diagnosis and evaluation that has been independently performed using existing individual data can be performed at once from a more esthetic point of view.

Typically, there are *Digital Bracket Setup* and *Digital Clear Setup* in treatment. In order to accurately attach the orthodontic braces to the teeth, it is preferable to use the indirect bonding method, and there is an advantage in that the chair time of the patient is also reduced. However, this method requires a cumbersome laboratory process for inexperienced clinicians because it is essential to fabricate a precise plaster model and requires a complex laboratory process. If digital bracket setup is applied to this, a more efficient and accurate indirect bonding can be obtained. Infection control can also be minimized because there are no laboratory works required to scan the patient's dentition with an intraoral scanner and manage the plaster model without the alginate impression taking process. Furthermore, digital clear setup can be performed using intraoral scan data, and a clear aligner can be manufactured using 3D printing technology, which can lengthen the patient's visit interval compared to treatment with a conventional fixed orthodontic braces. This is also advantageous in that customized orthodontic treatment can be performed in the post-corona era as it can minimize patient visits. In this lecture, I would like to introduce the digital approach in orthodontic treatment and research using intraoral scanners, cone-beam CT scans, 3D facial scans, and 3D printing that can be also used as a strategy to respond to the post-Corona era.

CURRICULUM VITAE

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Present Academic and Hospital Appointments:

Professor
Department of Orthodontics
Chonnam National University School of Dentistry, Gwangju, Korea
Clinical Professor, Department of Orthodontics
Chonnam National University Hospital

EDUCATION

2002-2006   D.D.S. degree from Chonnam National University,
            School of Dentistry, Gwangju
2007-2009   Master degree from Chonnam National University,
            Graduate School, Gwangju
2009-2012   Ph.D. degree from Chonnam National University,
            Graduate School, Gwangju

CAREER

2006-2007   Internship at Chonnam National University Hospital
2007-2010   Residency of Orthodontics, Chonnam National University Hospital
2010-2011   Fellow, Department of Orthodontics, Pusan National University Hospital
2011-2012   Fellow, Department of Orthodontics, Chonnam National University Hospital
2012-2015   Assistant Professor, Department of Orthodontics,
            School of Dentistry, Chonnam National University
2016-   Associate Professor, Department of Orthodontics,
            School of Dentistry, Chonnam National University
2021-   Professor, Department of Orthodontics,
            School of Dentistry, Chonnam National University

MEMBERSHIP

The Korean Dental Association (2006-)
The Korean Officials' Dental Association (2006-)
The Korean Association of Orthodontists (2007-)
World Federation of Orthodontists (2013-)
American Association of Orthodontists (2013-)
European Orthodontic Society (2013-)

HONORS AND AWARDS

2021   The Poster Presentation Award, Korean Association of Orthodontists
2020   The Poster Presentation Award, Korean Association of Orthodontists
2019   The Poster Presentation Award, Korean Association of Orthodontists
2018   The Poster Presentation Award, Korean Association of Orthodontists
2017   Young Scientist Research Award, Korean Association of Orthodontists
2017   The Best Table Clinic Presentation Award, Korean Association of Orthodontists
2017   The Poster Presentation Award, Korean Association of Orthodontists
2016   The Poster Presentation Award, Korean Association of Orthodontists
2014   The Poster Presentation Award, Korean Society of Surgery-first Orthodontics
2013   The Poster Presentation Award, Korean Association of Orthodontists
2012   The Poster Presentation Award, Korean Association of Orthodontists

S2-2

Occlusal disharmony, a potential factor for promoting rat models of depression

Sihui Zhang

Objective: Patients with occlusal disharmony (OD) may be more susceptible to chronic mild stressor (CMS) compared with those without OD. Therefore, this study was to investigate the effect of OD on CMS in rat model of depression, whose pathogenesis are not yet established.

Material and methods:To this end, OD was produced by removing 0.5 mm-thick hard tissues from the cusps of maxillary molars on one randomly selected side (left or right) of SD rats. For the other side, 0.25 mm-thick hard tissues were removed from the cusps to Sprague-Dawley (SD) rats. CMS was developed by 2 different stressors per day (e.g, overnight illumination; periods of food and/or water deprivation) for 28 days. Each OD, CMS, OD + CMS treated group and nontreated control group was compared behavior, endocrine and histologically. OD was administered to interfere with the body weight gain, spontaneous activity and sucrose preference in rats. This effect tended to be more impressive in OD + CMS group.

Results of weight, EMP, OFT, and SPT showed that there were significant differences between the four groups ($p < 0.05$), and there was a significant interaction between the time and groups. The concentration of ACTH and CORT in the OD+CMS group was significantly higher than that in the control group (all $p < 0.05$). Significant decreases were found in GR expressions in PFC and hippocampal CA1 areas, while significant increases were found in 5-HT$_{2A}$R expressions in PFC, amygdala, and hippocampal CA1 areas in OD, CMS, OD + CMS group when compared with control group (all $p < 0.05$). Similar trends were also found in GR expression in amygdala area ($p < 0.05$), and a more distinct variation was observed in values of all the parameters mentioned above in OD + CMS group.

Conclusion: OD may be a promoting and improving factor for depression through peripheral and central pathways via the hypothalamus-pituitary-adrenal (HPA) axis , GR and 5-HT system.

Key word: occlusal disharmony, chronic unpredictable mild stressor, depression, hypothalamus-pituitary-adrenal axis , 5-HT system

Curriculum Vitae

Personal Information:

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Education Background:

2002.09 - 2007.07 Bachelor of Dental Science	Xiangya School of Medicine, Central-South University, Hunan Province, China
2007.09 - 2010.07 Master of Dental Science	Xiangya School of Medicine, Central-South University, Hunan Province, China
2014.02 - 2014.05 Visiting Scholar	College of Dentistry, New York University College of Dental Medicine, Columbia University New York Hospital Queens Wyckoff Heights Medical Center
2017.09 - 2020.07 Ph. D	School and Hospital of Stomatology, Fujian Medical University Fujian Province, China

Professional Experience:

Time: 2010.9 - 2017.10
Position: Resident, School and Hospital of Stomatology, Fujian Medical University.
Time: 2017.10 - current
Position: Assistant professor, School and Hospital of Stomatology, Fujian Medical University.
Time: 2020.03 - current
Director, Experimental Teaching Center, School and Hospital of Stomatology, Fujian Medical University

Research:

Dr Zhang's clinical and research interests are occlusal splints and the relationship between occlusal disharmony and chronic mild stressor. She lectures frequently on occlusal disharmony promotes chronic mild stressor.

Publications:

1. **Zhang Sihui**, He Kixun, Lin Chenjing, et al. Efficacy of occlusal splints in the treatment of temporomandibular disorders: a systematic review of randomized controlled trials[J]. Acta Odontologica Scandinavica, 2020(6):1-10.
2. **Zhang Sihui**, Chen Xiaoling, et al. Study Experience in Oral Multidisciplinary Problem-Based Learning[J]. National Medical Frontiers of China.

S2-3

Oral Medicine Research of Universitas Indonesia: Exploring Special Need Dentistry Awareness and Interdisciplinary Oral Health Care

Masita Mandasari[1], Yuniardini Septorini Wimardhani[1], Febrina Rahmayanti[1], Anandina Irmagita Soegyanto[1], Esther Rotiur Hutagalung[2], Tassya Lay[3]

[1]Department of Oral Medicine, Faculty of Dentistry Universitas Indonesia, Jakarta, Indonesia

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Abstract

Oral medicine is a discipline of dentistry which specializes in the management of oral soft tissue diseases mainly by topical and systemic medication and oral health management in patients with complex medical condition. The latter intersect with the discipline of special needs dentistry (SND) which concern the oral health of people with a variety of medical conditions or limitations that require more than routine delivery of care. Despite its importance, SND has not been recognized as a speciality in Indonesia thus many dentists may not be familiar with SND. We started by conducting a study to explore the perception of dentists in Jakarta regarding special needs dentistry. This study which conducted through online survey distributed to registered dentist of Jakarta. There were 250 dentists consisted of 173 general practitioners and 77 dentists of various specialities. Most respondents reported that they did not have SND component during undergraduate dental school and did not provide treatment to patients with special needs in their clinical practice. However, most respondents showed motivation and interest towards SND training. These findings suggested that awareness of SND should be raised in dental communities and especially developed in dental science curriculum.

Management of oral health in special need individuals may involve multidisciplinary approach. Therefore, we follow up with another study which aimed to determine the baseline of oral health care awareness, attitudes, and perceptions in freshmen students of medical, dental, and nursing school in Universitas Indonesia. It is expected that the result of this study can be used to develop oral health care curriculum in health sciences study programs of Universitas Indonesia. Using total sampling method, the average response rate of this study was 95.8%. The preliminary result of this study was that the majority of the students have good awareness and interest in practicing oral health. The students also inclined more to having good perception on where oral health care should be given although they tended to have different perception on which population needing oral health care. With more analysis which is still undergoing, we expect that this study will point out the topics of oral health care to be taught in health sciences study programs curriculum.

Currently, we are running a study on caregivers of special need individuals. The aim is to determine their oral health literacy using the Indonesian version of Health Literacy in Dentistry (HeLD-ID) for good oral health outcomes and the individuals in their care. As of the time this abstract is written, a pilot study on 21 caregivers in a social institution for multiple disabilities individuals has completed. Moving forward, this study will invite more participants of institution caregivers as well as family caregivers of special need individuals to obtain more perspective regarding oral health literacy which related to oral disease prevention and health promotion.

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DDS, PHD, ORAL MEDICINE SPECIALIST

PROFILE

- Assistant professor in Oral Medicine Department. Faculty of Dentistry Universitas Indonesia since 2016.
- Team member of Special Care Dentistry in Faculty of Dentistry Universitas Indonesia and hospital accreditation of Universitas Indonesia Dental Hospital.
- Working part time as clinician in private practice.

RESEARCH

MAIN INTEREST

- Oral cancer and oral complication from cancer treatment
- Oral health of medically-compromised patients
- Special care dentistry

ONGOING AND FUTURE PROJECTS

- Head and neck cancer awareness in young adults
- Oral health knowledge in healthcare professionals and caregivers of special needs individuals
- Oral cancer screening behavior and national oral cancer registry
- Oral complication of head and neck cancer therapy
- Internet-based oral cancer queries

RECENT PUBLICATIONS (FIRST AUTHOR)

- Mandasari M, Rahmayanti F, Derbi H, Wimardhani YS. Special care dentistry perception among dentists in Jakarta: An online survey study. PLoS One. 2021;16(4):e0249727.
- Mandasari M., Syarif ZO, & Rahmayanti F. Health-related anxiety in the management of oral Soreness in an HIV seropositive patient. J Dent Indones. 2020;27(1): 42-45
- Mandasari M., Astuti AK, & Rahmayanti F. A case of inconspicuous recurrent herpes labialis mimicking unilateral angular cheilitis. J Dent Indones. 2018;25(3): 171-174

EDUCATION

ORAL MEDICINE SPECIALIST
Universitas Indonesia, Indonesia (2017-2020)

PHD IN ORAL PATHOLOGY
Tokyo Medical and Dental University, Japan (2011-2016)

DDS
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An Adiponectin Receptor Agonist Promote Osteogenesis via Regulating Bone-Fat Balance

Hanghang Liu, Shibo Liu, Huanzhong Ji, Qiucheng Zhao, Yao Liu, Pei Hu, En Luo

Adiponectin signaling has been considered to be a promising target to treat diabetes related osteoporosis resulting from excessive osteoclastogenesis and bone-fat imbalance. However, contradictory results regarding bone formation were observed due to the complex paracrine feedback regulation and various isoforms of adiponectin. Therefore, it is urgently needed to investigate the role of adiponectin receptor signals on bone-fat balance in order to having a comprehensive understanding of the biological effect of adiponectin. We primarily applied a newly discovered specific adiponectin receptor agonist AdipoRon to treat pre-osteoblast, pre-osteoclast and two kinds of mesenchymal stromal cells to investigate the role of Adiponectin receptor signals on bone-fat balance including osteoblast-osteoclast and osteoblast-adipocyte differentiation balance. We then established femur defect mouse model and treated them with AdipoRon to see whether adiponectin receptor activation could promote bone regeneration and further confirm its effect in adipogenesis of inguinal adipocytes. In our study, we found that AdipoRon could slightly inhibit the proliferation of pre-osteoblast and pre-osteoclast, but AdipoRon showed no effect on the viability of mesenchymal stromal cells. AdipoRon could remarkably promote cell migration of mesenchymal stromal cells. Additionally, AdipoRon promoted osteogenesis in both pre-osteoblasts and mesenchymal cells including bone marrow mesenchymal stromal stem cells and adipose derived stem cells. Besides, AdipoRon significantly inhibited osteoclastogenesis via its direct impact on pre-osteoclast and its indirect inhibition of RANKL in osteoblast. Moreover, both bone marrow mesenchymal stromal stems cells and adipose derived stem cells showed obviously decreased adipogenesis when treated with AdipoRon. Consistently, AdipoRon treated mice showed faster bone regeneration and repressed adipogenesis in inguinal adipocytes. Our study demonstrated a pro-osteogenic, anti-adipogenic and anti-osteoclastogenic effect of adiponectin receptor activation in young mice, which suggested adiponectin receptor signaling was involved in bone regeneration and bone-fat balance regulation. Thus, AdipoRon could be a promising target for the treatment or prevention of osteoporosis.

Hanghang Liu, DDS, PhD. Postdoc in Sichuan University, West China Hospital of Stomatology. Visiting Scholar in Maine Medical Center Research Institute, Clifford Rosen Lab.

Research interest: Effect of adiponectin receptor signaling in regulating bone-fat balance of bone marrow mesenchymal cells derived from young and aging individuals; Role of ZFP467 in mediating cell differentiation and energy metabolism.

Extracellular Matrix Derived from Dental Pulp Stem Cells Promotes Mineralization

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Abstract

Extracellular matrix (ECM) plays a pivotal role in many physiological processes. ECM macromolecules and associated factors differ according to tissues, impact cell differentiation and tissue homeostasis. Dental pulp ECM may differ from other oral tissues and impact mineralization. Thus, the present study aimed to identify the matrisome of ECM proteins derived from human dental pulp stem cells (DPSCs) and its ability to regulate mineralization even in cells, which do not respond to assaults by mineralization, the human gingival fibroblasts (GF). ECM were extracted from DPSCs cultured in normal growth medium supplemented with L-ascorbic acid (N-ECM) or in osteogenic induction medium (OM-ECM). ECM decellularization (dECM) was performed using 0.5% triton X-100 in 20mM ammonium hydroxide after 21 days. Mass spectrometry and proteomic analysis identified and quantified matrisome proteins. The dECM contained ECM proteins but lacked the cellular components and mineralization. Interestingly, collagens (COL6A1, COL6A2 and COL6A3) and elastic fibers (FBN1, FBLN2, FN1 and HSPG2) were significantly represented in N-ECM while, annexins (ANXA1, ANXA4, ANXA5, ANXA6, ANXA7 and ANXA11) were significantly overdetected in OM-ECM. GF were reseeded on N-dECM and OM-dECM and cultured in normal or osteogenic medium. GF were able to attach and proliferate on N-dECM and OM-dECM. Both dECM enhanced mineralization of GF at day 14 compared to tissue culture plate (TCP). In addition, OM-dECM promoted higher mineralization of GF than N-dECM although cultured in growth medium. ECM derived from DPSCs proved to be osteoinductive and this knowledge supported cell derived ECM can be further utilized for tissue engineering of mineralized tissues.

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Research Interest: Molecular biology of stem cells isolated from dental and oral tissues

Specific microRNAs regulate dental pulp stem cells behavior: A Systematic Review

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MicroRNAs (miRNAs), small non-coding RNA, control the translation of messenger RNAs into proteins. miRNAs have a crucial role in regulating the diverse biological processes of many physiological and pathological activities. miRNAs have shown to modulate the stemness and differentiation of various mesenchymal stem cells. The miRNAs in dental pulp stem cells (DPSCs) have been demonstrated to regulate the levels of proteins crucial for DPSC proliferation and differentiation. The present systematic review describes the functions of miRNAs, focusing on the roles of miRNAs in in regulating stemness maintenance and differentiation. Furthermore, the functions of miRNAs in DPSCs cell proliferation and differentiation were reviewed. DPSC miRNA expression profiles compared with other cell types was described. The roles of miRNAs in dental pulp inflammation were also discussed.

Curriculum Vitae
- Doctor of Dental Surgery (Honors), Rangsit University, Thailand
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Research interest
- microRNAs expression profile dental pulp cells
- Target genes of microRNAs in dental pulp cells

Iloprost promoted acellular cementum formation *in vivo*

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Abstract

Tooth replantation is one of alternative treatment for edentulous area. Root surface treatment prior to tooth replantation by bioactive molecule or cytokines have been proposed to increase success rate and promoted PDL regeneration. This study evaluated the use of the prostacyclin analogue, iloprost, an angio-/osteo-/odontogenic factor, as a root surface treatment in promoting acellular cementum formation in a tooth replantation *in vivo*. We found that microCT evaluation demonstrated a significant higher bone volume in the iloprost-treated group compared to HBSS-treated groups. Histologic analysis revealed deposition of a thick layer of acellular cementum along the cervical root in the iloprost group with well-organized PDL fibers. *In vitro* PDL cells treated with iloprost significantly increased gene expression of RUNX2, OSX, BSP and ALP. These induction effects were inhibited by an IP-receptor antagonist. These observations suggest that iloprost may be a promising biomolecule for conditioning of the root surface prior to of its replantation.

CV

Dr. Chalida is currently associate professor and assistant dean in research affair, faculty of Dentistry, Chulalongkorn University. She graduated and obtained her DDS degree in 2004 and received Japanese Monbugakusho Scholarship. She received her clinical training at department of Fixed Prosthodontics and PhD at department of Cellular Physiology and Chemistry, Tokyo Medical and Dental University, Japan in 2009.

Dr. Chalida received external grants supported by Thailand research funds. She received two young investigator grants by Thailand research fund from 2011-2017. She is currently receiving mid-career research grant from National Research Center of Thailand.

Research Interest Pulp Biology, Tooth and tissue Regeneration, Dental Mechanics

The role of Yes-associated protein on cell fate decisions of human periodontal ligament cells under compressive force loading

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Abstract

During tooth movement, mechanical stimuli has been known to influence self-renewal and differentiation fates of dental-derived cells, including periodontal ligament (PDL) cells. However, the underlying mechanisms in which PDL cells process through mechanotranduction in making cell fate decisions remains to be fully understood. In response to mechanical stimuli, the downstream regulator of Hippo pathway, Yes-Associated Protein (YAP) has been identified as a mechanosensitive transcriptional activator that control cellular activities, including cell proliferation and differentiation in several cell types but yet to be studied in human PDL cells. Herein, we performed experiments to determine the potential of YAP as a mechanosensing regulator in PDL cells. Intermittent compressive force (ICF) was applied to YAP-knockdown (YAP-KD) PDL cells concurrently with a normal control cells and non-ICF treated cells. The cells were then determined for cell-proliferation and differentiation capacity to osteoblasts and adipocytes. Results showed that the expression level of YAP of PDL cells can be significantly stimulated by ICF, but not by continuous compressive force (CCF). The downstream target genes of YAP including *CYCLIN-D1, C-MYC*, and *CTGF* was significantly activated in PDL cells after ICF loading. Moreover, ICF potentially promoted osteogenesis, but not adipogenesis of PDL cells. YAP-knockdown (YAP-KD) significantly decreased cell proliferation and osteogenic differentiation of PDL cells, while markedly increased adipogenic differentiation. Applying ICF to the YAP-KD PDL cells significantly improved osteogenic differentiation capacity. However, the adipocyte differentiation in YAP-KD cells was not affected upon ICF loading. Altogether, our result suggested that YAP could be a mechanosensing regulator response to ICF that require for osteogenic differentiation capacities of human PDL cells. Our findings may provide the possibility to facilitate PDL tissue regeneration by manipulation of Hippo-YAP signaling pathway.

Curriculum Vitae

Nuttha Klincumhom, she joined the laboratory of Andras Dinnyes at the Molecular Animal Biotechnology Laboratory, Szent Isvan University and Biotalentum Ltd. (Hungary) as a Ph.D. fellow to perform her stem cell research in PartnErS project in 2009. She received her Ph.D. from Chulalongkorn University where she studied reproductive technology and stem cell biology. In 2015, she took a position as a lecturer at Department of Anatomy and joined Prof. Prasit Pavasant's laboratory at Center of Excellence for Regenerative Dentistry, Faculty of Dentistry, Chulalongkorn University where she continued the stem cell research in dental field.

Research interest: Biology of periodontal ligament stem cells regarding their proliferation capacity, differentiation potential, immunomodulatory property, mechanobiology and their clinical applications.

The Essential Role of BMP Signaling in Tooth Root Formation

Jun Wang, Xudong Xie, Chunmei Xu, Stephen E. Harris, Jian Q. Feng

OBJECTIVES: Jawbone and dentin share many common features, although which one evolutionarily comes first is still under debate. The goal of this study was to investigate the role of BMP2 and BMP4 in controlling the fate of pulp cells during molar root formation.

METHODS: The *Gli1-Cre^{ERT2}* mice were crossed with *Bmp2$^{flox/flox}$* and *Bmp4$^{flox/flox}$* mice in *R26R^{tdTomato}* background to specifically inactivate *Bmp2* and/or *Bmp4* (two key BMP ligands) in the dental pulp cells. A single dose of tamoxifen was injected at postnatal day 5 and animals were harvested at postnatal week 4 with EdU injection 3 hours before sacrifice. The combined approaches of X-ray, μCT, *in vivo* cell lineage-tracing, histology, and immunostaining were used.

RESULTS: The deletion of single Bmp2 or Bmp4 led to minor dentin defects, while double knockout (dKO) mice displayed profound defects in molar roots, characterized by short and thin root dentin with few dentinal tubules. The quantitative μCT data demonstrated that these changes were statistically significant (n=6, $P < 0.05$). Mechanistic studies (including cell lineage tracing analysis) showed 1) instead of polarized odontoblast layers, a single cuboid-like osteoblast layer formed; 2) a change of dentin matrix to bone-like matrix, in which bone-like cells were buried; 3) a great increase in pulp cell proliferation and bone marker expression; 4) a sharp reduction in odontoblast markers such as nestin and DSPP; and 5) an ectopic bone-like structure formed in pulp. Together, data supported a vital role of BMP signaling in preventing the cell fate change from odontoblast lineage to osteoblast lineage during root dentin formation.

CONCLUSIONS: Our findings demonstrated that BMP signaling (a combined role of BMP2 and BMP4) is essential for determining the cell fate of Gli1$^+$ pulp cells during molar root formation, and supported a notion that tooth development occurs after jawbone.

Short CV

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I obtained my PhD and DMD degrees in Sichuan Univeristy. I have published more than 30 peer-reviewed articles, including 5 articles in *Journal of Dental Research*, 1 article in *Journal of Bone and Mineral Research*, and 1 article in *Journal of Periodontology*. I have won several academic awards, inclduing IADR Pulp Biology Research Group Young Investigator Prize for Innovation, ASBMR Young Investigator Travel Award, Travel Award of The Korean Academy of Periodontology and etc..

Research Interests

My research interests are periodontium and tooth, especially the role of mesenchymal stem cells in periodontal homeostasis and tooth formation.

Iron Metabolism in the Development and Ageing of Odontoblast

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Abstract

Background: Iron is an essential element that is indispensable for life. Body iron homeostasis is a delicate balance and orchestrated by series iron regulatory proteins (IRPs). Imbalance in iron homeostasis, both insufficient or overloaded, is associated with many pathological processes. As the core of the dentin-pulp complex, odontoblast functions to maintain the bioactivity of the dental pulp. However, either the physiological or pathological role of iron in odontoblast is still largely unknown. In this study, we intend to primarily reveal the basic process of iron metabolism in the development and ageing of odontoblast.

Materials and Methods: Human dental pulp of different ages and mouse (C57BL/6) mandibular incisor were used to investigate the role of iron metabolism in the development and ageing of odontoblast. Colocalization of IRPs (Transferrin receptor-1, Ferritin, and Ferroportin) was detected by immunofluorescence staining. A Fe^{3+}-specific Aggregation-induced Emission (AIE) probe TPE-o-Py was used for *in situ* detection of iron (Fe^{3+}).

Results: According to the maturation of odontoblast in mouse mandibular incisor, the expression of IRPs and the accumulation of iron gradually increased from labial cervical loops, the stem cell niche, to the distal region of matured odontoblast. A similar stemness-related expression model could be observed in a 14-years-old human dental pulp sample with dental papilla. In the ageing process of odontoblast, the content of iron altered in an age-dependent manner, which could be supported by the gradually increased signal of iron in human dental pulp from 10 to 47 years old. The expression of IRPs shared a similar distribution pattern.

Conclusions: The accumulation of iron and the upregulated expression of IRPs were positively related to the maturation and ageing process of odontoblast. The underlying mechanism through which iron affects the differentiation and maintaining homeostasis of odontoblast requires further investigation.

Short-CV
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Research interest

Functions and mechanisms of autophagy in maintaining the homeostasis of odontoblast

P1-8

Effect of rapid increases in oxygen levels on glucose metabolism of cancer cells

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Objectives
It is known that the oxygen concentration within cancer tissue is low. However, the oxygen concentration within cancer tissue is expected to increase rapidly again when the oxygen supply is recovered by angiogenesis or hematogenous metastasis. Therefore, we investigated the effect of the fluctuation of oxygen concentration on the glucose metabolism of cancer cells since glucose metabolism is the main pathway for cancer cells to obtain energy.

Methods
Oral squamous cell carcinoma cells (HSC-2 and HSC-3) and normal human keratinized epithelial cells (HaCaT) were used. The glucose metabolic activity of the cells cultured in normoxia (21% oxygen) and hypoxia (1% oxygen) was measured as acid-producing activity using a pH stat system in normoxic (21% oxygen) and hypoxic (1% oxygen) conditions. Acidic end-products were also quantified with HPLC. The acidic end-products and reactive oxygen species (ROS) generated by glucose metabolism were also measured.

Results
Normal cells cultured in normoxia showed a lower metabolic activity in hypoxic than normoxic conditions (0.54-0.63 times, $p<0.05$), while cancer cells cultured in hypoxia showed a higher metabolic activity in normoxic than hypoxic conditions (2.02-4.79 times, $p<0.05$). There were no significant differences between normoxic and hypoxic metabolic activity of normoxia-cultured cancer cells or hypoxia-cultured normal cells. The cancer cells cultured in hypoxia produced lactic acid in hypoxic conditions; however, they did not increase the lactic acid production in normoxic conditions, irrespective of their high metabolic activity. ROS production was higher in normoxic conditions in all cells, especially the hypoxically cultured HSC-3 cells.

Conclusions
Rapid increases in oxygen levels might enhance the glucose metabolism of hypoxically cultured cancer cells by mainly activating the TCA cycle and electron transport system. The activation of the TCA cycle and the electron transport system might increase the ATP and ROS supply in cancer cells through the oxidative phosphorylation.

CV
2020	Graduate Division of Advanced Prosthetic Dentistry, Tohoku University Graduate School of Dentistry
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Research interest
Glucose metabolism of oral cancer cells, Education of Intraoral Scanner.

Treatment with hydrogen peroxide photolysis inhibits tooth demineralization caused by *Streptococcus mutans* biofilm.

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Background: Antimicrobial technique utilizing hydroxyl radicals generated by hydrogen peroxide (H_2O_2) photolysis has been developed. The technique exerts strong bactericidal effect against not only planktonic bacteria but also *Streptococcus mutans* biofilm. Thus, it is expected that the technique can inhibit tooth demineralization by inactivation of *S. mutans* biofilm. Therefore, present study aimed to evaluate the effect of H_2O_2 photolysis on tooth demineralization caused by *S. mutans* using rat molars.

Materials and methods: *S. mutans* biofilm formed on the rat molars was subjected to H_2O_2 photolysis treatment. The samples were immersed in 3% H_2O_2 and irradiated with a 365-nm LED for 90 s. Viable bacterial counts in the biofilm immediately and 30 h after treatment were evaluated by colony counting. The acidogenicity of the biofilm, re-established 30 h after treatment, was assessed by pH measurement using a microelectrode. The tooth demineralization in both enamel and dentin induced by an additional 3-day incubation after treatment was analyzed using micro-CT.

Results and conclusion: H_2O_2 photolysis treatment reduced viable bacteria in the biofilm by over 4-log CFU/sample. Besides, the acidogenicity of the biofilm re-established after H_2O_2 photolysis treatment was less pronounced than that of the control biofilm treated with water without LED irradiation. Regarding tooth demineralization especially in dentin, H_2O_2 photolysis group showed lower depth of radiolucent layer in the micro-CT image than the control group. These findings suggest that H_2O_2 photolysis can inactivate cariogenic biofilms and exert anti-demineralization effects. Therefore, H_2O_2 photolysis may be applicable into dental caries treatment. (246 words)

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Research interest: Application of hydrogen peroxide photolysis to caries treatment

Bifacial aspects of ethanol: antibacterial effect and carcinogenic effect by metabolism to acetaldehyde depend on ethanol concentration

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Abstract

Introduction: Alcohol consumption and poor oral hygiene are considered as risk factors for oral cancer. The reason is thought to be that the acetaldehyde produced from ethanol by oral bacteria is carcinogenic. Previous studies reported that the indigenous oral bacteria, such as *Streptococcus* and *Neisseria* species, produced acetaldehyde from 10 mM ethanol. However, the oral environment always fluctuates greatly and affects bacterial metabolisms. Thus, we have already elucidated the effects of the environmental factors on bacterial acetaldehyde production. *Streptococcus* and *Neisseria* species efficiently produced acetaldehyde from ethanol at neutral to slightly alkaline pH under aerobic conditions. Meanwhile, it is well known that ethanol has bactericidal effect. However, it was unknown that the boundary between these two effects, antibacterial and carcinogenic effects. Therefore, we tried to clarify the relationship between these two effects at the wide range of ethanol concentrations.

Materials and Methods: We used 5 *Streptococcus* species and evaluated bacterial acetaldehyde production, growth, and survival abilities under a wide range of ethanol concentrations.

Results: Under high concentrations of ethanol (5,000 to 10,000 mM ≒ 25 to 50%), these bacteria were not viable but continued to produce small amounts of acetaldehyde. On the other hand, moderate concentrations (1,000 to 2,000 mM. ≒ 5 to 10%), expected during drinking alcohol in the oral cavity, inhibited bacterial growth but did not kill these bacteria, and a large amount of acetaldehyde was produced. The boundary between bactericidal and carcinogenic effects was overlapped.

Discussion: Our results suggest that usual drinking of alcohols for a long time leads to the high acetaldehyde production by oral bacteria, since oral bacteria can produced acetaldehyde from ethanol at a wide range of concentration. At a high concentration of ethanol, bacteriostatic and bactericidal effects can be expected, but it should be noted that acetaldehyde is continuously produced from ethanol.

Research interest: oral bacteria, metabolism, carcinogenicity, acetaldehyde

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Asiaticoside stimulates osteogenic differentiation of hPDL through Wnt pathway

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Asiaticoside is an active compound isolated from Herb *Centella asiatica* (L.) Urban, which has been shown to induce osteogenic differentiation in human periodontal ligament (hPDL) cells. The aim of this study was to investigate the mechanism involved in asiaticoside-induced osteogenic differentiation. hPDL cells were treated with asiaticoside and cell viability was tested by MTT assay. The mRNA expression levels were analyzed by using real-time PCR. hPDL cells were cultured in osteogenic medium and ALP enzymatic activity was determined by ALP assay, whereas alizarin red staining was performed to investigate mineralized nodule formation. The β-catenin localization in nucleus was demonstrated by both immunocytochemistry and nuclear fractionation. Data were analyzed using one-way analysis of variance (ANOVA) with $p < 0.05$ considered as a statistically significant difference. The results showed that asiaticoside had no effect on the cell viability at any of the tested concentrations. Real-time PCR revealed that osterix (*OSX*) and dentin matrix protein1 (*DMP1*) mRNA were significantly enhanced by asiaticoside treatment. Alkaline phosphatase activity and in vitro mineralization were also significantly induced. Interestingly, asiaticoside dose-dependently increased *WNT3A* mRNA expression, but not *WNT5A* and *WNT10B*. The activation of Wnt signaling was shown to result in nuclear accumulation of β-catenin as evaluated by immunofluorescence staining and western blot analysis. Pre-treatment with recombinant human Dickkopf1 (rhDKK1) inhibited asiaticoside-induced β-catenin nuclear translocation and osteoblast marker gene expression. Moreover, rhDKK1 attenuated asiaticoside-induced DMP1 protein expression. These data demonstrate that asiaticoside induces osteogenic differentiation of hPDL cells by activating the Wnt/β-catenin signaling pathway and suggest asiaticoside as a novel therapeutic agent for periodontal regeneration.

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Research of interest: Molecular biology, Periodontal tissue regeneration

P1-12

D-galactose induced aging aggravates bone dyshomeostasis in obesity

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Background: Obesity and aging independently exert undesirable effects on the bone, leading to accelerated bone loss. However, the effects of combined obesity and aging (adipaging) on bone homeostasis remain controversial.

Objective: To compare the effect of obesity, aging, and adipaging on bone homeostasis.

Methods: Six-week-old male Wistar rats were fed with either a normal diet (ND; n=12) or a high-fat diet (HFD; n=12) for 16 weeks. At the end of week 12, the rats were subcutaneously injected with either vehicle (NDV and HFV) or 150 mg/kg/day of D-galactose to induce aging (NDD and HFDD) for an additional 4 weeks (n=6/group). At the end of treatment, blood was collected to measure metabolic parameters, age-, oxidative stress-, and bone turnover-related markers. The femora and tibiae were also obtained to evaluate the oxidative stress level and trabecular bone parameters, respectively.

Results: Compared to the NDV control, NDD, HFV, and HFDD groups exhibited higher serum MDA level, lower bone volume per tissue volume (BV/TV), and lower trabecular number (Tb.N). Interestingly, a reduction in serum sRAGE level and trabecular thickness (Tb.Th), as well as an increase in serum telomerase level, CTX-1 level, and trabecular separation (Tb.Sp) were revealed only in the HFDD group, when compared with those of the NDV control.

Conclusion: D-galactose induced aging aggravates systemic oxidative stress and bone dyshomeostasis in the obese condition. Therefore, early interventions to alleviate adipaging-induced bone dyshomeostasis is highly suggested to decrease the risk of fracture among the elderly.

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Education and Research Experiences: 2004-2010: Doctor of Dental Surgery (DDS.), Faculty of Dentistry, Chiang Mai University, Thailand. **2013-2015:** Master of Science (M.Sc), Faculty of Dentistry, Chiang Mai University, Thailand. **2018-today:** Full-time lecturer at the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Chiang Mai University, Thailand. **2019-today:** PhD. Candidate in Oral Sciences, Faculty of Dentistry, Chiang Mai University, Thailand
Area of Research Interests: Bone Remodeling, Aging, Obesity, Metabolic Bone Diseases

Continuous versus released compressive force on osteoclastogenesis of RAW 264.7 cells

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Abstract

Orthodontic tooth movement occurs by the bone remodeling process through compressive force on the pressure site and also increases cellular activity. Osteoclasts play an important role in this process. However, there are few studies that compare continuous compressive stress and released force on osteoclastogenesis. In this study, the compressive force (0.6 g/cm2) was applied by the acrylic mass to osteoclast precursor cells to investigate their osteoclastogenesis. RAW 264.7 cells were divided into five groups and cultured for four days in an alpha-MEM medium containing 50 ng of RANKL. The Acrylic mass was taken out of the 96 well plates in one group every day in the released forced group (days 1, 2, and 3 respectively) and continued cultured until day 4. On day 4, each group was examined for the number of TRAP-positive multinucleated cells by TRAP staining and counted using a Zeiss fluorescence microscope (Carl Zeiss, Oberkochen, Germany) equipped with a 10X objective by two individuals. The results of this study showed that the continuous compressive force increased the number of TRAP-positive cells with a time-dependent. The released force group before day 4 showed a lower number of TRAP-positive multinucleated cells.
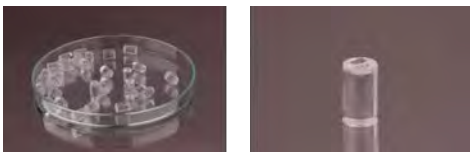
Figure 1. The acrylic cylinder body is made of laser-cut acrylic to fit a 96 well plate.
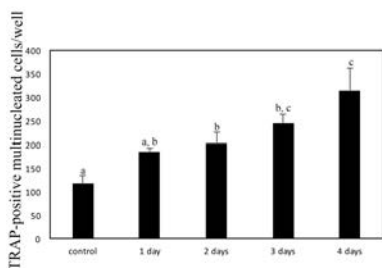
Figure 2. The greater number of TRAP-positive MNCs (≥ 3 nuclei). Data are representative of three independent experiments. All values are shown as mean $\pm$ SD. Significant differences between groups are indicated by different letters (a, b and c; $P < .05$).
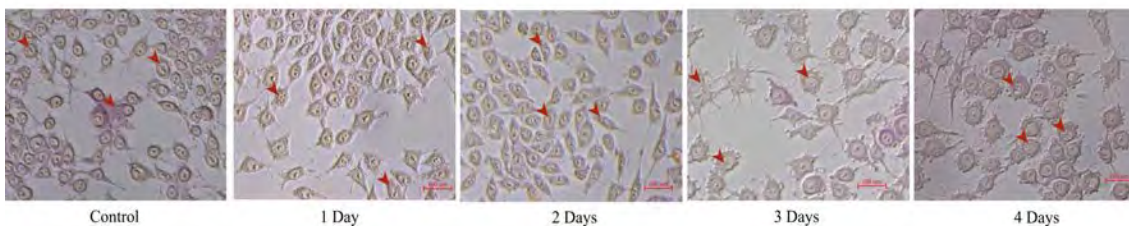
Figure3. The red arrows indicate TRAP-positive MNCs.

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Further Education:

<u>Medical Microbiology</u>**,** Harvard University. Division of Continuing Education, Cambridge (United States of America), 2016.

<u>Introduction to Epidemiology</u>, Harvard University. Division of Continuing Education, Cambridge (United States of America), 2018.

<u>Continuing Education in Orthodontics Certificate</u>, TUFTS University of Dental Medicine, Boston (United States of America), 2018.

Title: Comparison of matrisome between jawbone and tibia osteoblasts
Author: <u>**ALBA NATALIA GARCIA LIMON**</u>

SUMMARY

Context: Local site-specific differences between bones from different anatomical regions may account for their different properties and functions. **Objectives**: To identify mechanisms behind these differences, we have performed a cross-study comparing RNA transcriptomes of mandible and tibia osteoblasts (OBs) from mouse bones focusing on genes encoding extracellular matrix (ECM) proteins. **Methods**: Gene expression profiles were obtained from OBs isolated from mandible and tibia of P9 Col1a1*2.3-GFP mice using RNAseq sequencing technique. The transcripts were excluded from analysis if gene expression level was < 1. The transcripts within these groups were overexpressed if $p \leq 0.05$ and fold change (FC) ≥ 1.4 in mandible OB or tibia OB. Relative gene expression was checked on raw-bone mouse tissues using quantitative polymerase chain reactions (qPCR). **Results**: Bioinformatic analysis identified key genes overexpressed in mandible OBs (Amelx, Ambn, Rspo4, Mmp20, Dspp) and in tibia OBs (Nov, Bcan, Prg4, Rspo3). **Conclusion:** Our findings support significant differences in expression of genes encoding ECM proteins in mandible and tibia OBs. It strongly suggests functional differences in formation, resorption, and mechanical properties of these bones and may help us to understand the unique pathophysiology of jawbones

Mesh key words: osteoblasts, Transcriptome Analysis, Extracellular Matrix, cell signature, jawbone.

Osteopontin induces osteogenic differentiation by human periodontal ligament cells via calcium binding domain-ALK-1 interaction

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Abstract

Recently we have generated recombinant human osteopontin (rhOPN) using a plant platform (*Nicotiana benthamiana*) and demonstrated its osteogenic induction capacity when coated on culture plate by human periodontal ligament (PDL) cells. The aim of this study is to elucidate the molecular mechanism underlying the rhOPN-induced osteogenic differentiation of human PDL cells. Full length rhOPN (FL-OPN) and three constructs of OPN containing integrin binding domain (N142), calcium binding domain (C122) and mutated calcium-binding domain (C122δ) were generated from *N. benthamiana*. Human PDL cells were isolated from extracted third molars and cultured on FL-OPN, N142 or C122-coated surface. Real-time PCR and Western blot analyses were used to determine mRNA and protein expression. *In vitro* calcification was determined by Alizarin red staining. Chemical inhibitors were used to elucidate signaling pathways. In silico analyses were performed to predict the protein-protein interaction. Human PDL cells seeded on FL-OPN and C122-coated surface significantly increased of both mRNA and protein expression of osterix (OSX) and enhanced *in vitro* calcification. Soluble FL-OPN as well as a surface coated with N142 did not affect *OSX* expression. Inhibition of activin receptor-like kinase (ALK-1) abolished the induction of osterix expression. *In silico* analysis suggested a possible interaction between calcium binding domain (CaBD) of OPN and ALK-1 receptor. C122, but not C122δ coated surfaces induced the expression of p-Smad-1 and this induction was inhibited by an ALK-1 inhibitor. The results suggested that next to full length OPN, the CaBD of OPN if coated to a surface, induces osteogenic differentiation. This suggested for the first time that CaBD of OPN could play a role in osteogenic differentiation via interaction with ALK-1 receptor.

Keywords: osteopontin, calcium binding domain, ALK-1, osteogenesis, periodontal ligament cells

Effect of Proanthocyanidin-ACP Nanoparticles on Promoting Biomimetic Remineralization of Dentin

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Objectives: The aim of this study was to synthesize proanthocyanidin-amorphous calcium phosphate (PA-ACP) nanoparticles and investigate their effect on promoting dentin remineralization and inhibiting collagen degradation, in order to provide a new perspective for biomimetic dentin repairing.

Methods: PA-ACP nanoparticles and N-ACP nanoparticles free of PA were synthesized by the template method. Reconstituted type I collagen fibrils were mineralized in PA-ACP or N-ACP solution for 1, 3 and 7 days and observed by transmission electron microscopy. After treated by PA-ACP or N-ACP, the dentin disks were examined by scanning electron microscopy, attenuated total reflection-Fourier transform infrared spectrum and X-ray diffraction to measure the chemical and morphological changes during remineralization. To evaluate the collagenase activity, zymography of the demineralized dentin matrix after different treatment was conducted using an EnzChek collagenase/gelatinase kit.

Results: Collagen fibrils were partially mineralized after 7 days in N-ACP group, while in PA-ACP group, collagen fibrils were partially mineralized after 3 days and almost completely mineralized after 7 days. Dentin samples in N-ACP group and PA-ACP group were obviously remineralized after 7 days, but PA-ACP also induced the dentin tubules occlusion. After treated with PA-ACP, the enzyme activity of the demineralized dentin matrix decreased by ~40% compared to that of N-ACP group ($P < 0.05$).

Conclusions: PA-ACP nanoparticles could effectively induce biomimetic remineralization of demineralized dentin, accelerate the remineralization process and inhibit the collagenase activity, indicating their potential application in biomimetic repair of dentin.
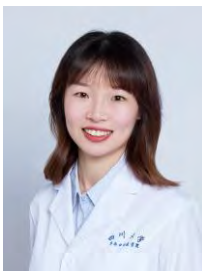
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Research interest: biomimetic mineralization of dental hard tissue.

P2-5

Loss of IκBζ accelerates dentin formation and matrix gene expression

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Abstract:

Epigenic modification, especially the histone modification is positively associated with hard tissue formation by regulating matrix synthesis and osteo/odontogenic differentiation. However, the key endogenous epigenetic modulator of odontoblasts to regulate the expression of genes coding dentin extracellular matrix (ECM) proteins has not been identified. We focused on NF- B inhibitor ζ (IκBζ) which was recently regarded as the NF-κB-independent epigenetic modulator. We found that thicker dentin width and more aggressive dentin formation was been observed in IκBζ null mice. Mechanistically, we found that whole-genome identification of H3K4me3 enrichment, ECM and ECM organization-related gene loci were selectively activated by the knockdown of IκBζ, which consistently resulted in the up-regulation of these genes. Collectively, this study suggested that IκBζ is the key negative regulator of dentin formation in odontoblasts by inhibiting dentin ECM- and ECM organization-related gene expression through altering the local chromatin status marked by H3K4me3. Therefore, IκBζ is a potential target for epigenetically improving the clinical outcomes of dentin regeneration therapies such as pulp capping.

Introduction of presenter:
Name: Yuan Hang
curriculum vitae:
2012~2017: study in Qinghai University, China. Major in oral medicine
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Orofacial bone remodeling and regeneration of hypoparathyroidism

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Hypoparathyroidism (HypoPT) is a rare endocrine disorder characterized by hypocalcemia and low or undetectable levels of parathyroid hormone (PTH). The clinical symptoms of HypoPT patients include perioral numbness, muscle cramps, paresthesia *et.al*. These symptoms are mainly due to hypocalcemia since PTH functions as a key mediator in mineral ion homeostasis and skeleton remodeling. The skeletal dynamics of HypoPT patients are reported to be affected. As a crucial part of the skeletal system, orofacial bone harbours distinct developmental origin and osteogenic pattern. However, the remodeling and regeneration of orofacial bone under HypoPT condition remains unkown.

In the current study, we applied bilateral parathyroidectomy (PTX) and unilateral extraction of maximal first molar to 8 weeks SD rats to establish four surgery groups, including sham group, PTX group, sham + extraction group and PTX + extraction group. ELISA assay showed significantly reduced serum calcium, increased serum phosphate and undetectable PTH levels in PTX group. MicroCT analysis revealed that the alveolar bone volume of PTX group statistically increased at 7, 14, 28 days post-surgery. Immunostaining suggested that PTX caused downregulation of osteogenesis and osteoclastogenesis in the alveolar bone. PTX resulted in attenuated regeneration of extraction socket, accompanied by lower Runx2^{+} osteoblasts and TRAP[+] osteoclasts. RNAseq analysis demonstrated that PTX led to downregulation of osteogenesis related genes in the regeneration process.

In summary, our study successfully generated HypoPT rat model and found that HypoPT suppressed bone remodeling, ultimately led to higher alveolar bone volume under physiological condition. Yet, HypoPT resulted in impeded bone turnover, which delayed the repair and regeneration of the extraction socket. These results provide fundamental basis for diagnosis and treatment of orofacial bone defects related diseases in HypoPT patients.

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Research interest: mesenchymal stem cell, PTH1R signaling, orofacial bone development

Smart porous scaffold promotes peri-implant osteogenesis under the periosteum

Ze He, Yao Liu, Yue Sun, En Luo

Objective：Adequate peri-implant bone mass and bone quality are essential factors to ensure the initial stability of the implant and success of implant operation. In clinical settings, the lack of bone mass often restricts the implant operation. In this study, we fabricated a smart porous scaffold with a shape memory function and investigated whether it could promote peri-implant osteogenesis under the periosteum.

Materials and Methods：A porous shape memory polymer (SMP) scaffold was fabricated and its shape memory function, mechanical properties, and degradation rate were tested in vitro. Moreover, the scaffold was implanted in the mandible of rabbits to evaluate its efficacy to promote peri-implant osteogenesis in the periosteum and enhance the initial stability of the implant. Histological, micro-CT, and biomechanical analyses were carried out for further verification.

Results：The SMP scaffold has a good shape memory function and biocompatibility in vitro. In vivo experiments demonstrated that the SMP scaffold could recover to its original shape after implantation to create a small gap in the periosteum. After 12 weeks, the scaffold was gradually replaced by a newly formed bone, and the stability of the implant increased when it implanted with the scaffold.

Conclusions：The present study indicates that the SMP scaffolds have a good shape memory function and could enhance peri-implant bone formation under the periosteum. The SMP scaffold provides a clinical potential candidate for bone tissue engineering under the periosteum.

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Research interest:We examined the efficiency of the smart porous scaffold to facilitate osteogenesis peri-implant under the periosteum. The characteristics of smart porous scaffold have been investigated in some studies, but the application of the scaffold as bone increment technology in implantation has not been seen. The study indicated that the scaffold have good shape memory function and could promote bone formation peri-implant under the periosteum. Our findings revealed the scaffold has great applied potential in solving the problem of implantation without enough basal bone volume.

Yes-associated protein promotes bone healing

after tooth extraction in mice

AUTHORS

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RESEARCH INTEREST

Poor healing of tooth extraction wounds is a common clinical problem, but its mechanism is not completely clear. Our research may suggest the mechanism of tooth extraction wound healing from another view, and provide some ideas for future clinical and drug research studies.

ABSTRACT

In this study, a tooth extraction socket model was established in vivo, and Lv-YAP1-GFP, LV-GFP or saline was injected locally into the extraction socket. Expression of markers of osteogenesis, osteoclastogenesis, adipogenesis, proliferation and apoptosis were tested to explored whether YAP can promote bone formation in the process of tooth extraction socket healing. In this study, 66 BALB/c mice were divided into 3 groups and underwent left maxillary first molar extraction, Lv-YAP1-GFP, Lv-GFP or saline was injected into the tooth extraction socket. The maxilla was harvested 1, 3, 7, and 10 days after operation for subsequent analysis by Micro-CT and immunohistochemical analysis. Quantitative analysis of the expression of TRAP, ALP, BMP2, Runx2, Osterix, OCN, RANKL, PPARγ, and PCNA was conducted. The results of immunofluorescence showed that the lentivirus was successfully transfected into the extraction socket. On the middle and last stage of tooth extraction healing, results of Micro-CT showed that the BV/TV, Tb.Th and Tb.N were significantly higher in the experimental group, results of immunohistochemistry showed that the overexpression of YAP increase in the expression of BMP2, ALP, RUNX2, Osterix, OCN, and PCNA. The expression of PPARγ and TUNEL staining results were significantly lower in the experimental group. The expression of TRAP and RANKL showed no significant differences among the 3 groups. We conclude that YAP could promote bone formation in the middle and late stages of tooth extraction socket healing. The overexpression of YAP increased bone formation and cell proliferation, decreased adipogenic differentiation and apoptosis.

REV-ERBs negatively regulate mineralization of the cementoblasts

Liangliang Fu [+], Min Wang [+], Haibin Xia

Objective: The role of circadian clock in cementogenesis is unclear. This study examines the role of REV-ERBs, one of circadian clock proteins, in proliferation, migration and mineralization of cementoblasts to fill the gap in knowledge.

Methods: Expression pattern of REV-ERBα in cementoblasts was investigated in vivo and in vitro. CCK-8 assay, scratch wound healing assay, alkaline phosphatase (ALP) and alizarin red S (ARS) staining were performed to evaluate the effects of REV-ERBs activation by SR9009 on proliferation, migration and mineralization of OCCM-30, an immortalized cementoblast cell line. Furthermore, mineralization related markers including osterix (OSX), ALP, bone sialoprotein (BSP) and osteocalcin (OCN) were evaluated.

Results: Strong expression of REV-ERBα was found in cellular cementum around tooth apex. *Rev-erbα* mRNA oscillated periodically in OCCM-30 and declined after mineralization induction. REV-ERBs activation by SR9009 inhibited proliferation but promoted migration of OCCM-30 in vitro. Results of ALP and ARS staining suggested that REV-ERBs activation negatively regulated mineralization of OCCM-30. Mechanically, REV-ERBs activation attenuated the expression of OSX and its downstream targets including ALP, BSP and OCN.

Conclusions: REV-ERBs are involved in cementogenesis and negatively regulate mineralization of cementoblasts via inhibiting OSX expression. Our study provides a potential target regarding periodontal and cementum regeneration.

Short CV

2015-2020	Bachelor	Zhengzhou University, China	
2020-	Master Candidate	Wuhan University, China	Supervisor: Haibin Xia

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Research Interest

Periodontal Regeneration Materials, Osteo-immunomodulation, Implant Dentistry

Publications

Fu L[#], Wang M,[#] Zhu G, et al. REV-ERBs negatively regulate mineralization of the cementoblasts [published online]. *Biochem Biophys Res Commun*. 2021;587:9-15.

Fu L, Liu G, et al. Patient-reported outcome measures of edentulous patients restored with single-implant mandibular overdentures: A systematic review. *J Oral Rehabil*. 2021;48(1):81-94.

Modification of collagen with proanthocyanidins by mimicking the bridging role of glycosaminoglycans for dentine remineralization

Ye Zhang, Yanyun Pang, Qing Liu, Xu zhang*, Ying Liu*

Glycosaminoglycans (GAGs) form bridging cross-bands that maintain the structural integrity of collagen in the organic matrix of dentine. In dentine caries, proteolytic enzymes appeared to trigger GAG bridge degradation, followed by breakdown of the collagen network, imposing critical limitations on dentine remineralization via the biomimetic mineralization of collagen. While contemporary mechanisms of collagen modification through immobilizing functional groups have been established to improve collagen mineralization, this effort remains a challenge due to the lack of consideration in preserving the spatial stability of collagen. In our study, naturally derived proanthocyanidins (PA) was applied to simulate the bioactivities of GAGs. Detailed analyses showed that PA reconstructed interfibrillar bridges of the collapsed collagen network and reduced the interfacial energy between the mineral-organic phases to enhance collagen hydrophilicity, subsequently facilitating the infiltration of calcium phosphate precursors and hence promoting collagen mineralization. With this strategy, the mechanical behaviours of demineralized dentine were significantly improved *in vitro*. PA exhibited satisfactory inhibitory effects on the activity of cariogenic bacteria (comparable to that of chlorhexidine). Moreover, an *ex vivo* study indicated that remineralization and antibacterial effects were evident in the rat oral cavity. This strategy highlights the importance of maintaining the structural integrity of the collagen network in dentine remineralization and offers great clinical potential for the effective treatment of dentine caries.

Short-CV

Ye Zhang, PhD of Hospital of Stomatology, Tianjin Medical University. As the independent first author, I have published one SCI paper with impact factor of 7.99. The main research interests are bionanomaterials, oral biomaterials and tissue engineering.

Modification of type I collagen with PEGylated lysozyme (lyso-PEG) to promote interfibrillar mineralization

Yanyun Pang, Yingtao Gao, Peng Yang *,Xu Zhang*

Mineralized collagen fibrils are the basic unit of bone, dentin and cementum. There have been many studies that mimic the function of non-collagenous proteins (NCPs) of biomimetic mineralized collagen fibrils and used to repair hard tissue defects, furthermore clarify the underlying mechanism. Researchers generally believe that the most important thing to achieve interfibrillar mineralization is to obtain a high content of calcium and phosphorus minerals in the fibrils and that the mechanical properties of the scaffold must match the natural hard tissue. Through our research, we found that amyloid-like protein aggregates---lysozyme (lyso) conjugated with poly(ethylene glycol) (PEG) (lyso-PEG) can significantly promote the intrafibrillar mineralization of collagen, shorten the time of intrafibrillar mineralization and increase the strength of internal mineralization . In our research, lyso-PEG can bind and modify type I collagen fibrils, and then use the abundant functional groups and charges on its surface to attract ACP, and further release calcium and phosphorus ions to complete intrafibrillar mineralization, making the mineralization time shorter and the mineralization effect is better. This study explored the first application of amyloid-like protein aggregates in the mineralization of collagen fibrils and further developed a more convenient method to promote intrafibrillar mineralization, providing a more promising convenient method for biomi -metic mineralized collagen fibrils.

Short-CV

Yanyun Pang, PhD of Hospital of Stomatology, Tianjin Medical University. The main research interests are oral biomaterials and tissue engineering.

P2-12

Amyloid-Like universal coating loaded with octenidine for remineralization and antibacterial to prevent and arrest caries

<u>Danyang Lu</u>, Xiangyu Zhang, Xu Zhang*.

Abstract

Dental caries is a chronic progressive devastating disease caused by the imbalance of dental plaque biofilm resulting in acid accumulation and tooth demineralization. Given the current challenges in caries treatment, preventing and arresting caries materials have become a breakthrough in caries research, especially when the medical service is temporarily unavailable. The amyloid-like aggregation of bovine serum albumin (BSA)—namely, PTB nanofilm—exhibits a dual function of spontaneous strong adhesion to solid surfaces such as hard tissues of teeth and good antifouling to proteins, platelets, and microbials, as well as the prevention of biofilm formation. In addition, BSA possesses 19 Ca^{2+} binding cite, which could accelerate mineralization. Octenidine (OCT), an established antimicrobial compound, can be used prophylactically and therapeutically and does not induce bacterial resistance. Therefore, PTB nanofilm loaded with octenidine (PTB/OCT) exhibits both remineralization and antibacterial superiority on enamel. Besides, as the drug nano-carrier system, PTB could load with different concentration of OCT, which overcomes the slightly solubility of OCT and is benefit to the application of antibacterial agents in oral biomaterials. Compared to other anti-caries products, PTB/OCT achieve the long-time stability of preventing caries due to strong adhesion and the novel bifunctional anti-caries strategy presents an effective method for the prevention and arrest of caries, which provides a promising clinical fluoride-free product for caries management.

Short-CV

Danyang Lu, PhD of School and Hospital of Stomatology, Tianjin Medical University. The main research interests are remineralization of hard tissue of teeth, oral biomaterials and caries management. I have published one paper about amyloid biomaterial treating dentin hypersensitivity in Advanced Materials.

Role of Common Oral Infectious Diseases in Inducing Stroke:A Review

Fan Liu

State Key Laboratory of Oral Disease & National Clinical Research Center for Oral Diseases & Dept. of Nursing, West China Hospital of Stomatology, Sichuan University, China.

[**Abstract**] Stroke as a major disease which has many risk factors seriously endangering the health of Chinese residents. Infection and systemic inflammation diseases are one of the driving factors of Stroke. Common oral infectious diseases include periodontitis, gingivitis, dental caries, endodontic disease may related to the induction of Stroke. This paper reviewed the research progress of common oral infectious diseases on promoting Stroke and related prevention ways. Expounding the relationship between common oral infectious disease and Stroke, so as to improve the health literacy and provide a theoretical basis for reducing the risk of Stroke, and put forward relevant measures for individuals and medical institutions to promote the oral health.

Fan Liu is studying for a nursing doctorate in Sichuan University now, who is working in nursing field for about 20 years has published more than 50 articles. Fan Liu has rich experience on critical diseases nursing, such as stroke, infectious diseases and so on. Recently she was arranged to West China Hospital of Stomatology as the chief of department of nursing. As the special background of systematic disease combined oral disease, especially oral infectious disease, the article was brought up by Fan Liu.

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Modified Dental Anesthesia Simulation Model Improves Skills and

Willingness for Dental Students

Zhaosong Meng, Jiacheng Liu, Hongjie Li, Dai Shen, Changyi Li, Lei Sui

Abstract

Purpose: This work aims to evaluate the teaching effects of a modified dental anesthesia simulation model (DASM) on inferior alveolar nerve block (IANB) practice teaching. The modified DASM integrated three-dimensional imaging technology and a three-dimensional positioning system to support IANB teaching.

Methods: From Jan 2020 to Aug 2021, 63 dental students were divided into two groups for IANB training. One is the analog simulation (AS) group (N=33), using modified DASM for IANB training. Another one is the student-to-student (SS) group (N=30), using the student-to-student dental local anesthetic training pattern. Students carried out theory examination, skill assessment, and questionnaires after training session and internship. The final response rate of questionnaires is 100%.

Results: After the training session, the theory and practice scores were similar between AS group and the SS group ($p>0.05$). However, the practice score was higher in AS group than the SS group after the internship ($p<0.001$). The anxiety score in the AS group was higher than in the SS group before the internship. But internship relieved the anxiety of the AS group effectively ($p<0.0001$). And the anxiety score of the AS group was close to the SS group after internship. Most of the students (63.4%) wish to use DASM on IANB training in various forms.

Conclusions: The modified DASM could effectively improve the long-term IANB skills than traditional student-to-student training pattern. And the willingness of students to perform IANB also significantly increased by modified DASM. This modified DASM is an effective adjunct method for IANB practice teaching.

Short-CV: Zhaosong Meng received his B.S. from Nanchang University in 2010, his M.S. from the West China School of Stomatology Sichuan University at Chengdu in 2012 and his Ph.D. from West China School of Stomatology Sichuan University in 2015. Since 2015 he has been employed by School of Stomatology Tianjin Medical University until now as an instructor.

Research interests: Dental stem cells, dental education and oral and maxillofacial surgery.

P3-3

Curriculum setting and students' feedback of pre-clinical training in different dental schools in China—A national-wide survey

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Research interest: Orthodontics and Dental Education

Introduction

Adequate time and effective training facilities are essential for undergraduate dental students participating in pre-clinical dental practice to ensure them providing safe treatment for patients in the future. The study aimed to explore the current status of pre-clinical dental training in China in relation to the curriculum setting and students' feedback of pre-clinical training in different dental schools and thus provide information for further standardize curricula.

Materials and method

An online questionnaire was distributed electronically to undergraduates in 44 Chinese dental schools of different levels according to China Discipline Ranking (CDR). The questionnaire collected information in relation to the training hour and student to facility ratio of four main dental courses (cariology and endodontics, periodontology, prosthodontics and oral surgery), as well as the application and effect of virtual reality (VR) simulator in pre-clinical dental practice in different schools. Students' feedback was also collected.

Demographic descriptors of questionnaire respondents

	Sex		Year of study		Length of schooling		
	Female	Male	DDS5	DDS4	8-year programme	7-year programme	5-year programme
Number	415	150	294	271	43	6	516
Percentage	73.45%	26.55%	52.04%	47.96%	7.61%	1.06%	91.33%

A total of 565 valid questionnaires were recruited from 44 dental schools. Ultimately, there were 200 questionnaires came from 11 schools in group 1 (A and A+ level school), 208 questionnaires came from 13 schools in group 2 and 157 questionnaires from 20 schools in group 3 (B-and C-level school). The personal information of the respondents is listed in Table 1.

Students' feedback about the pre-clinical training courses they received

No. and percentage of total responders

Groups	Level of sufficiency			Level of efficiency			Level of satisfaction		
	Group one[a]	Group two[b]	Group three[b]	Group one[a]	Group two[b]	Group three[b]	Group one[a]	Group two[b]	Group three[b]
1	4 (2.00)	13 (6.25)	11 (7.01)	2 (1.00)	1 (0.48)	3 (1.91)	3 (1.50)	6 (2.88)	6 (3.82)
2	3 (1.50)	25 (12.02)	22 (14.01)	3 (1.50)	5 (2.40)	6 (3.82)	4 (2.00)	18 (8.65)	8 (5.10)
3	30 (15.00)	59 (28.37)	56 (35.67)	28 (14.00)	69 (33.10)	46 (29.30)	24 (12.00)	75 (36.00)	66 (42.00)
4	89 (44.50)	62 (29.81)	44 (28.03)	74 (37.00)	67 (32.20)	65 (41.40)	90 (45.00)	59 (28.30)	50 (31.80)
5	74 (37.00)	49 (23.56)	24 (15.29)	93 (46.50)	66 (31.70)	37 (23.50)	79 (39.50)	50 (24.00)	27 (17.20)

As shown in Table 2, students in Group 1 showed a higher percentage of better feedback towards the course experience in the level of equipment sufficiency, degree of satisfaction and level of training efficiency, whilst students in Group 3 were the lowest. The difference between Group 1 and the other two groups was statistically significant ($p < 0.05$) as for the feedback in 3 aspects with the general pre-clinical courses, whilst no statistically significant difference was found between Group 2 and Group 3.

The application and effect of virtual reality simulator in pre-clinical training

No. and percentage of total responders

Groups	Level of efficiency			Level of satisfaction			Level of availability		
	Group one[a]	Group two[a]	Group three[a]	Group one[a]	Group two[b]	Group three[b]	Group one[a]	Group two[b]	Group three[b]
1	0 (0.00)	1 (1.14)	1 (1.56)	2 (1.36)	2 (2.27)	2 (3.13)	5 (3.40)	5 (5.68)	2 (3.13)
2	5 (3.40)	5 (5.68)	7 (10.94)	10 (6.80)	8 (9.09)	8 (12.50)	9 (6.12)	13 (14.77)	11 (17.19)
3	36 (24.49)	29 (32.95)	19 (29.69)	30 (20.41)	33 (37.50)	24 (37.50)	45 (30.61)	33 (37.50)	25 (39.06)
4	58 (39.46)	33 (37.50)	23 (35.94)	61 (41.50)	26 (29.55)	20 (31.25)	48 (32.65)	22 (25.00)	18 (28.13)
5	48 (32.65)	20 (22.73)	14 (21.88)	44 (29.93)	21 (21.59)	10 (15.63)	40 (27.21)	15 (17.05)	8 (12.50)

As shown in Table 3, twenty-seven of 44 responded dental schools (61%) claimed that they have introduced virtual reality simulator to assist sette the pre-clinical training, and the Group 1 (72.73%) showed a highest percentage of use, whilst Group 2 (53.33%) showed the lowest. Seventy-one per cent of the respondents in Group 1 are very satisfied with the introduction of virtual reality simulator in the pre-clinical training curriculum, followed by Group 2 (51.14%), and Group 3 (46.88%) was the lowest. As for level of training efficiency and availability about virtual reality, similar trend can also be found.

The training hour and student to facility ratio
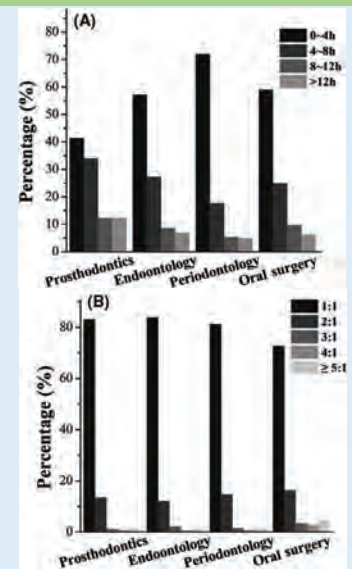
As shown in Figure a, more than 40% of the students claimed that they spent less than 4 hours per week on the pre-clinical training in each main course, with periodontology the most frequently reported course (71.99% of the respondents) and prosthodontics the least frequently reported course (41.39%).

As shown in Figure b. More than 95% of the students claimed that they had access to the training facilities on their own in prosthodontics, cariology and endodontics and periodontology course, whilst the percentage of the respondents to the ratio for oral surgery course that more than 2:1 was found increased to 10.78%.

Conclusion

Pre-clinical dental training in China remained imperfect in insufficient training time, training facility and students did not have access to standard pre-clinical training and quality assurance. VR technique has potential values in pre-clinical dental practice in China.

Locally Delivery of Minocycline Immediately After Implant Surgery: A 12-Week Randomized Controlled Clinical Trial

Yanjun Zhang, Xingmei Yang, Quan Yuan*. State Key Laboratory of Oral Diseases & National Clinical Research Center for Oral Diseases & Department of Implant，West China Hospital of Stomatology，Sichuan University，Chengdu，China.
*Quan Yuan E-mail: yuanquan@scu.edu.cn

Abstract

Background: The aim of this randomized controlled clinical trial is to determine the clinical and microbial effects of local delivered minocycline hydrochloride ointment immediately after implant surgery.

Materias and Methods: Forty partially edentulous patients were recruited and randomly assigned to two groups: test group (minocycline hydrochloride treatment group); control group(blank control). Pain index was measured at 3 days after surgery. Gingival index (GI), modified Sulcus Bleeding Index (mSBL) and peri-implant crevicular fluid samples were measured and collected at 3 and 7 days after surgery. IL-1β, IL-10 and TNF-α concentrations were measured by enzyme linked immunosorbent assay (ELISA). Microbial analysis was performed with real-time polymerase chain reaction. The change of marginal bone level (MBL) measured with panoramic radiograph was analyzed between immediately and 12 weeks after surgery.

Results: The results of pain index, GI and mSBL in the test group were significantly lower than in the control group (P=0.03, 0.005 and 0.015, respectively) at 3 days, and (P ＜0.001) at 7 days. The concentration of IL-1β, IL-10 and TNF-α were significantly lower in the test group (P=0.016, 0.034 and 0.045, respectively) at 3 days. The relative abundance of streptococcus and gram-negative anaerobic bacteria was significantly lower in the test group (P=0.011 and ＜0.001, respectively) at 3 days, and (P=0.017 and ＜ 0.001, respectively) at 7 days after surgery. There was no significantly difference of MBL between the test and control group.

Conclusion: These findings indicated that the local delivery of minocycline provides significant benefits in terms of reducing postoperative pain, promoting wound healing and decreasing gram-negative anaerobic bacteria early colonization.

Research interest: peri-implant wound healing; characteristic of peri-implant microbes in early period

Topic   : **Implant and stem cells**
Category Based   : **Research and Education in Dentistry**

MESENCHYMAL STEM CELLS: A PROMISING THERAPY FOR DENTAL IMPLANTS OSSEOINTEGRATION IN DIABETICS MODEL

Mefina Kuntjoro[1]*, **Nike Hendrijantini[1], Bambang Agustono[1], Darin Rinaldi[2], Farasaty Utami[2]**

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ABSTRACT

Background: Diabetics can leads to lack and delayed osseointegration in dental implant due to hyperglycemic. Thus, it has always been a challenge for prosthodontist as there is still no therapy for these conditions. Human umbilical cord mesenchymal stem cells (hUCMSCs) was a very well developed stem cells among researchers around the world because of the ability in improving bone microenvironment and osteogenic potentials. **Objective**: To examine the effect of hUCMSCs on dental implant osseointegration in hyperglicemic condition. **Method:** Twenty eight Wistar rats were injected intraperitoneally with Streptozotocin 20mg/kg BW 5 days in a row to make diabetic model. The treatment was carried out after fasting blood sugar levels > 300 mg/dl and waiting 5 days for the glycation period. The source of stem cells is human umbilical cord which has been isolated and cultured until passage 6. The experimental animals were divided into 4 groups, namely the 2-week implant group (K1), the 4-week implant group (K2), the 2-week implant + hUCMSCs group (P1) and the 4-week implant + hUCMSCs group (P2). The variables examined were osterix, BIC (Bone Implant Contact), and BIV (Bone Implant Volume). The data were analyzed statistically using ANOVA and Mann-Whitney Test. **Result:** There were significant differences in Osterix, BIC, and BIV level in treatment groups compared with control groups. BIC and BIV level in treatment groups continue to increases significantly to maintain osseointegration. While Osterix, an essential marker for bone maturation, is decreasing as homeostasis occured**. Conclusion**: hUCMSCs accelerate and increase dental implant osseointegaration in diabetics model.

Keywords: **hUCMSCs, implant, diabetes, osseointegration, BIC.**

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EDUCATION

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School of Dentistry   Feb. 2021 –Present

ABSTRACT

Applying Mobile Augmented Reality Technology in Dental Education

Yi Chen Hsu, Tran Thi Ngoc Trang, Chien Fu Tseng, Pei-Yun Liu, Ding Han Wang*, Ming Lun Hsu*

Information and communication technology (ICT) have been applied in influencing the field of industry and make it become more digitize. With the development of ICT, mobile devices becoming widely used in public. In recent years, more and more educational application connected to mobile device, make learning get closer to population. There are several educational applications combine augmented reality to increase more fun experience. Augmented reality (AR) is a technology that integrates real-world environment and virtual objects. Follow the definition of AR, Mobile Augmented reality (MAR) applies above concept in mobile devices that can be used anytime, and makes us can carry them easily wherever we go. According to the current popularity of the use of MAR in the public, our study captures the advantages and incorporate to create a new value application for learning and also to support healthcare services. Three-dimensional medical model reconstructed based on 2D image has been used in recent years in clinical performance and training system, which can clearly identify the difference and more information in details than 2D drawing. By using 3D medical image integrating MAR technique, which can be applied into education field for student and clinical field between healthcare worker and patient. A concrete image allowing students and users to construct visualization which are invisible in some of the case to develop their own cognitive ability.

P3-7 Application of digital surgical technologies in the treatment of dentofacial deformities secondary to condylar osteochondroma hyperplasia

Zhaokun Zhu, Tai Yue, Liu Yao, En Luo*

State Key Laboratory of Oral Diseases & National Clinical Research Center for Oral Diseases Dept. of Oral and Maxillofacial Surgery, West China Hospital of Stomatology, Sichuan University, Chengdu, 610041, P.R. China.

Abstract

Purpose： To introduce a modified method using CAD/CAM surgical cutting and drilling guides with additional pre-bent titanium miniplates to improve the accuracy of operation for the treatment of dentofacial deformities secondary to condylar hyperplasia.

Materials and Methods ： 20 patients with condylar hyperplasia and secondary dentofacial deformities were treated by the CAD/CAM surgical cutting and drilling guides as well as pre-bent titanium miniplates. Pre- and post-operative 3D-cephalometric measurements were recorded and the difference between virtual simulation and postoperative modeling images was measured. Follow-up and radiographic examinations were performed. **Results：** In our study, all patients were satisfied with the surgical outcome, without obvious relapse or evidence of temporomandibular joint disorder or other complications during follow-up; all patients avoided condylar reconstruction and sagittal split of ramus osteotomy on the ipsilateral mandible side. Comparison between simulated plans and actual postoperative outcomes showed surgical simulation plan was accurately transferred to the actual surgery. **Conclusions：**

The application of CAD/CAM surgical cutting and drilling guides as well as pre-bent titanium plates could achieve accurate and favorable outcomes, improving the clinical planning and surgical execution for patients with condylar hyperplasia and secondary dentofacial deformities.
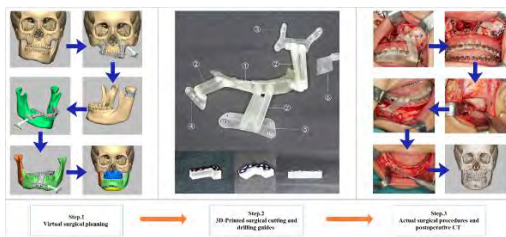
Fig.1

Fig.2
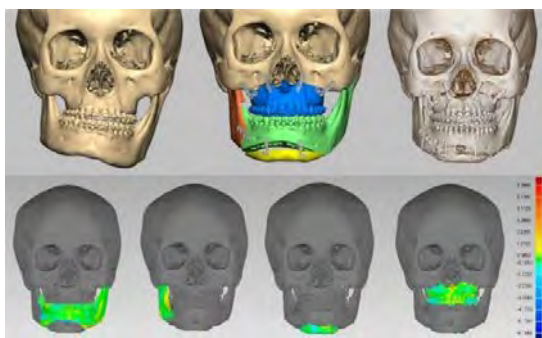
Fig.3

Fig.4

International Symposium for Interface Oral Health Science 2022

Study on the correlation between tongue size, position and lower dental arch morphology in skeletal class II adolescents

Author： Zi yi,Wang Yan hong,Zhao Xin tong,Zhong
Department of Orthodontics, Tianjin Medical University Hospital of Stomatology

Objective:

In this study, the three-dimensional measurement and analysis of the tongue and lower arch morphology of skeletal class II adolescents was conducted to explore the correlation between the size and position of the tongue and the morphology of the lower dental arch in skeletal class II adolescents.It aims to provide a theoretical basis for the treatment of adolescent patients.

Method:

According to the inclusion criteria, 60 cases of skeletal class II adolescent patients (21 males and 39 females, with an average age of 14.94 ± 1.83 years) were collected. Use Invivo5 to perform three-dimensional reconstruction of the CBCT data of all patients, adjust the three-dimensional level, measure the position and size of the tongue, the length of the lower dental arch, the width of the front and back and other indicators. Use SPSS 23.0 software package to perform correlation statistical analysis on the measurement data.

Results:

The front width of the lower arch is positively correlated with the length of the tongue, the area of the tongue body, the total area and the area of the middle part of the tongue, and it is significantly positively correlated with the height of the tongue and the position of the tip of the tongue; the width of the back of the lower arch is positively correlated with the height of the tongue and the area of the tongue. Position, total area and mid-tongue area are significantly positively correlated; the length of the lower arch is significantly positively correlated with the length of the posterior tongue in the mouth. The above correlations are statistically significant ($P<0.05$).

Conclusions:

The size and position of the tongue of skeletal adolescents are correlated with the width and length of the front and back of the lower dental arch. Patients with a larger tongue and a higher position of the tongue in the mouth have a wider and longer dental arch.
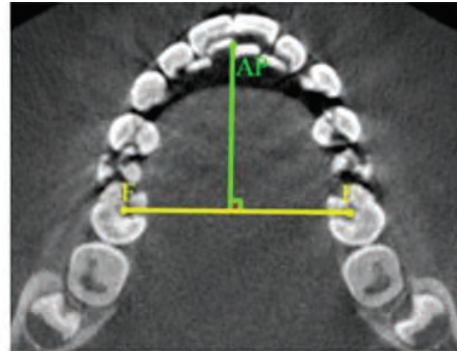
AP:Lower arch length
FF:Posterior width of lower arch
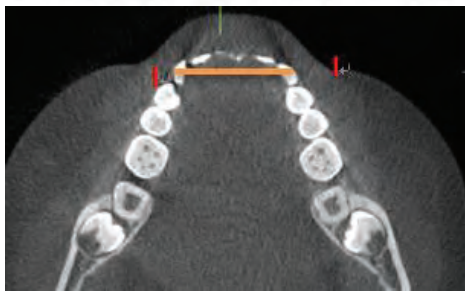
II: Front width of lower arch
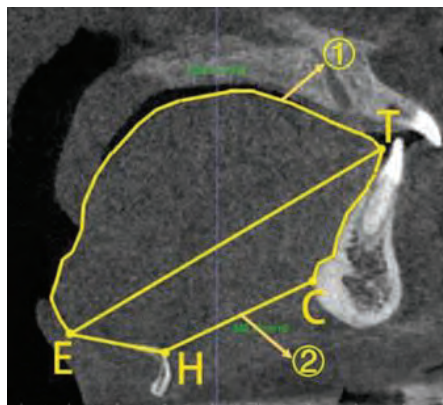
T: tip of tongue;
E: root of epiglottis;
ET: connection between tip of tongue and root of epiglottis;
C: most convex point of mental spine;
H: uppermost point of hyoid bone;
①: area of tongue body;
②: area of tongue base
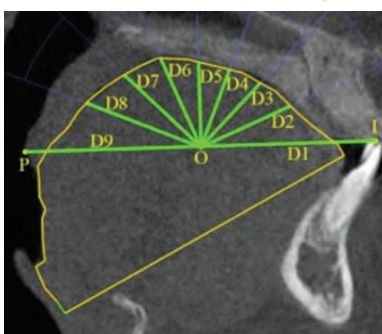
I: the incisor point of the lower central incisor;
P: the last point of the soft palate;
O: the midpoint

Scanning Electron Microscope Observation of Dental Root Canal After Irrigated by Chitosan Tiger Shrimp Shell (Penaeus monodon) Waste Solution

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Abstract

Root canal irrigation is one part of biomechanical preparation of root canal treatment. The purpose of this treatment is to take out debris, to dissolve smear layer, antibacterial, and lubricants. NaOCl is one irrigation material frequently used, although it is not able to clean the smear layer and toxic. Tiger shrimp is one of the shrimps consumed in high quantities per year. Tiger shrimp contains 36% chitosan of total body weight. Chitosan is believed to have antibacterial and bio-adhesive capability so that it may be used as an alternative material of irrigation canals. This study was aimed to know the cleaner capability of chitosan tiger shrimp shell (Penaeus monodon) waste solution shrimp chitosan in dental root canal walls by Scanning Electron Microscope (SEM) observation. The goat teeth were preparation by conventional technique and irrigated with various solutions. Root canal wall from each group was observed by SEM. The result showed that teeth irrigated by 10% chitosan solution was the cleanest. However, there was no significant difference between each group. Briefly, chitosan solution wasable to clean up debris and could be used as root canal irrigations solution

Keywords: chitosan, SEM, tiger shrimp waste.

Investigation on the understanding and cognition of oral residents joining standardized training towards clinical practice in aesthetic and restorative dentistry

Author: Liang Shanshan, Xiao Weiwei, Yang Guang, Kong Junjun, Huang Cui

Research Interest: Aesthetic dentistry

Address: School and Hospital of Stomatology, Wuhan University

Objective

To investigate the understanding and cognition of oral residents joining standardized training towards clinical practice in aesthetic and restorative dentistry.

Methods

A questionnaire survey was implemented and 313 oral residents joining standardized training in School and Hospital of Stomatology, Wuhan University participated in this investigation by "wjx.cn" platform. The data was analyzed by SPSS. The contents of the survey included the background of participants, their understanding and their cognition towards clinical practice of aesthetic and restorative dentistry and the demand for relative courses.

Results

A total of 313 questionnaires were distributed and 272 were responded, with a response rate of 86.90%. The results showed that only 11.03% residents had the experience of systematic learning in aesthetic and restorative dentistry. Most residents (88.24%-98.16%) thought that the clinical skills of aesthetic restorative dentistry were necessary. 96.32% of the residents thought it was critical to enroll more courses and lectures related to aesthetic and restorative dentistry. There was no significant difference on these items among three different grades ($P>0.05$), except for the cognition towards communication between doctors and technicians ($P=0.040$).

Conclusion

Oral residents joining standardized training generally lack sufficient understanding of aesthetic and restorative dentistry, and have urgent demand for courses and lectures related to it. Therefore, it is imperative to improve the education of aesthetic and restorative dentistry for oral residents joining standardized training.

Investigation on the situation of clinical practice of oral aesthetic analysis and design for oral residents receiving standardized training

Author: Liang Shanshan, Kong Junjun, Lui Siin, Yang Ziyi, Huang Cui
Research Interest: Aesthetic dentistry
Address: School and Hospital of Stomatology, Wuhan University

Objective

To investigate the performance of and influencing factors on clinical practice of oral aesthetic analysis and design for trainees receiving resident standardized training.

Methods

Totally 263 trainees were selected at School and Hospital of Stomatology, Wuhan University, in January 2020. The platform "wjx.cn" was used for questionnaires distribution and data collection. The contents of questionnaire included the general information of participants, the current situation of clinical practice of oral aesthetic analysis and design and their self-evaluation of the aesthetic restorative capacity. Chi square test and multivariable logistic regression analysis were applied for analyzing the data.

Results

The results showed that 63.5% (167/263) of the trainees evaluated themselves as competent to complete clinical practice of oral aesthetic restoration; but only 33.8% (89/263) of the trainees were capable of doing the digital aesthetic analysis and design. The trainees majoring in prosthodontics had better "clinical practice capacity of oral aesthetic restoration" (OR =4.90 , 95% CI:2.27~10.60), and did better in "understanding the aesthetic needs of patients" (OR = 2. 47, 95%CI: 1.10~5.59), "digital aesthetic analysis and design" (OR = 2.29 95%, CI:1.23 ~ 4. 26), and "making research model and diagnostic wax pattern" (OR =2.75, 95%CI:1.43~5.28) "four licenses in one" master degree students did better in "record aesthetic information by using oral clinical digital photography" (OR = 2.37, 95%CI:1.27~4.40) and "making research model and diagnostic wax pattern" (OR = 1.91, 95%CI: 1.07~3.41). The trainees of grade 2017 did better in "digital aesthetic analysis and design" (OR = 2.41, 95%CI:1.20~4.83).

Conclusion

Part of trainees in standardized training of oral residents had mastered the relevant technologies of oral aesthetic analysis and design and had the clinical practice capacity of aesthetic restorationu Trainees whose major was prosthodontics or who was "four licenses in one" master degree students or whose grade was 2017 were more likely to perform well in these aspects.

Investigation on the satisfaction of oral residents joining standardized training towards the prosthodontics morning-course mode

Author: Liang Shanshan,Yang Ziyi,Shi Hongqian,Xiao Weiwei,Huang Cui
Research interest: Aesthetic dentistry
Address: School and Hospital of Stomatology, Wuhan University

Objective

To investigate the satisfaction of trainees in standardized training of oral residents with the prosthodontics morning-course mode, and to explore trainees' favorite teaching forms.

Methods

A total of 140 trainees from grade 2017 to 2020 who were trained in the prosthodontics training base of Hospital of Stomatology, Wuhan University and participated in the prosthodontics morning-course mode from June to October 2020 were selected as the research objects. The platform of "wjx.cn" was used for sending questionnaires and collecting data. The contents of the questionnaire included the general information of participants, their satisfaction with the course arrangement and teaching content of the morning-course mode, and the overall satisfaction, as well as their favorite teaching forms. Fisher's exact test was used for data analysis.

Results

The trainees' satisfaction with time arrangement and venue arrangement of the prosthodontics morning-course mode were 95.0%(115/121) and 93.0%(120/129); the trainees' satisfaction with the coverage of the teaching content and clinical practicability were 85.0%(102/120) and 96.8%(120/124);and the overall satisfaction was 96.2%(125/130). There was no significant difference in the satisfaction with the above-mentioned 5 aspects among the trainees in different gender, types and majors(P>0.05); There was significant difference in the satisfaction with the coverage of the teaching content among the trainees in different grades (P=0.042), but no significant difference was observed in the other four aspects among trainees in different grades (P>0.05). More than 70% trainees' favorite teaching forms of the prosthodontics morning-course mode were case report [80.0% (112/140)], practical course [75.7% (106/140)] and difficult case discussion [75.7% (106/140)].

Conclusion

The trainees in standardized training of oral residents were highly satisfied with the prosthodontics morning-course mode, and the case report, practical course and difficult case discussion were their favorite teaching forms of the prosthodontics morning-course mode.

Comparison in Education and Management of the Caries Disease between two Universities.

Åkerlind K., Tu L., Nakamura K., Hong G., Örtengren U.

Purpose: Evaluation of the educational management of caries disease between the University of Gothenburg and Tohoku University of Sendai. **Background:** Caries is the world's most common illness and considered as a multifactorial disease. By performing Caries Risk Assessment (CRA) it is possible to identify high risk patients. CRA is recommended to be performed regularly both in Sweden and Japan, but seems less commonly executed in the latter. Prevention is a critical factor in the treatment of the caries. Important factors to take into consideration are diet, fluoride administration and antimicrobial products. The dental education is five years in Sweden and six years in Japan. Since cariology and management of the caries disease is an important part in dentistry and dental education, the purpose of this study was to compare the educational management of the caries disease between the University of Gothenburg and Tohoku University of Sendai. **Method:** A questionnaire was developed focused on caries prevention, risk assessment and caries education and sent to the final year dental students, researchers/teachers and The Head of Cariology/The Head of Division for International Collaborative and Innovative Dentistry from each university. The answers were summarized and analyzed. **Results:** Both universities answered that CRA, prevention, restricted sugar intake and diet is important. The two universities would, however, perform CRA on different patient groups and also recommend different base prophylaxis and fluoride regime. 100% of the Swedish teachers considered their cariological education sufficient for everyday practice, but only 33% of the Japanese teachers considered their cariological education sufficient. Among the students, the distribution of answers was 87% (Sweden) vs 33% (Japan) respectively. All respondents wanted more practical training for the students. **Conclusion:** CRA was considered important at both universities but the differences in caries management was evident.

We are two dental students (25 and 24 years of age) in our last year of our studies. Our research interest is within cariology and caries risk management.

Reduced Bone Dimensions in Oligodontia: a Case-Control Study

Nicolas Dupré[2,5,6], Orianne Gondel[1], Rufino Felizardo[1,2,3,6], Maria Clotilde Carra[1,4,6], Muriel de La Dure-Molla[1,2,6], Benjamin P.J. Fournier[1,2,5,6], Stéphane Kerner[1,2,5,6,7]

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[2] *Reference Center for Oral and Dental Rare Diseases, ORARES, Rothschild Hospital, AP-HP, Paris, France.*
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[6] *APHP, Rothschild Hospital, Odontology Department*
[7] *Department of periodontics, School of dentistry, Loma Linda, University Loma Linda, CA, US*

Objectives: Oligodontia (OD) is a rare developmental disease characterized by agenesis of at least six permanent teeth. Once diagnosed, patients require complex oral rehabilitation. Difficulties in dental implants treatment have been reported. We aim to determine whether the bone volume of the maxilla and mandible are altered in OD patients compared to non-OD patients, in a retrospective case control study.

Methods: CBCTs of 53 adult OD patients (40 maxillary, 32 mandibular) were analyzed and compared with those of 82 (51 maxillary, 31 mandibular) age- and sex-matched controls. Alveolar bone dimensions were evaluated at every tooth position site.

Results: In OD patients, upper maxilla bone width was decreased in sites with permanent teeth, while bone height was only decreased in the anterior area ($17,1\pm3,0$mm vs $19,2\pm3,9$mm, $p<0,001$). Edentulous sites (compared with control patients' edentulous sites) showed a reduced height in the anterior sites (($15,0\pm4,1$mm vs $19,4\pm4,4$mm, $p<0.001$) and a decreased thickness in the premolar at 3 mm ($p=0,05$) and molar areas at 3 ($p<0.001$) and 6mm ($p=0,05$).

In the mandible, the permanent teeth were associated with a decreased bone height in premolar and anterior areas, while bone thickness was significantly reduced in the incisive-canine area at 3 ($p<0.001$), 6 ($p<0.01$), and 12 mm ($p<0.001$) depth in OD patients. In mandibular edentulous sites, bone thickness diminished at every site. Of interest, bone thickness increased in the sites with permanent or temporary teeth compared to edentulous ones. This morphology modification was associated with changes in alveolar nerve position in case of molars agenesis.

Conclusions: Maxillary and mandibular bone volume is decreased in OD patients compared to controls. Since the absence of teeth in OD patients is associated with volume deficit, it may be beneficial to keep temporary teeth functional to limit alveolar bone resorption.

Nicolas DUPRE
Email: nicolas.dupre@outlook.fr
Research interest: Oral and Facial Rare Disease

University Resume

2021-NOW	Master 2 – Development, Inflammation, Regeneration, Université de Paris
2020-2021	Master 2 – Oral-facial Rare Disease, Université de Paris
2020	Doctor of Dental Surgery, Université de Paris
2019-2020	Master 1 – Health, Université de Paris

Professional Resume

|	
2019-NOW	Dental practice in private office
2017-NOW	Dental practice at Oral and Facial Rare Disease Department, Hôpital Rothschild, AP-HP, Paris

Single-cell analysis reveals that cancer-associated fibroblasts promote oral squamous cell cancer invasion through TGF-β1/Smad pathway

Shunhao Zhang, Tianle Li, Wenbin Yang[#]

State Key Laboratory of Oral Diseases, National Clinical Research Center for Oral Diseases, Department of Oral and Maxillofacial Surgery, West China Hospital of Stomatology, Sichuan University, Chengdu, China, 610041

Abstract: Though substantial progress has been made in cancer biology and treatment, the prognosis of oral squamous cell carcinoma (OSCC) is still not satisfactory because of local tumor invasion and frequent lymph node metastasis. The tumor microenvironment (TME) is a potential target, in which cancer-associated fibroblasts (CAFs) are of great significance due to their interactions with cancer cells. However, the exact mechanism is still unclear. Therefore, we focused on the crosstalk between cancer cells and CAFs, and discovered that CAFs were the main source of TGF-β1. Transwell assay and western blot assay further proved that CAF activated TGF-β1/Smad pathway to promote OSCC invasion. Through survival analysis using TCGA datasets containing nearly 200 OSCC samples, we confirmed that CAF overexpression is correlated with poor overall survival in OSCC. To further elucidate the origin and role of CAF in OSCC, we analyzed single-cell RNA sequencing data on four OSCC tumor samples and identified eight distinct cell types including CAF in TME, indicating high intra-tumoral heterogeneity. Then two subtypes of CAF, namely myofibroblast (mCAF) and inflammatory CAF (iCAF), were further distinguished based on specific marker genes. We found that although mCAF showed higher portion, iCAF upregulated significantly both in stage IV samples and malignant tissues, indicating that iCAF may play a key role in OSCC progression. Based on the differentially upregulated genes of CAF, GO and KEGG enrichment analysis revealed that receptor ligand activity and focal adhesion were significantly enriched in iCAF and mCAF respectively, revealing their different roles in OSCC progression. Furthermore, the gene expression pattern dynamically altered across pseudotime, potentially taking part in the transformation from epithelial to mCAF or iCAF through epithelial to mesenchymal transition (EMT). These results could help elucidate the protumor mechanisms of CAFs, which may provide deep insight into drug discovery.

Short CV: Shunhao Zhang is an undergraduate in West China School of Stomatology, Sichuan University. He has published two SCI paper in scientific journals including Cell Proliferation and Microbial Cell Factories. In addition, he has presented a scientific poster in the 15th National Academic Conference on Oral and Maxillofacial Surgery. Currently, he is conducting research on oral and maxillofacial oncology in State Key Laboratory of Oral Disease at Sichuan University under the supervision of Dr. Wenbin Yang.
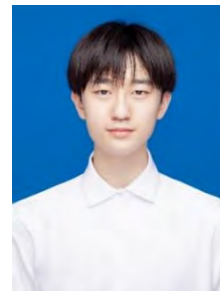
Research interest: Oral and maxillofacial oncology

Oral Phenotype of Singleton-Merten: A Case Report

M. Riou[1,2,3], M. de La Dure-Molla[1,2,4], S. Kerner[1,2,3], S. Rondeau[5], A. Legendre[6], V. Cormier-Daire[4], B. Fournier[1,2,3]

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[2] *Reference Center of Oral and Dental Rare Diseases. Hôpital Rothschild, Odontology Department, APHP, Paris, France.*
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[6] *Laboratoire de biologie médicale multisites Seqoia – FMG2025, Paris, France*

Background: Singleton-Merten syndrome is a rare autosomal dominant disorder with blood vessels calcifications, teeth anomalies and bone defects.

Aim: We aim to describe the oral features of a Singleton-Merten patient, the diagnosis and the treatment he received.

Results: A 10-years-old patient presented at the pediatric dentistry department for a permanent tooth pulpitis. We followed him for numerous carious lesions, severe teeth malposition especially in the anterior arch, and oral hygiene deficiency with a 100% plaque index, associated with dental and jawbones anomalies The X-ray did not show any dental agenesis but revealed short roots and a decrease of the alveolar bone height. In order to investigate the diagnosis, he was referred to the Reference Center of Rare Oral and Dental Diseases. We observed dysmorphic facial features, fine and space hair, a trigonocephaly with triangular face, discrete hypertelorism, long arched eyebrow and low set-ears. He also presented muscle weakness, cutaneous xerosis and ophthalmologic glaucoma, without intellectual disability. Whole genome sequencing analysis revealed a heterozygous *de novo* variant in *IFIH1* (NM_022168.4) c.2465G>A (p.Arg822Gln) and confirmed a Singleton-Merten syndrome. We carried out the necessary health education and care, a partial denture replaced the hopeless teeth and maintained the vertical dimension.

Conclusions: Few descriptions of oral features occurred in literature between congenital findings and "acquired" pathologies, such as missing teeth. The oral phenotype of these patients remains insufficiently described, while it may contribute to diagnosis. Early diagnosis may prevent delayed teeth loss and improve quality of life.

Margot RIOU
Email: margot.riou@aphp.fr
Research interest: Oral and Facial Rare Disease

University Resume
2021-now   PhD student
2020-2021   Master 2 – Development, Inflammation, Regeneration, Université de Paris
2017   Doctor of Dental Surgery, Université de Paris

Profesional Resume
2018-now   Assistant professor, Pediatric Dentistry, Université de Paris, AP-HP
2017-2019   Dental practice in private office

Clinical Analysis of the Relationship between Temporomandibular

Joint Disorders and Oral Iatrogenic Factors

Xingtong Mu, Baoxin Fan, Juan Zhang*

[Abstract] Objective: To study the relationship between iatrogenic factors and temporomandibular disorders. **Methods**: This is a retrospective analysis of patients in the temporomandibular joint clinic of Stomatological Hospital of Tianjin Medical University from June 2012 to July 2021. Among them, 466 patients had TMD symptoms after oral treatment. Descriptive statistics were made on the previous medical records of these patients. **Result:** Among the 466 medical records included, there were 359 female patients (77.0%) and 107 male patients (23.0%). Youth female accounted for the largest proportion. The number of patients after orthodontic treatment is the largest. Other therapeutic measures such as root canal therapy and tooth extraction are also risk factors for TMD. The patients mainly developed facial asymmetry, joint pain and joint noise. The number of patients who came to our department due to TMD symptoms after oral treatment tended to increase year by year ($R^2 = 0.737$, P = 0.003). **Conclusion:** Iatrogenic factors may be one of the risk factors of TMD. Oral clinicians should take active interventions to prevent the occurrence of TMD.

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Xingtong Mu, undergraduate course 5th year, School of Stomatology, Tianjin Medical University, studies under Juan Zhang specializing in study of temporomandibular diseases and occlusion.

Baoxin Fan, master course 1st year, School of Stomatology, Tianjin Medical University, studies under Juan Zhang specializing in study of temporomandibular diseases and occlusion.

Juan Zhang*, deputy chief physician and master supervisor of Stomatological Hospital of Tianjin Medical University, doctor of Sun Yat-sen University and postdoctoral fellow of Peking University, member of Chinese Stomatological Association, TMD and Occlusion Committee, specializes in study of temporomandibular diseases and occlusion.

P4-6

Research intere : **Prosthodontics**

PERSONALIZED COMPLETE DENTURE: THE USE OF SEMIADJUSTABLE ARTICULATOR FOR FLAT RIDGE (A CASE REPORT)

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ABSTRACT

Background: The process of post-extraction alveolar bone resorption is an unavoidable phenomenon and can increase with poor denture fabrication. The use of semi-adjustable articulators can produce dentures with personal occlusion and articulation of the patient so as to increase patient's comfort. **Objective**: To explain the case management of complete edentulous flat ridge using a semi-adjustable articulator. **Case Report:** A female 69 years old patient, came with the chief complaint to replace the old complete denture made by an illegal street dentist because it was uncomfortable and currently unusable. There was a flat ridge in the left posterior region of the mandible. **Case Management:** The complete denture was made using a semi-adjustable articulator. Preliminary bite registration was performed with a centric tray with a facebow transfer as a mounting aid to the articulator. Individual trays equipped with bite rims mounts were made to perform functional impression using an close mouth suction effective methods with polyvinyl siloxane material and followed by intraoral gothic arch tracing. A bite record and facebow transfer then performed as a guide for mounting on the articulator. The arrangement of the teeth was carried out using a 2D setting up template and a complete denture wax trial was carried out. After that, contouring, acrylic processing and polishing were carried out on the complete denture. Correction of the occlusion was performed in the patient, then insertion of complete denture and aftercare education was explained to the patient. **Conclusion**: Fabrication of complete dentures using a semi-adjustable articulator produces an optimal dentures and increases patient satisfaction.

Keywords: **complete denture, flat ridge, semiadjustable articulator.**

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	Education	: 1. DDS: Faculty of Dental Medicine, Universitas Airlangga 2. MHS: Master of Health Science, Faculty of Dental Medicine, Universitas Airlangga 3. Specialist: Prosthodontist, Faculty of Dental Medicine, Universitas Airlangga

Intraosseous Venous Malformation of the Zygoma:

Cases Report and Literature Review

Abstract: Objective: intraosseous venous malformation (IVM) of the zygoma is comparatively rare, and their clinical and radiological features, as well as treatment modalities, had not been comprehensively reviewed nor well established. Method: 4 cases from our hospital were pathologically diagnosed as IVM in zygoma, and literature research recognized another 58 cases. Clinical manifestation, radiological features and treatment methods were carefully reviewed and summarized. Result: Zygomatic IVMs occured more often in women and the mid-age. These lesions were usually asymptomatic and were round and well-defined with radiated, honeycomb, spongious, or dendritic patterns inside on CT imaging. We also reported a cone-beam computed tomography (CBCT) scan of this lesion, showing its fine internal dendritic structure with high resolution. En-bloc excision or resection could gain a satisfactory outcome, which was regarded as the best option of treatment. Methods of reconstruction were diverse and recently alloplastic material has been reported as the commonly used filling material. Conclusion: Zygomatic IVMs are rare but they are the most common vascular malformations of the zygoma, which have some common clinical and radiological features. Those features can facilitate clinicians and radiologists to make accurate diagnosis and then to achieve optimal treatment.

Author: Zelin Ye, Meng You, Guangning Zheng

Zelin Ye, graduated student of West China School of Stomatology, Sichuan University, majoring in dental and maxillofacial radiology.

Training Gadget with force visualization system as a learning tool of periodontal treatment

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Kasumi TAKEMOTO[2], Mana IGARI[3], and Takeyoshi KOSEKI[3]

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Introduction: It requires sophisticated and delicate hand instrumentation technique for the treatments of dental caries and periodontal diseases, then, students need adequate and intensive training to get a grasp of sensitive manipulation. For example, complete removal of subgingival calculus and microbial deposits from root surfaces is one of the essential skills for successful periodontal treatments. To learn these clinical skills of scaling and root plaining (SRP) efficiently and effectively, we developed the Training Gadget as a learning tool of periodontal treatment with the force-visibility of hand instrumentation. In this report, we described the developed Training Gadget, and discuss the application in professional skills training.

Materials and Methods: For developing this education systems, we tried to visualize the invisible force against the target tooth applied by the trainee's manipulation. The model tooth (A2ARA-777, Nissin Co.Ltd) which connected to the 3D force sensors, were embedded into the top of Training Gadget. Output signals were processed with instrumentation amp and analog-digital converter, then the force data were transmitted to host computer or smartphone through USB connection. For display the force of manipulation, we used the game engine, Unity 2018.3.0f2 provided by Unity Technologies. Three dental students, who just started the clinical course of SRP, performed the SRP manipulation by using this Training Gadget, and described the impression of this learning system.

Results and Discussion: All students used this Training Gadget agreed with the usefulness for the beginners to understand the tactile sense of SRP, and mentioned the possibility to enlarge the learning opportunity as a remote education system. Using the visually appealing technologies of virtual reality, we are able to observe the force applied to the model tooth from various directions in real time operation. In the world during the current Corona pandemic, this Training Gadget would provide one of the solutions in the remote education system of manipulation skills of dental practice.

Keiju ASHIDA
The 4th grade dental student, Tohoku University School of Dentistry.
Research interest: Development of the tools to improve dental clinical skills; I assembled this learning tool with professor Koseki. I and 2 other 4th grade students participated in the practice of SRP technique with this completed Training Gadget.

SITUATIONAL AWARENESS ANALYSIS OF DENTAL STUDENTS DURING COVID-19 PANDEMIC IN DENTAL HOSPITAL UNIVERSITAS AIRLANGGA

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Abstract:

Background: Covid-19 pandemic has affected dental practice due to high risk of virus exposure, including to dental medicine students. Spread control of Covid-19 virus during dental procedure can be done with several modification such as usage of Personal Protective Equipment (PPE), extraoral suction tool, and room modification into negative pressure. These changes require good perception, comprehension, and projection skills from dental students when carrying out clinical learning, which can be assessed as situational awareness. **Purpose**: We aim to analyze situational awareness in dental students of Faculty of Dental Medicine Universitas Airlangga during Covid-19 pandemic. **Method**: We conducted data collection with Quantitative Analysis of situational awareness (QUASA) questionnaire to final year pre-clinical dental students and clinical dental students of Faculty of Dental Medicine Universitas Airlangga. **Result**: Clinical students have higher situational awareness value than pre-clinical students with total score of 50,5% and 46,63% respectively. **Conclusion**: Situational awareness of clinical dental students are better than pre-clinical dental students.

Keywords : Covid-19 pandemic, dental students, Situation Awareness, room with negative pressure.

Short Curriculum Vitae

My name is Vankalayya Yastriza Dayusmara, undergraduate student from Faculty of Dental Medicine, Universitas Airlangga, Indonesia. I joined a faculty organization and continue to participate in an internship program regarding community development and dedication with the role of design division. I'm currently at the final year of pre-clinical stage and finishing my thesis regarding situational awareness under supervision of Dr. Andra and Dr. Muhammad Subhan Amir from Department of Oral and Maxillofacial Surgery.

Research and Development of Virtual Simulation in Pre-clinical Periodontal Training

Chang Shu, Jianxia Hou

Periodontitis, one of the most prevalent diseases, is regarded as the most common reasons for tooth loss. Clinical skills of periodontics like probing, scaling and root planing are of high technical sensitivity, which indicates that repetitive training is a must for medical students. Traditionally, phantom head with artificial or extracted teeth, and pig jaws are used for pre-clinical periodontal training. However, the availability, physical properties (such as stiffness and friction), cost, and ethics are some of the major problems of the existing training methods. Practicing on live patients is much more effective, while exposing the patients to high risk due to the insufficient training. In recent years, haptic-enhanced VR simulation is proposed as an alternative methodology to provide the sensorimotor training needed as part of the dental curriculum. Here, we developed a commercial VR system, Unidental®, which establishes a VR-based periodontal skill training circumstances by integrating mechanical and visual display. It reproduces the feeling and information of dental operation on real teeth and periodontal tissue and can help with the repetitive training of probing, scaling, root planing and basic periodontal surgeries. Thus, it is a good supplement to the traditional pre-clinical periodontal training. However, there is several problems for the large-scale application. How to evaluate the training effect of these simulators, whether these simulators truly promoted the skills remain unclear. More researches on this innovative training method are needed for further development of the VR training system, and the improvement of pre-clinical periodontal training.

Name: Chang Shu
Affiliation: Department of periodontology, Peking University School and Hospital of Stomatology, Peking University.
Research Interests: virtual reality technology on dental education, clinical research for periodontology and implant dentistry.
Profile: Chang Shu received his BDS education at West China hospital of Stomatology, Sichuan University in 2021. He is currently a candidate for MDS degree of periodontics in Peking University School and Hospital of Stomatology, Peking University. He is author of 3 referred publications in English.

武漢大學　武汉大学口腔医学院
WUHAN UNIVERSITY　SCHOOL OF STOMATOLOGY WUHAN UNIVERSITY

Research-type Clinical Medical Student Training Research

Presenting Author:Xin Ling
Professional Title :Postgraduate Student
Work Unit:School of stomatology, Wuhan University

Short CV: Xin Ling, a second-year graduate student in dentistry and endodontics, School of Stomatology, Wuhan University, is involved in a graduate and undergraduate teaching and research project.

Research interest:education;teaching.

Abstract:

The development of medicine is the result of problem-oriented research and transformation.It is produced and developed in the long-term struggle against disease, and it is also the result of research and transformation on clinical problems.Clinicians are the main and key role in discovering clinical problems, coagulation scientific problems, research and problem solving.Taking a clinical problem-oriented approach and building research-oriented disciplines is the need of medical development and the only way to improve the level of medical technology.

The clinician's approach to any patient is itself part of the research.Firstly, to be a research-type clinical medical student, we should gain rich clinical experience and try to cultivate our ability of thinking in scientific research,so that can we define our direction of research.It's vital to choose a appropriate research for oneself.How to define the research theme and understand the frontier direction of current research can be obtained from clinical practice with the thinking that is good at finding problems. In order to carry out the research smoothly, we also need corresponding training, such as the learning of statistics and the training of basic laboratory skills.In addition, the cultivation of research-oriented clinical medical students cannot be separated from the support of hospital platforms, and professional clinical research platforms and high-quality clinical research teams are of vital importance.

In a word, the training of research-oriented clinical medical students should be carried out in professional medical institutions with rich clinical resources and research strength, as well as standardized training qualifications.

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professional theory knowledge
                                   →   Identify clinical   →   identify the
basic laboratory skills                 problem                research direction
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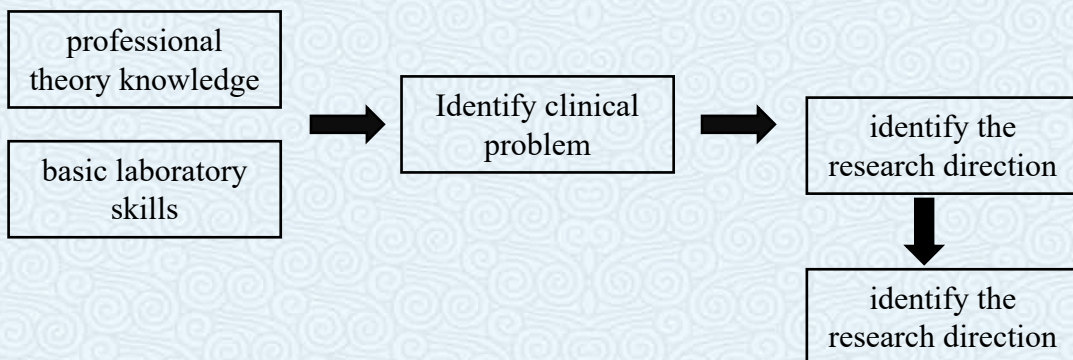
P4-12

Application of computer-aided technology in fiber post removal

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[Abstract]

In recent years, fiber posts have gradually replaced metal posts and have been widely used in clinical practice. Its elastic modulus, outstanding aesthetic performance, and good bonding characteristics ensure the firm integration with dentin. But it also increases the difficulty of removing the fiber post. Clinically, the tooth that needs to remove the fiber post often has been prepared, it is difficult to judge the direction of the root and the fiber post through the crown, increase the risk of root deflection and perforation during removal. At present, the removal systems for fiber posts mainly include two types: microscope-assisted ultrasonic removal and mechanical drill bit removal. With the gradual development of "Guided endodontics" in the field of dental endodontics, it has promoted the development of computer-aided technology in the field of endodontics，dynamic navigation system and digital-guide technology are also used to remove the fiber post in the clinical. Compared with the traditional fiber post removal systems, the computer-aided removal methods are accurate, efficient, and minimally invasive. This article aims to introduce the clinical application, advantages and disadvantages of various fiber post removal methods, and analyze the clinical feasibility and accuracy of computer-aided technology in fiber post removal, so as to provide clinicians with relevant references.

The prediction of temporomandibular disorders with deep learning

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4. Lakehead University-Thunder Bay Regional Health Research Institute (TBRHRI), Thunder Bay P7B 5E1, Canada

Background: Temporomandibular disorders (TMD) are one of the most common causes for orofacial pain and also have the potential to generate chronic pain. The etiology of TMD is still unclear, and its symptoms, signs and progression are extremely complex. TMD require early diagnosis and treatments, especially for combinations with other oral diseases. This study aims to develop an artificial neural network (ANN) model for predicting TMD based on clinical-collected data including clinical features, systematic medical condition, and psychosocial state.

Method: The popular data mining-based ANN was utilized to predict TMD with all 18 variables collected from patients as the input. The total dataset consists of 88 cases which are reviewed by Board-certificated orthodontists. 75% (66) cases are randomly selected as the training dataset, while the remaining 25% (22) cases are for test.

Results: Among the considered 88 cases, 58 (65.9%) were with TMD, while the left 30 (34.1%) without TMD. The number of male and female are 21 and 67, respectively, with an average age of 27.63 years. The calculation results illustrated the average sensitivity and specificity of the ANN-based TMD risk prediction through 10-fold-cross-validation analysis were 92.31% (95% confidence interval (CI), 62.09%-99.60%) and 88.89% (95% CI, 50.67%-99.42%), respectively. Moreover, the accuracy of ANN was 90.91% (95% CI, 78.90%-100.00%).

Conclusions: The results show the proposed ANN model could predict the TMD risks with a high accuracy rate, which indicate the potential of machine learning in oral and maxillofacial diseases screening and diagnosis. This study could provide dental care providers with a simple tool to find individuals' risk of TMD based on patient's psychological factors, oral examinations, and systemic medical conditions.

Wei ZOU   DDS., DMD., Ph.D.
Research Assistant Professor, Attending Doctor (Orthodontics)
College of stomatology Xi'an Jiaotong University, Department of Orthodontics
Research interest: Dental Materials, Orthodontics, Artificial Intelligence in Dentistry

Diagnosis and Management of Dens Evaginatus and Dens Invaginatus in a single tooth: A case report

Sukarawan W., Limsomwong P., Manosubsak N.

Dens evaginatus is a developmental anomaly represented by the protrusion of the cusp arising from the occlusal surface of posterior teeth or the lingual surface of anterior teeth. Meanwhile, dens invaginatus is another type of developmental malformation characterized by the infolding of enamel, dentin with or without pulp within the crown of the tooth. Many case reports of dens evaginatus and dens invaginatus have been published, however, the occurrence of both anomalies in a single tooth is considerably rare. This case report presents a 7 years 1 month old, Asian girl who came for the regular recall visit without any chief complaint. The oral examination and periapical radiography revealed the concomitant of dens evaginatus and dens invaginatus in the left permanent maxillary lateral incisor. The projecting tubercle caused malocclusion and traumatic contact with the left primary mandibular canine. In addition, the invagination of enamel, dentin, and pulp which extended from the fissure along the tubercle downward into the root canal was observed from the radiograph. The complications of both anomalies might result in pulp infection and endodontic treatment, then the prophylaxis treatment plan was emphasized in this case. Since the root was developing with an open apex, the treatment goal was to prevent pulpal exposure and maintain the root formation. Reduction of tubercle to prevent the traumatic occlusion followed by the composite resin restoration and sealant for caries prevention were performed. Long-term follow-up is necessary for monitoring the complete root formation and maintaining optimum oral health to prevent unnecessary endodontic treatment in this patient.

Associated Professor Dr. Waleerat Sukarawan

Education
2002: DDS (Honors), Chulalongkorn University, Thailand
2009: Ph.D. in Oral Biology, UNC Chapel Hill, USA
2014: Diplomate, Thai Board of Pediatric Dentistry
Work
2002– Present: Lecturer at Department of Pediatric Dentistry, Chulalongkorn University, Thailand
Research interest: Cariology, Dental stem cell biology

Effect of drinking water after fluoride varnish application on saliva fluoride level

Songsiripradubboon S., Jiraritthumrong K., Pakdeemeechai S., Ruangturakit V.

Objective:

To investigate the effect of water drinking after fluoride varnish application on the fluoride retention in the whole saliva.

Materials and methods:

This study used a randomized three-arm crossover design with 15 subjects. In each of the three arms, 0.5 mg of 5% sodium fluoride varnish was applied on all tooth surfaces. Subjects were randomly assigned into three conditions which are (1) drinking one glass of water after 5 minutes, (2) after 30 minutes, and (3) after 2 hours following fluoride varnish application. A minimum of two weeks was allowed for a washout period between each trial arm. Unstimulated whole saliva was collected at baseline, 0, 15, 30 minutes, 1, 2, and 4 hours after fluoride varnish application. Fluoride ion was measured by an ion-specific electrode. Fluoride concentrations at each time point and area under the curve were determined. Data were analyzed using a one-way analysis of variance (repeated measured) at a significant level of 0.05.

Results:

The fluoride levels of all groups demonstrated the same pattern, with the peak of fluoride levels occurring at the immediately after applying. The fluoride levels significantly decreased at 15 minutes after application and continuously declined for 4 hours. After 4 hours, there was no significant difference in fluoride concentrations in saliva among three groups ($p > 0.05$).

Conclusion:

Drinking water during 2 hours after fluoride varnish application does not affect salivary fluoride level at 4 hours after treatment.

Dr. Siriporn Songsiripradubboon
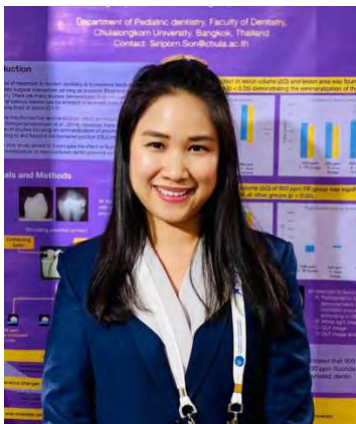
Education

2009: DDS (Honors) from Chulalongkorn University, Thailand

2014: Ph.D. in Dental Biomaterials From Chulalongkorn University, Thailand

2014: Diplomate, Thai Board of Pediatric Dentistry

Work

2014 – Present: Lecturer at Department of Pediatric Dentistry, Chulalongkorn University, Thailand

Research interest

Cariology: fluoride in de-and remineralization cycle

Pulp biology and pulp treatment

P5-4

The SEM-EDX analysis of artificial proximal enamel caries adjacent to an alkasite restorative material.

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The aim of this study was to evaluate the topography of artificial proximal enamel caries adjacent to an alkasite restorative material. The enamel specimens obtained from human premolar teeth (n=15) were randomly assigned to three groups (n=5): artificial caries group, alkasite group (CentionN®), and control group (composite resin; Filtek^{TM} Z350). Artificial enamel caries was formed in the enamel specimen. Only specimens in alkasite and control group were put in contact with proximal restorative materials, then subjected to pH-cycling for 7 days. All specimens were collected for surface evaluation using a scanning electron microscope (SEM). The fluoride content was analyzed using energy dispersive x-ray spectroscopy (EDX). The Student's t-test was used to compare the difference in the percentage of fluoride content between groups ($p<0.05$). The SEM images of alkasite group indicated greater mineral deposition than the control group. The mean fluoride content of the alkasite group increased significantly compared to the control ($p<0.05$). An alkasite restorative material significantly increased fluoride deposition on adjacent artificial enamel interproximal caries compared with a resin composite.

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- DDS, Higher Graduate Diploma (Pediatric Dentistry), Chulalongkorn University, Bangkok, Thailand

- Ph.D. (Developmental Oral Health Sciences), Tokyo Medical and Dental University, Tokyo, Japan

Research interest: Caries prevention, Restorative materials in pediatric dentistry

pH-responsive Antibacterial Monomers for the Inhibition of Dental Caries

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2.Department of Pediatric Dentistry, West China Hospital of Stomatology, Sichuan University, Chengdu, China
3.Department of Operative Dentistry and Endodontics, West China Hospital of Stomatology, Sichuan University, Chengdu, China

Introduction: Anti-bacterial materials for the inhibition of dental caries have been researched for years. Yet, in recent years, more researchers have been focusing on materials that could help regulate oral micro-ecology instead of killing all the bacteria. pH-responsive intelligent materials that could only show antibacterial effect in acidic environment have shown great potential. Our group recently designed a novel kind of pH-responsive tertiary amine monomer originally, dodecylmethylaminoethyl methacrylate (DMAEM), which could be protonated in acidic environment while deprotonated in the neutral one. Here, we investigated the impact of the monomers on oral biofilms and their anti-caries potential. **Methods and Results:** 6.25mg/mL and 12.5mg/mL DMAEM was used to treat *Streptococcus mutans* biofilms for 10min at different pH values. The results showed with the pH drop below pH7 the anti-biofilm effect of DMAEM increased significantly, which verified the pH-antibacterial effect. Then, DMAEM monomers were used to treat the biofilms with a repeated and short-time application mode like daily oral care for 48h (10min/12h). The test on the biofilms showed that DMAEM with this application mode could inhibit the biofilm viability and acid production. Saliva-derived biofilms were treated in the same way and the microbial diversity was tested by 16S rDNA test. The results demonstrated that after treatment the viability of the biofilms was decrease while the diversity was increased, which revealed DMAEM had the potential to regulate the oral diversity to a healthier one. A rat dental caries model was also conducted and DMAEM monomers showed could good biocompatibility and significantly reduce the dental caries occurrence in rats. **Conclusion:** DMAEM monomers had pH-responsive anti-biofilm effect. With a repeated and short-time application mode, DMAEM showed significant anti-bacterial and anti-caries effect. It also demonstrated great potential to keep oral micro-eubiosis.

Key words: pH-responsive, anti-bacterial, anti-caries, oral microecology, oral biofilm

Curriculum Vitae:

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Department of Pediatric Dentistry, West China Hospital of Stomatology, Sichuan University. Email: liangjingoudentist@163.com
Representative publications:

1) Liang J, Liu F, Zou J, et al. *Journal of Dental Research*, 2020, 99(12): 1368-1376.
2) Liang J, Li M, Ren B, et al. *Dental Materials*, 2018, 34(3): 400-411.
3) Liang J, Yang B, Zhou X, et al. *Drug Delivery*, 2021, 28(1): 272-284.

Research interest: Dental Caries, pH-responsive materials, oral biofilms, oral microbiome

P5-6

The mechanical and microstructural properties of self-glazed zirconia

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[2]Department of Prosthetic Dentistry/Dental Materials Science, Institute of Odontology, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden.

Monolithic zirconia crowns are widely used in prosthodontic treatment. Recently, self-glazed zirconia (SGZ), which is manufactured by additive 3D gel deposition approach, has been developed. However, there is little scientific information on SGZ. The aim of the present study was to analyze the mechanical and microstructural properties of SGZ.

The disc shaped specimens of SGZ (Hangzhou Erran Technology, Hangzhou, China) were prepared via precision additive 3D gel deposition followed by final sintering (thickness: 1.3 mm, diameter: 15.6 mm). Conventional dental zirconia stabilized with 3 mol% yttria (Lava Plus Zirconia, 3M, St. Paul, MN, USA) was used as a control. Chemical composition of specimens was analyzed by wavelength dispersive X-ray fluorescence (XRF). Biaxial flexural strength test was performed. The microstructure was observed by scanning electron microscopy (SEM), and the grain size was determined. Crystallin structure was analyzed using X-ray diffraction (XRD) analysis followed by Rietveld refinement.

XRF analysis revealed that SGZ contained yttria at a concentration of 3.209 mol%. The mean flexural strength was 508 MPa, which was lower than the conventional zirconia (893 MPa). SEM showed that SGZ contained extremely large grains (45.94 µm) with gaps filled with small grains (0.392 µm). The size of small grains was slightly larger than that of the conventional zirconia (0.307 µm). According to Rietveld analysis, the conventional zirconia was composed of 79% tetragonal phase and 21% pseudocubic phase. In contrast, Rietveld refinement could not be performed for SGZ due to the presence of the large grains, which resulted in insufficient numbers of grains. However, as both materials had the diffraction peaks at the same 2θ angles, it is reasonable to assume that SGZ was also mainly constituted of tetragonal phase.

In conclusion, the different fabrication processes (i.e. 3D deposition vs conventional milling) considerably influences both mechanical and microstructural properties of 3 mol% yttria-stabilized zirconia. Further studies are necessary before clinical application.

Shunichi Shishido
DDS, PhD
2008.4-2014.3 University student at Tohoku University
2014.4-2015.3 Resident at Tohoku University Hospital
2015.4-2019.3 Postgraduate student at Tohoku University
2019.4-   Assistant professor at Tohoku University

Research interest: zirconia dental ceramics, prosthodontics

Development of orthodontic wires for metal allergy patient using titanium nitride (TiN) plating.

Authors: Arata Ito, Hideki Kitaura, Haruki Sugisawa, Takahiro Noguchi, Fumitoshi Ohori and Itaru Mizoguchi

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Abstract:

Most of the orthodontic materials contain metal such as nickel (Ni) and cobalt (Co), which may release metal ions into the oral cavity, is a problem for the patients with metal allergies. Non-metal orthodontic appliances such as plastic and ceramic brackets and elastomeric materials, have been clinically used and effective for the treatment of allergic patients. Concerning arch wire, only β-Ti wire which contains no Ni are available. This material restrictions disturb establishment of proper force system in orthodontic treatment. To overcome this problem, it is necessary to modify the surfaces of orthodontic wires to prevent the release of metal ions into the oral environment. It has been reported that the release of metal ions from orthodontic wires was caused by lactic acid produced by caries-inducing bacteria and gastric acid, mainly hydrochloric acid, due to gastroesophageal reflux disease. The purpose of this study was to examine effect of plating of orthodontic wire with TiN on metal ion release from the wire in acid immersion and mechanical properties of the wire. To investigate the acid corrosion resistance of the wire, the amount of metal ions eluted from the wire immersed in acid was measured by using inductively coupled plasma mass spectrometry (ICP-MS), the properties of the wire surface were examined by scanning electron microscopy. TiN plating of orthodontic wires can inhibit acid-mediated corrosion, and reduce the elution of Ni ions from the wire surface. To investigate the mechanical properties of the TiN coated wire, the tensile strength and stiffness of SS wire were increased, although the orthodontic force of NiTi wire were slightly reduced, the super-elastic properties were not lost, and TiN coating reduced the friction force against the brackets. These results suggest that TiN plating for orthodontic wires may be useful for the orthodontic treatment of patients with metal allergies.

Research interest

TiN ion plating, Metal allergy, Orthodontic wire

Short -CV

2012.3, D.D.S., Tohoku University School of Dentistry

2012.4- Dental resident, Tohoku University Hospital

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P5-8   Visualization and analysis of droplet dynamics at dental treatment situation

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5 Biological Flow Studies Laboratory, Department of Finemechanics, Graduate School of Engineering, Tohoku University, Sendai, Japan.

Objectives
Aerosols and droplets generated during dental treatment have been implicated in the person-to-person transmission of viruses, and there is current interest in understanding the mechanisms responsible for the spread of Covid-19 by these means. There are few reports about the dynamics of droplets at each dental treatment and equipment to indicate the appropriate protection for dentists and dental assistants.

Methods
We evaluate the dynamics of droplets caused by using dental equipment (air turbine, ultrasonic device, and implant motor) to track the particle flow in the measurement range rendered visible in a 2D cross-section with a laser beam source, and the image was captured with a high-speed camera and analyzed with a software. The quantitative analysis was also performed with water sensitive recording papers and measurement of total mass pf droplets and droplets size around patient.

Results
Our data showed that implant motor was minimum generated device compared with air turbine and ultrasonic bone cutting device. And incisor area was higher risk for aerosol generation compared with molar region.

Conclusions
Our results suggest that implant surgery seems to be safer than general dentistry, such as using an air turbine. Moreover, in case of harvesting autologous bone for implant surgery, we consider that to prevent the spread of droplets by harvesting bone from the mandibular branch instead of the chin bone. Therefore, attention should be paid to minimize their use and select an appropriate device, especially during a pandemic by an airborne spreading agent.

CV
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Research interest
Dental implant surgery, Aerosol dynamics, Glucose metabolism of oral cancer cells.

P5-9

Effect of computer-assisted design and manufacturing cutting and drilling guides accompanied with pre-bent titanium plates on the correction of skeletal class II malocclusion: a randomized controlled trial

Liu Shibo，Luo En

Abstract

This study was performed to assess the effect of correcting skeletal class II malocclusion based on the application of computer-assisted design and manufacturing (CAD/CAM) cutting and drilling guides accompanied with pre-bent titanium plates. Fifty patients with skeletal class II malocclusion were recruited into this prospective randomized controlled clinical trial and assigned to two groups. Patients underwent bilateral sagittal split ramus osteotomy directed by CAD/CAM cutting and drilling guides accompanied with pre-bent titanium plates (group A) or CAD/CAM splints (group B). Postoperative assessments were performed. Differences between the virtually simulated and postoperative models were measured. Patients in both groups had a satisfactory occlusion and appearance. More accurate repositioning of the proximal segment was found in group A than in group B when comparing linear and angular differences to reference planes; however, no significant difference was revealed for the distal segment. In conclusion, CAD/CAM cutting and drilling guides with pre-bent titanium plates can provide considerable surgical accuracy for the positional control of the proximal segments in bilateral sagittal split ramus osteotomy for the correction of skeletal class II deformities.

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Research interest: Application of computer-assisted design and manufacturing guides in orthognathic surgery

P5-10

Unilateral Occlusal Reduction Induces Decreasing Articular Cartilage Thickness of Temporomandibular Joint (TMJ)

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Abstract

Background: Unilateral occlusal reduction causes premature contact of the teeth. As a result premature of contact can change the functional movement of the jaw, so that the occlusion becomes unbalanced, this will result in increased mechanical overloading on the temporomandibular joint. Mechanical overloading on TMJ could be induces articular cartilage damage of the TMJ. *Objective:* Determine the effect of unilateral occlusal reduction on articular cartilage thickness of TMJ.

Methods: Twenty Wistar rats (Rattus norvegicus) were divided into a control group and treatment groups. The treatment group showed by occlusal reduction of the right molar in mandible and maxillary, while the control group presented no occlusal reductions. Moreover, the treatment groups were decapitated based on the 7, 14, and 21 days of observation periods. Data were analyzed by Independent sample T test.

Results: Histological examinations showed that the condition of the temporomandibular joints on the left and right sides in the control group showed a good and thick shape of the articular disc and the treatment group showed a thin and severed articular disc layer. This study showed a significant difference in the thickness of the TMJ articular cartilage between the control and treatment groups ($p<0.05$).

Conclusion: Unilateral occlusal reduction could be decreasing the articular cartilage thickness in TMJ. The articular cartilage thickness on the right side was thicker than the left side shown in the treatment groups on day 14 and day 21.

Keywords: Unilateral occlusal reduction, Temporomanidbular Joint (TMJ), Articular Cartilage Thickness

Study of Programmed Co-axial Electrospun Injectable Nanofibers for Sequential Anti-tumor Treatment

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Maintaining the effective range, time, dose of the local chemotherapy drugs, and achieving minimally invasive and sequential therapy, are the focus of current research for drug delivery systems. In this study, an injectable nanofiber with a core-shell structure, constructed by coaxial electrospinning technology and ultrasonic oscillation technology, has different sequential releasing effects of hydroxycamptothecin (HCPT)and doxorubicin (DOX) for the local treatment of human lung cancer and salivary adenoid cystic carcinoma. Two kinds of programmed co-axial electrospun injectable nanofiber with a length of 10μm, a diameter of 552nm±44.5nm, and core-shell structure, were obtained as SF-HCPT/DOX (short fragment, core-DOX，shell-HCPT) and SF-DOX/HCPT (short fragment, core-HCPT，shell-DOX), of which the drug in shell layer would be released quickly in the first five days and the drug in core layer would be released stably. The different programmed co-axial electrospun injectable nanofibers had different therapeutic effects for different tumors. In vitro, the obviously inhibitory effect of human adenoid cystic cancer cells appeared in 2μg/ml SF-DOX/HCPT, with smaller half inhibitory concentration. In vivo, similar therapeutic effect of SF-DOX/HCPT was observed on human adenoid cystic carcinoma. On contrary, the better efficacy of human lung cancer cells appeared in SF-HCPT/DOX.

Utilizing co-axial electrospinning and ultrasonic oscillation methods, the programmed co-axial electrospun injectable nanofibers, micro/nano structured, were obtained with different sequentially releasing effects. The different sequentially releasing injectable nanofibers, carried chemotherapeutic drugs – HCPT and DOX, had different tumor inhibitory effects, suggesting that the injectable fibers obtained in this study can be used as an injectable drug delivery system for local sequence therapy of malignant tumors.

CV

Yao Liu, assistant researcher, lecturer, attending physician, visiting scholar of Tufts University School of Dentistry, Young Committee of the Oral and Maxillofacial Surgery Professional Committee and Committee of the Orthognathic and Temporomandibular Joint Surgery of the Sichuan Province Association of Stomatology, good at bone regeneration, digital surgery and other technologies; published more than 10 SCI papers as the first or other author, participated in the compilation of 1 monograph, presided over the National Natural Science Foundation of China and other scientific research projects.

The Translation from In Vitro Bioactive Ion Concentration Screening to In Vivo Application for Preventing Peri-implantitis

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Peri-implantitis is a typical pathological condition characterized by the destructive inflammation in the soft tissue and the progressive loss of supporting bones. The use of biomaterials as carriers of bioactive ion coatings is a promising approach. However, determining the effective dosage of each ion to achieve an in vivo application of the in vitro screening is challenging. Here, we selected zinc and strontium ions to provide multiple effects on antibacterial activity and osteogenesis. The optimal coating with effective release concen-trations of the two ions was obtained after the two-step screening from in vitro testing. This type of in vivo bioactive ion usage leads to an enhanced osseointegration during the immediate implantation in a periodontitis-affected environment and prevents soft tissue inflammation and bone resorption in an inflammatory environment. The new biologically active ion screening method verify the effectiveness of this clinical translation and its potential for large-scale production and could determine the effective dosage of each ion for a specific application.

Minimally Invasive, Precise and Stable Technology of Digital Titanium Mesh-Assisted Bone Augmentation

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An adequate volume of bone all around the implant is critical to obtaining the long-term success of implant therapy. Considered as one of the most successful methods applied for bone defect reconstruction, Guided Bone Regeneration (GBR) finds its wide application for augmenting bone volume around the implants reconstructed. Resorbable membranes are the most used membranes in GBR but due to their spatial instability, desired therapeutic effects cannot be achieved in most cases. In cases of non-resorbable membranes, typically titanium mesh, although they can maintain space stability, the incidence of complication attributable to their relatively stiff texture is high. Considering all those drawbacks and based on evidence-based medicine, bone augmentation has been conducted digitally in the bone defect site in accordance with the desired bone contour and digital titanium mesh has been completed with the 3D- printed jaw model. The prefabricated digital titanium mesh has significantly shortened the operation time and lessened the patient's pain. What's more, it can also prevent the generation of ineffective bone augmentation, and greatly reduce the exposure rate of titanium mesh (exposure rate: 9.52%). As for precision, digital titanium mesh-assisted bone augmentation achieves a precision of up to 95.82%. Besides, after one year of loading, the labial plate of the implant remained 2.12±1.04 mm, which is comparable to the initial design of digital titanium mesh-assisted bone augmentation. The stable osteogenesis space provided by the digital titanium mesh is also one of the strengths of this technology. At 6-8 months after surgery, the volume absorption percentage of bone grafts in the group of absorbable membranes reached 37.57% while in the group of digital titanium mesh group, the percentage stood only at 23.40%. In conclusion, the technology of digital titanium mesh-assisted bone augmentation is minimally invasive, precise as well as stable. Going forward, such a technology may allow future bone augmentation to advance in the direction of precision and controllability.

Short-CV:

Songhang Li obtained master of medicine in implant dentistry from West China School of Stomatology Sichuan University in 2020. He is currently pursuing doctor of medicine under the supervision of Prof. Xiaoxiao Cai. His research interests include digital bone augmentation and application of nanomedicine in the field of bone regeneration. His achievements related to digital bone augmentation triggered a heated discussion in an editorial of *Clinical Implant Dentistry and Related Research*.

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Hertwig's Epithelial Root Sheath Cells Combined with Dental Follicle Cells Induce Periodontal Tissue Regeneration

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FEI BI, graduate student enrolled in Prof. Guo's research team, has been studying the mechanism and application of osteogenic/odontogenic ability of Hertwig's epithelial root sheath(HERS) cells and early orthodontics in pediatric dentistry. E-mail: 1484222469@qq.com

Prof. WEIHUA GUO, has been leading the way of his research group in the fields of illustrating the mechanism of dental development, understanding and applying the odontogenic stem cells to all kinds of clinical diseases which might be targeted and cured by /with them, constructing the treated dentin matrix(TDM)-based bio-root and conducting its application trials in big animal experiments , and the prevention and treatment exploration of children and adolescents'malocclusion. E-mail：guoweihua943019@163.com
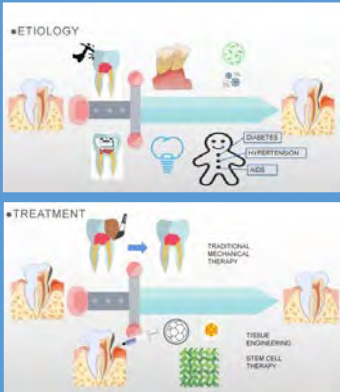
Pathological factors such as occlusal harshness, dental calculus with bacteria and systemic diseases might render normal periodontal tissue unhealthy, showing red and swollen gingiva, periodontal pocket, alveolar bone loss and even outer absorption of tooth root. Hertwig's epithelial root sheath (HERS) cells, from the perspective of natural tooth root and periodontal development, are able to induce dental follicle cells (DFCs) to differentiate into cementoblast, osteoblast and fibroblast to form cement, alveolar bone and parodontium. Meanwhile, the very cells are capable of rendering themselves differentiating into cementoblast via epithelial-mesenchymal transition and conduct cement forming and ossification process.

The immunofluorescence was performed to identify the epithelial cells and mesenchymal cells. Alizarin red assay, real time qPCR and Western blot were conducted to confirm the enhanced osteogenic potential of harvested HERS cells combined in vitro. The animal model of periodontal tissue defect was constructed and the outcomes displayed extraordinary regenerative effectiveness by applying HERS cells combined with DFCs in situ, testified by Micro-CT analysis and histological staining.
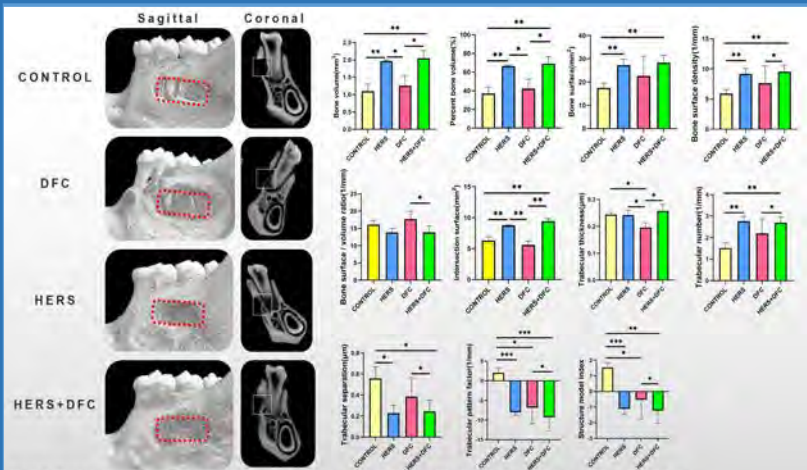
Figure3. Construction of 8-week-old SD rat mandibular buccal periodontal tissue defect and transplantation and Micro-CT analysis

Figure1. (A) Acquisition of Hertwig's epithelial root sheath(HERS) cells and Dental follicle cells(DFCs). (B). Identification of acquired cells.

Figure3. A.Mineralization induction and quantification analysis; B.Western blot of osteogenic related proteins after 3d culture of cells; C.real-time qPCR of osteogenic related gene expression after 3d culture of cells
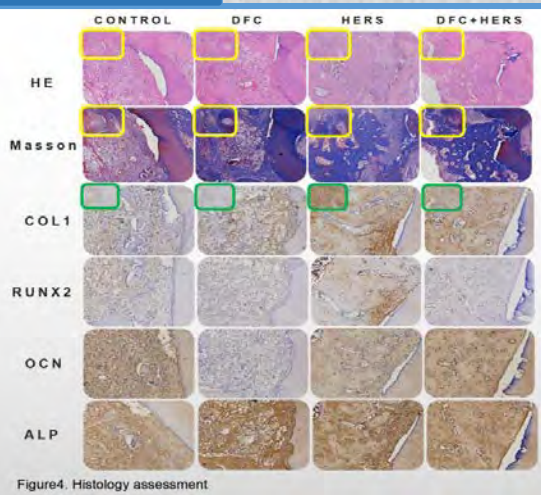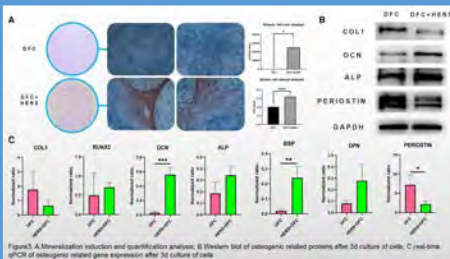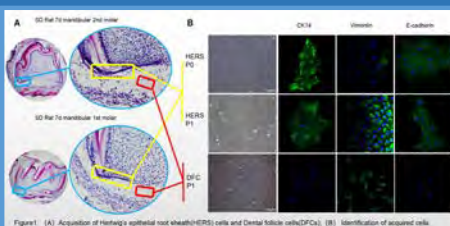
Figure4. Histology assessment

To draw a conclusion, HERS cells combined with DFCs in the exploration of tissue regeneration mimicking the physiological developmental process of cement, bone and periodontium formation suggests their enormous potential to treating the severe periodontal damage in clinical practices.

Deformation assessment of the manually pre-bent titanium miniplates

in orthognathic surgery with finite element analysis

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Abstract: This study summarized the literature regarding the application of pre-bent titanium miniplates in orthognathic surgery and evaluated the extra deformation of the manually pre-bent titanium miniplates via finite element analysis for acquiring higher surgical accuracy. The literature was reviewed with a chart. Three models of titanium miniplates with different thicknesses (1.0 mm, 0.8 mm, 0.6 mm) were created using COMSOL Multiphysics software for biomechanical behavior analysis. The 3 models were virtually bent into 5 angles (15 degree, 30 degree, 45 degree, 60 degree, 80 degree). respectively to simulate the preoperative virtual bending, then to simulate the practical manual bending via finite element analysis. The stresses and displacements of these models were recorded. The models from virtual bending simulation and manual bending simulation were registered to analyze the deviations. The results showed that the maximum stress and the displacement deviations between the virtual bending models and the manual bending models increased with the thickness and bending angle of the pre-bent miniplate models. To improve the surgical accuracy, measures should be applied to the manually pre-bent titanium miniplates to reduce the extra deformation when the plate being thicker and the bending angle being larger.
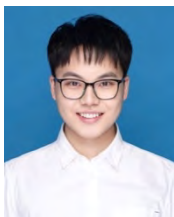
Li-nan Liu received his bachelor's degree from the medical college, Dalian University in 2019. He is currently studying for a Master's degree in the West China School of Stomatology, Sichuan University. His research mainly focuses on bone metabolism and the treatment of dentomaxillofacial deformities.

Lin28 contributes to odontogenic differentiation of dental papilla cells during tooth development

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Dentin formation is achieved by odontoblasts, a special type of terminally differentiated cells lying on the outer wall of dental pulps. They originate from dental papilla cells at the late bell stage of tooth development. The cell fate determination of dental papilla cells is responsible for giving rise to odontoblasts, which is a key process during dentin formation.

Lin28 is a conserved RNA binding protein in eukaryotic cells. It has been unveiled that Lin28 manifested a strong role in organ development and cell differentiation. However, few studies have probed into its expression during tooth development.

By immunohistochemical staining, we have found that Lin28 showed specific expression pattern during mouse first molar development. Lin28 showed continuous high expression in the epithelium from E12.5 to P3. Lin28 was absent in the dental papilla and meanwhile boosted in the odontoblasts from E17.5 and on. Lin28b, the paralog of Lin28, was not detected during tooth development. Lin28 expression level did not change during *in vitro* odontogenic differentiation of dental papilla cells. But overexpression of Lin28 promoted odontogenic differentiation of dental papilla cells *in vitro*.

The results revealed Lin28's potential role in promoting dental papilla cells' cell fate determination towards odontoblasts.

CV:

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Research Interest: Epigenetic regulation in tooth development and tooth eruption.

Intermittent compressive force regulates cell proliferation and osteogenic differentiation of mouse induced pluripotent stem cells

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Mechanical force significantly contributes in the control of cell homeostasis, repair and regeneration. Induced pluripotent stem cells (iPSCs) have been proposed as an excellent cell source for regenerative medicine. However, the effect of force on iPSCs especially in osteogenic differentiation remains unidentified. This study aimed to investigate how intermittent compressive force (ICF) affect osteogenic differentiation of mouse iPSCs. Retinoic acid (RA)-treated iPSCs were subjected to ICF in serum-free culture medium for 24 hours. Expression of mRNA was investigated by real-time polymerase chain reaction (RT-PCR) and RNA sequencing analysis. *In vitro* mineralization was determined using alizarin red S staining. Gene expression profiles by RNA sequencing demonstrated that ICF regulated genes involved in various pathways, including cell cycle, p53 and osteogenic differentiation. Flow cytometry revealed that ICF induced cell cycle and proliferation, while decreased the number of apoptotic cells. *In vitro* mineralization was increased in ICF pretreated iPSCs. Moreover, ICF significantly enhanced expression of transforming growth factor β1 (Tgfb1) at both mRNA and protein levels, and pretreatment with a TGF-β inhibitor (SB431542) prior to ICF inhibited the upregulation of *Ccnd1, Cdk6* and Runx2 expression. In conclusion, ICF promoted proliferation and osteogenic differentiation while decreased apoptosis in iPSCs probably occurred via TGF-β signaling. This knowledge would be beneficial in manipulate iPSCs for regenerative medicine.

CV

Name: Miss Jeeranan Manokawinchoke

Education: 2006 Bachelor of Science in Microbiology,
                 Chulalongkorn University
          2014 Master of Science in Oral Biology,
                 Chulalongkorn University
          2018- Ph.D. candidate
                 Division of Molecular and Regenerative Prosthodontics,
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Research interest
Dental stem cells for regenerative medicine

Effect of implant placement depth on bone remodeling on implant-supported single zirconia abutment crown: A 3D finite element study

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Abstract

State of problem: Subcrestal implant placement has been introduced to maintain peri-implant bone level. However, there is still lack of information in exploring biomechanical effects of implant placement depth on bone remodeling.

Purpose: This study aims to evaluate the influence of subcrestal implant placement depth on bone remodeling using time-dependent finite element analysis (FEA) with a bone remodeling algorithm over 12 months.

Methods: Seven models of different subcrestal implant placement depth (0 mm, 0.5 mm, 1 mm, 1.5 mm, 2 mm, 2.5 mm, 3 mm) were analyzed using FEA to evaluate the biomechanical responses in bone and implant, including von Mises equivalent stress, strain energy density (SED), and overloading elements. The SED was used to be a mechanical stimulus for simulating cortical and cancellous bone remodeling over the first 12 months after final prosthesis delivery.

Result: Highest increase in cortical bone density was observed in Model 1.5 mm, whereas the lowest was presented in Model 3 mm. In contrast, in the cancellous bone, Model 3 mm had the highest increase in bone density, while Model 0 mm had the lowest. It was also found that the highest peak von Mises stress in cortical bone occurred in Model 2.5 mm (107.24 MPa), while that in cancellous bone was in Models 2.5 mm (34.55 MPa) . Interestingly, the maximum von Mises stress values in cancellous bone exceed the natural limit of the bony material, indicating that the overloading elements was observed in Model 2 mm, 2.5 mm and 3 mm.

Conclusion: The deeper the implant placement, the greater the bone density apposition. It is noted that the depth of the implant more than 1.5 mm exhibited the higher maximum von Mises stress and greater overloading elements.

Clinical Implications: Dental implant placements should not exceed 2 mm apically. Subcrestal 1.5 mm implant placement is recommended as it clearly demonstrates rapid increase in cortical and cancellous bone density.

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Education and Qualifications
2013 DDS. Khon Kaen University, Thailand. 2017 MSc in Prosthodontics Khon Kaen University, Thailand. Currently CMU Presidential Schoolarship PhD. Student, Oral Science Chiangmai University, Thailand
Research Interests and Activities
Prosthodontics, Digital Dentistry, Dental photography, Dental Implantology, Optimization, Finite element analysis, Biomechanics, Computer Aided Design (CAD)

Research interest : **Prosthodontics**

SURGICAL OBTURATOR PROSTHESIS FOR POST-HEMIMAXILLECTOMY PATIENT (A CASE REPORT)

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ABSTRACT

Background: One of the most frequent treatment for oral cancer is removal of the affected area with surgery, which can cause defect and cause difficulties in speech, swallow, and mastication. Surgical obturator inserted immediately after surgical can support soft tissue healing, minimize contractions of the wound, and promote rehabilitation of oral functions. **Objective:** This case report describe prosthodontic treatment of post hemimaxillectomy patient with surgical obturator. **Case report:** A 44 years old male patient was referred to Prosthodontic Specialist clinic by head and neck surgery department for a obturator before hemimaxillectomy surgery. The patient was diagnosed with oral squamous cell carcinoma of the hard palate. **Management:** Pre-operative impression was taken before surgery, and then the cast was sent to the surgeon to delineate area of resection. After that, the surgical obturator outline was made accordingly. After drawing the outline, the cast were reduced to obtain space as the defect will be after the surgery. Continue with the clasp fabrication, teeth arrangement, and packing the acrylic, then the process were finished after polishing the surgical obturator. The surgical obturator were inserted immediately after hemimaxillectomy. Continue with control post insertion to maintain patient's oral health. **Conclusion:** Proper diagnosis and proper treatment planning will result in good rehabilitation of patient after the surgery and improve the patient's quality of life. Surgical obturator also improve tissue healing progress, and minimize facial disfigurement. Surgical obturator can improve the rehabilitation process such as speaking, swallowing, and chewing food. Surgical obturator may have good physicological impact on patient after resection to restore the aesthetic appeerence.

Keywords : Hemimaxillectomy, surgical obturator, oral cancer

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MgO/TCPP-Loaded PLGA Photodynamic Microspheres Enhance Fibroblast Activity to Treat Periodontitis

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Abstract

Periodontitis is a chronic immuno-inflammatory disease initiated and sustained by oral pathogenic bacteria, aggravated by host immune response, which results in loss of soft and hard tissue supporting the teeth. Scaling and root planning (SRP) combined with antibacterial, anti-inflammatory and tissue-regeneration-promoting drugs become a promising method to treat periodontitis. In the present work, poly (lactic-co-glycolic acid) (PLGA) microspheres were employed to load photosensitizer Tetrakis (4-carboxy-phenyl) porphyrin (TCPP) and magnesium oxide (MgO) nanoparticles, named as PMT. The established PMT is expected to exert antibacterial photodynamic therapy (aPDT) effect and promote tissue-regeneration for the treatment of periodontitis. Our results showed that under near infrared light irradiation, PMT produced reactive oxygen species due to the activated TCPP, killed periodontal pathogenic bacteria including *F. nucleatum* and *P. gingivalis*. In addition, controlled released of magnesium ions could facilitate proliferation and migration of fibroblasts. Moreover, animal experiment was performed to verify the *in vivo* effect of PMT. H&E staining revealed decreased inflammatory cells and increased bone regeneration in PMT group. Our study provides a promising strategy to fight periodontal diseases using a novel antibacterial and tissue-regeneration-promoting drug.

Profile:

Name: Wanmeng Wang   Date of Birth: 1997.01

Nationality: P.R.China   Major: Prosthodontics

Emali: wangwanmeng@tmu.edu.cn

Education Background:

　　Master: Tianjin Medical University (2019.09-Now)

　　Bachelor: Weifang Medical University (2014.09-2019.06)

Research Publication:

1. **Wanmeng Wang**, Ying Li*, Research progress of 3D printed porous implants materials to promote osseointegration, Chinese Journal of Geriatric Dentistry, 2021, 19(5): 306-311.

2. Aobo Ma# , Yapeng You#, Bo Chen, **Wanmeng Wang**, Jialin Liu, Hui Qi, Yunkai Liang, Ying Li*, Changyi Li*. Icariin/Aspirin Composite Coating on TiO_2 Nanotubes Surface Induce Immunomodulatory Effect of Macrophage and Improve Osteoblast Activity. Coatings, 2020, 10, 427.

3. Tian Yujuan, Li Ying*, Liu Jialin, Lin Yi, Jiao Jian, Chen Bo, **Wang Wanmeng**, Wu Shuilin*, Li Changyi*, Photothermal therapy with regulated Nrf2/NF-κB signaling pathway for treating bacteria-induced periodontitis, Bioactive Materials; 2022, 9, 428-445.

4. Chinese invention patent：Dental tray for impression-taking and the method of application ZL. 202111031240.4.

Research Interest: nanoparticles and photodynamic drug for treating oral disease including periodontitis.

International Oral Health Seminar

Organoids in Clinical Dental Research
Keynote speaker: Yiming Chen

Abstract: Organoids refer to stem cell-derived in vitro models which are capable of resembling the morphology and basic tissue level physiological functions of specific organs. The advantage of organoid models are featured by both the convenience of two-dimensional cell lines and the comprehensiveness of experimental animal models. The capability to prod somatic cells into organoid models makes for a promising approach to study human biology. As a consequence, the organoid model was entitled as *method of the year* in 2017 by Nature Publishing Group.

Nature Method of the Year 2017
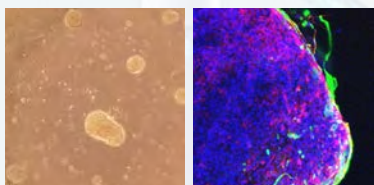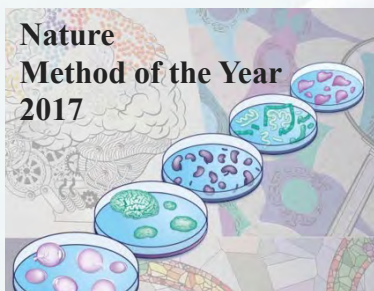
With regards to studies in stomatology, organoid models of lingual papilla and squamous-cell carcinoma have previously been established. The former serves as an ideal platform for durg sensitivity tests, while the latter provides a potential platform for personalized therapy. I primarily focus on the application of organoid models in drug toxicity tests. Currently, I am attempting to modify the protocols of model construction. Afterwards, I will mainly concentrate on developing an ideal platform which provides standardized toxicity detection for drugs.

As an emerging method, organoid models possess a promising future in the field of stomatology. Therefore, it is legitimate to attach greater significance to organoids in teaching and scientific research.

Resumé
First Name: Yiming
Family Name: Chen
Gender: Male
Age: 26
School: Peking University School of Stomatology
Grade: second year graduate
Awards and Scholarships:
National Scholarship (2016, 2017, 2021)
Special Grade Scholarship (2018)
First Grade Scholarship (2019)
Future Medical Star Scholarship (2019)
Outstanding College Graduate Reward of Beijing (2020)
Outstanding College Graduate Reward of Peking Univsersity (2020)
Visitor Programs:
Asahi University and Meikai University, JST Sakura Science Program (2019)
School of Dentistry, Chung Shan Medical University (2019)
Prince Philip School of Dentistry, HongKong Univeristy (2018)
Research Interest:
My research project primarily focuses on oral stem cells and the application of organoids in clinical study. On top of that, I am also interested in high throughput detection means such as single cell RNA sequencing. The combination of these two emerging methods may shed light on the study of complicated biological processes.

NAP1L2 Drives Mesenchymal Stem Cell Senescence and Suppresses Osteogenic Differentiation

Meilin Hu[1], Liangyu Xing[1], Li Zhang[1], Fan Liu[1], Sheng Wang[2], Ying Xie[2], Jingjing Wang[2], Hongmei Jiang[2], Jing Guo[2], Xin Li[2], Jingya Wang[2], Lei Sui[1], Changyi Li[1*], Dayong Liu[1*], Zhiqiang Liu[2*]

*: Corresponding Author

Abstract

Senescence of bone marrow mesenchymal stem cells (BMSCs) impairs stemness and osteogenic differentiation; however, the key regulators for senescence and the related osteogenesis are not defined. Herein, we screened the gene expression profiles of human BMSCs from young and old donors and identified that elevation of the nucleosome assembly protein 1-like 2 (NAP1L2) expression was correlated with BMSC senescence and impaired osteogenesis. Elevated NAP1L2 expression was observed in replicative cell senescence and induced cell senescence *in vitro*, and in age-related senescent human and mouse BMSCs *in vivo*, concomitant with significantly augmented chromatin accessibility detected by ATAC-seq. Loss and gain functions of NAP1L2 affected the activation of NF-κB pathway, the status of histone 3 lysine 14 acetylation (H3K14ac) , and chromatin accessibility on osteogenic genes in BMSCs. Mechanistic studies revealed that NAP1L2, a histone chaperone, recruited SIRT1 to deacetylate H3K14ac on promoters of osteogenic genes such as *Runx2, Sp7*, and *Bglap* and suppressed the osteogenic differentiation of BMSCs. Importantly, molecular docking analysis showed a possible bond between NAP1L2 and an anti-aging reagent, the nicotinamide mononucleotide (NMN), and indeed, administration of NMN alleviated senescent phenotypes of BMSCs. *In vivo* and clinical evidence from aging mice and patients with senile osteoporosis also confirmed that elevation of NAP1L2 expression was associated with suppressed osteoblastogenesis. Taken together, our findings suggest that NAP1L2 is a regulator of both BMSC cell senescence and osteogenic differentiation, and provide a new theoretical basis for aging-related disease.（support by National Natural Science Foundation of China, 82071079）

Key Words: BMSC; Senescence; Osteogenesis; NAP1L2; Senile osteoporosis

Meilin Hu, DDS, MDS, Tianjin Medical University School of Stomatology, Doctoral degree candidate. E-Mail: humeilin@tmu.edu.cn

Research interest: Her research interest focus on the molecular mechanisms of aging and longevity, with a particular emphasis on the mesenchymal stem cells. Specifically, to study how MSCs may act as a therapeutic target in delaying aging and age-associated diseases.

AMPK activation orchestrated replicative senescence of PDLSCs

Meilin Hu[1#], Ruiqi Liu[1#], Liangyu Xing[1], Qiong Li[1], Fan Liu[1], Feng Gao[1], Yan Shen[1], Xinming Zhang[1], Yuxin Cao[1], Jian Gao[1], Zhi Jia[1], Dayong Liu[1]*

*: Corresponding Author

Abstract

Periodontal ligament mesenchymal stem cells (PDLSCs) are a promising cell resource for cell-based regenerative medicine in dentistry. PDLSCs inevitably acquire a senescent phenotype after prolonged in vitro expansion, and the key regulators of cells during replicative senescence remain unclear. Herein, we cultured periodontal ligament stem cells to P20. β-galactosidase staining, cell scratch test, and qPCR were performed to confirm the occurrence of replicative senescence in PDLSCs during passaging. Three groups of cells at passage 4 (P4), passage 10 (P10), and passage 20 (P20) were collected for non-targeted metabolomics analysis. Metabonomic sequencing showed that the metabolism of replicative senescence in PDLSCs varied significantly. In particular, the content of fatty acid metabolites decreased with senescence, including capric acid, stearic acid, myristic acid, and dodecanoic acid. KEGG pathway analysis showed that the AMPK signaling pathway was closely related to AMP levels. The AMP:ATP ratio increased in senescent PDLSCs; however, the levels of phosphorylated AMPK and the profile of FOXO1 and FOXO3a, which are downstream of the AMPK signaling pathway, decreased with senescence. We treated PDLSCs with AICAR, an activator of the AMPK pathway, and the phosphorylated AMPK level at P20 PDLSCs was partially restored. In summary, our study suggests that the metabolic process of PDLSCs is active in the early stage of senescence, prefers to consume fatty acids, and is attenuated in the later stages of senescence. AMP accumulates in replicative senescent PDLSCs; however, the sensitivity of AMPK phosphorylation sites is impaired, causing senescent PDLSCs to fail to respond to changes in energy metabolism. Our findings provide a new basis for the clinical application of periodontal ligament stem cells. （support by National Natural Science Foundation of China, 82071079）

Key Words: Mesenchymal Stem Cells；Senescence；Metabolomics,；Adenosine Monophosphate

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Research interest: Her research interest focus on the molecular mechanisms of senescence and epigenetics, with a particular emphasis on the oral mesenchymal stem cells. Specifically, to study what role does replicative senescence of PDLSCs play in the clinical transformation of stem cells.
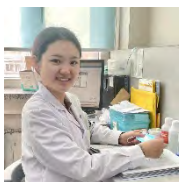
Visualization/scoring-based evaluation of tooth preparation for skill assessment by axial wall taper analyses

Y. Okuyama[1], T. Yamamoto[2], J. Dingnan[2], Y. Katsuda[1], I. Kumazawa[2], H. Yoshioka[2], M. Yamada[1], H. Egusa[1]

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[2] Tokyo Institute of Technology, Laboratory for Future Interdisciplinary Research of Science and Technology

Objective: Objective assessment methods for technical skills in the preparation of teeth for crowns are still not well established in dental education. We have developed an AI image recognition system to assess tooth preparation skills. An algorithm that automatically extracts the characteristics of abutment teeth is required to establish the system. The purpose of this study was to determine the algorithms to extract characteristics of abutment teeth by numerical analysis.

Material and Methods: First, the algorithm for extracting the minimum practical convergence angle (taper) between axial walls was verified. A non-prepared standard artificial tooth and 41 artificial teeth prepared by 4th grade undergraduate students were scanned on a positioning jig to standardize the three-dimensional (3D) position. On an occlusal surface in a 3D image of a non-prepared artificial tooth, buccolingual and mesiodistal baselines for sagittal and coronal cross-sections parallel to the tooth axis were set by connecting between the buccal and lingual cusps and between pits, respectively (**Fig. 1**). Outlines of each prepared tooth on the sagittal and coronal cross-sections in baselines were obtained. To derive an algorithm for automatically extracting the taper, buccolingual and mesiodistal tapers of each prepared tooth were quantified by geometric analysis.

Results and Discussions: The algorithm derived from the directional derivative calculation of the outlines of the 41 abutment teeth recognized tapers accurately in 160 out of 164 abutment tooth surfaces (97.6% accuracy). It tended to be less accurate in improperly prepared teeth (**Fig. 2**). The proposed algorithm to extract the characteristics of abutment teeth with high accuracy will promote the application of machine learning to the development of an AI image recognition system to assess tooth preparation skills and advance the field of dental education.
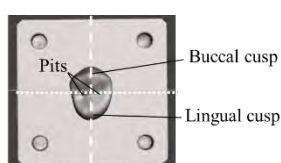
Fig.1 Buccolingual (dashed) and mesiodistal (dotted) baselines on occlusal surface in 3D data of a reference tooth
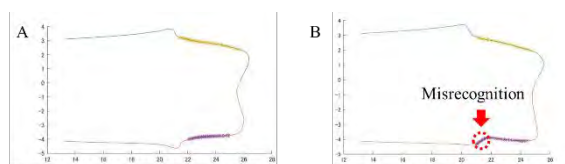
Fig 2. Representative images for buccolingual cross-sectional outline with recognitions (yellow and purple regions) for tapers by the algorithm in prepared teeth. Note the presence of misrecognition on the inadequately prepared tooth (B) in contrast with the adequate one (A).

A novel ECC-related bacterium, *Scardovia wiggsiae*, has a unique carbohydrate metabolism with fluoride resistance

<u>Mai Kameda</u>[1,2], Yuki Abiko[2], Jumpei Washio[2], Nobuhiro Takahashi[2]

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Early childhood caries (ECC) is a growing problem worldwide as a health disparity in children. In recent studies, *Scardovia wiggsiae* has been detected from ECC and has been noted as a novel caries-associated bacterium. *S. wiggsiae* is known to possess a unique metabolic pathway fructose-6-phosphate pathway (F6PPK-shunt), which is different from the glycolysis of most caries-associated bacteria such as *Streptococcus mutans*. The F6PPK-shunt might provide *Scardovia* with unique acid producing activity, acidic end-products and fluoride sensitivity. Therefore, in this study we tested these possibilities and attempted to elucidate the cariogenic potential of this bacterium.

In this study, *S. wiggsiae* C1A-55 and *S. mutans* NCTC 10449 ware used. All experiments were conducted under anaerobic conditions. The acid production from glucose was measured at pH 7.0 and 5.5 using a pH-stat system. Moreover, by adding a serial concentration of potassium fluoride to the reaction mixture, 50% inhibitory concentration (IC_{50}) of fluoride was obtained. Acidic end-products from glucose were analyzed by high performance liquid chromatography (HPLC). To identify the inhibitory steps by fluoride in metabolic pathways, the metabolome analysis was performed using the capillary electrophoresis and time-of-flight mass spectrometry (CE-TOFMS).

Our study on carbohydrate metabolism revealed that the F6PPK-shunt allowed *S. wiggsiae* to predominantly produce acetate from sugars, and that its acid production was resistant to fluoride. Furthermore, the enolase activity of *S. wiggsiae* was much more resistant to fluoride than that of *S. mutans*.

These results suggest that *S. wiggsiae* induces and promotes dental caries through a mechanism different from that of lactic acid bacteria such as *S. mutans*. In the future, it will be necessary to develop methods to prevent dental caries caused by acetic acid-producing and fluoride-resistant bacteria such as *S. wiggsiae*.

Research interest
ECC, Microbiology, Metabolism

Short-CV
2012.4~2018.3. Tohoku University School of Dentistry, Sendai, Japan (D.D.S)
2018.4~2019.3 Dental resident, Tohoku University Hospital
2019.4~ Tohoku University Graduate School of Dentistry (Ph.D. Course student)

Three-dimensional mechanical microenvironment enhanced osteogenic activity of mesenchymal stem cells-derived exosomes

Wenting Yu [#], **Xiaoxia Su** [#], Hong Zhou [*]

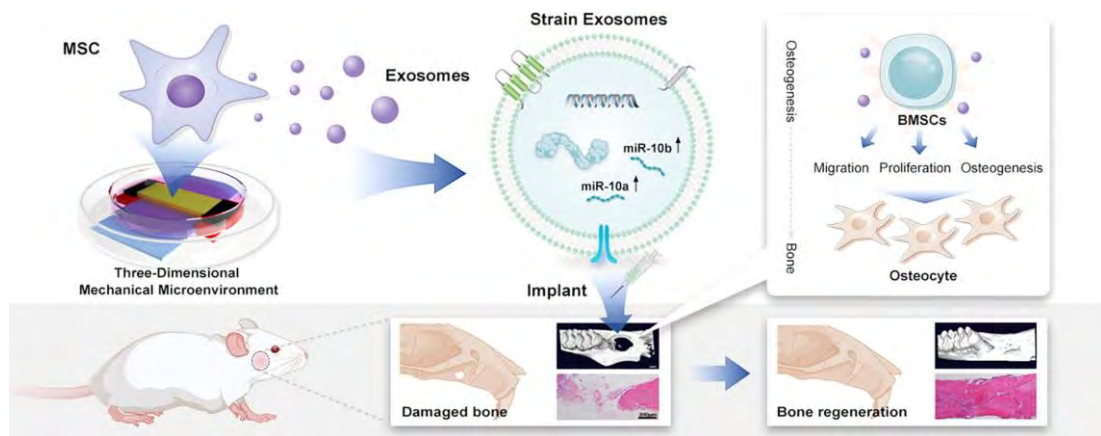**Xiaoxia Su** M.D.

✉ E-mail: orthodontist_su@163.com

- Membership of World Federation of Orthodontists
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RESEARCH INTEREST

- Exosomes
- Mesenchymal stem cells
- Tissue engineering
- Regenerative medicine

Know more about the research

ABSTRACT

We used periodontal ligament stem cells (PDLSCs), which were cultured in the 3D microscale magnetically stretched collagen hydrogels, as the model MSCs to explore the changes in haracteristics and bioactivity of MSC-derived exosomes in response to matrix strain. The levels of 25 miRNAs in exosomes secreted by PDLSCs in the 3D strain microenvironment (SM-Exo) were different from those obtained from the 3D culture microenvironment (Exo). Next, the bioactivity of SM-Exo was significantly enhanced as reflected by the improved proliferation, migration, and osteogenic differentiation of target cells. This was further confirmed by in vivo studies, in which PDLSC-derived exosomes obtained from the 3D strain microenvironment showed stronger bioactivity to repair alveolar bone defects in SD rats. This study proposed a novel strategy to promote alveolar bone regeneration via altered PDLSC-derived exosomes in the 3D strain microenvironment.

RESULTS
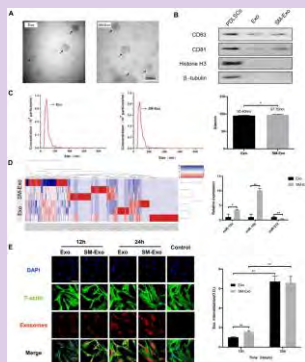
Characteristics of Exosomes and exosomal content.
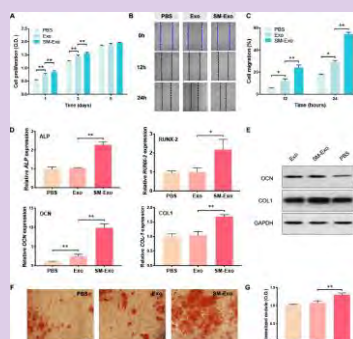
3D strain microenvironment affected bioactivity of PDLSC-derived exosomes in vitro
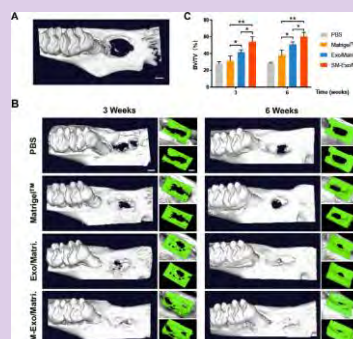
Micro-CT analysis of new bone formation at 3 and 6 weeks of healing
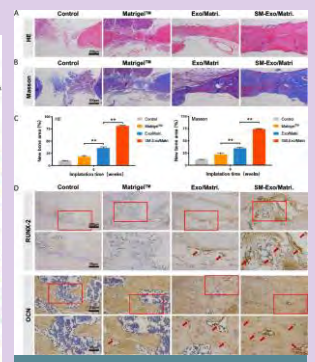
3D strain microenvironment promoted the osteogenesis efficiency of PDLSC-derived exosomes in vivo

Antibacterial effects of caffeic acid phenethyl ester on oral cariogenic bacteria and multispecies biofilm

__Xiaohui Lyu__[1], **Yumei Niu**[2], **Kun Wang**[1], **Zening Feng**[1], **Sili Han**[1], **Linglin Zhang**[1]*

1 *Department of Cariology and Endodontics, West China School of Stomatology, Sichuan University, Chengdu, China*

2 *Key Laboratory of Shanxi Province for Craniofacial Precision Medicine Research, College of Stomatology, Xi'an Jiaotong University, Xi'an, China*

Objectives: The purpose of this study was to investigate antibacterial effects of Caffeic acid phenethyl ester (CAPE) on oral cariogenic bacteria and multispecies biofilm.

Methods: Minimal inhibitory concentration (MIC) and minimal bactericidal concentration (MBC) against common oral bacteria were tested to assess the antimicrobial effect of CAPE. Time-kill assays, lactic acid measurement, growth curve assay at pH 5.0 and acid tolerance assay were applied to detect the antibacterial activity against *Streptococcus mutans*. To detect CAPE effects on *Streptococcus mutans* biofilm, Scanning electron microscopy (SEM), crystal violet assay, confocal laser scanning microscopy (CLSM) and EPS measurement were conducted. In multispecies biofilm model comprising *Streptococcus mutans*, *Actinomyces naeslundii* and *Streptococcus gordonii*, the antibiofilm activity was evaluated by colony forming unit (CFU) counting and CLSM.

Result: CAPE showed inhibitory and bactericidal effect against cariogenic bacteria. Besides, CAPE exhibited a short-term bactericidal activity against *Streptococcus mutans* and inhibited acid production and acid tolerance. Moreover, CAPE at 0.04 mg/mL and 0.08 mg/mL showed significant reduction in biomass quantification, biofilm viability and EPS production of *Streptococcus mutans* biofilm. Furthermore, CAPE at 0.08 mg/mL and 0.16 mg/mL eradicated and modulated mature multi-species biofilms by suppressing *Streptococcus mutans* and *Actinomyces naeslundii.*

Conclusion: Antibacterial effects of CAPE against the oral cariogenic bacteria and biofilm endowed its application potential in preventing and treating dental caries.

Xiaohui Lyu, PhD candidate，West China School of Stomatology, Sichuan University，China.

Supervisor: Dr. Linglin Zhang.

E-mail: 1303032124@qq.com

Research interests: oral microbiology

The effect of canonical and non-canonical pyroptosis in apical periodontitis

Zhiwu Wu, Rui Zhang, Mingming Li, Jinfeng He, Ran Cheng*, Tao Hu*

Aim: The aim of the study is to investigate the effect of pyroptosis in apical periodontitis.

Methodology: Label-free proteomics and double quantum dots (QDs) labelling staining was used to detected the proteins related to pyroptosis in human apical periodontitis tissues and experimental apical periodontitis rat model. In addition, VX765(a caspase-1 inhibitor) and Wedelolactone (a caspase-11 inhibitor) were used in an experimental AP rat model. Micro-CT was used to access the bone loss. THP-1 derived macrophages were stimulated with *Porphyromonas gingivalis* lipopolysaccharide *in vitro* for 6 h with or without caspase-1/-4/-5 inhibitor, Ac-FLTD-CMK. LDH release and Western blot was applied to evaluate the cell pyroptosis.

Results: Label-free proteomics showed that caspase-1 and PYCARD were expressed in human apical periodontitis tissue, but not in periodontal ligament. Double QDs labelling staining revealed the expression of caspase-1 and caspase-4/-5 in human apical periodontitis tissue. CD68+ macrophages mainly expressed caspase-5. Moreover, caspase-11 and caspase-1 were involved in the progression of in experimental rat apical periodontitis model. CD68+ macrophages also expressed caspase-1/-11. Inhibition of caspase-1 and -11 decreased bone loss when apical periodontitis was severe. LDH release and the expression of- pro-caspase-1, caspase-1 p20, pro caspase-4, caspase-4 p20, pro-caspase-5, caspase-5 p20, pro IL-1β, mature IL-1β and GSDMD-N increased in macrophages after LPS stimulating, but decreased treated with Ac-FLTD-CMK.

Conclusion: Caspase-1/-4/-5/-11 mediated pyroptosis contributed to apical periodontitis and bone loss.

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Research interest: endodontics, particularly pathogenesis of apical periodontitis. Oral health promotion.

Regulation of OrtR on Antioxidant Adaptability of *Streptococcus mutans*

Shuxing Yu[1,2], Yang Chen[1,2], Qizhao Ma [1,2], Jun Huang[1,2], Yuqing Li[1*], Jing Zou[1,2*]

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[2] Department of Pediatric Dentistry, West China Hospital of Stomatology, Sichuan University, Chengdu, China

ABSTRACT

The complex and changeable oral environment stresses the existence of various microorganisms in oral cavity. *Streptococcus mutans,* as a major caries-causing bacterium, has evolved many mechanisms of antioxidant adaptation, but the specific regulatory mechanisms need to be further studied. The purpose of this study was to investigate the regulatory mechanism of OrtR in TetR family on the antioxidant adaptability of *S.mutans*. We compared the antioxidant adaptability of OrtR overexpressed strains of *S. mutans* with control strains and identified the DNA binding sites of OrtR. The results showed that the antioxidant adaptation of OrtR overexpressed strain was decreased in the planktonic state compared with the control strain. OrtR overexpressed strains were at a disadvantage in the competition with hydrogen peroxide producing strains, such as *Streptococcus sanguis* and *Streptococcus gordonii* ($P < 0.05$). In OrtR overexpressed strains, genes related to antioxidant adaptation *ahpCF* and energy metabolism *adhABCD* of *S. mutans* were significantly down-regulated. OrtR specifically binds to transcription promoters of antioxidant adaptation genes, inhibits their transcription, and reduces their expression activity. In general, OrtR inhibits the transcriptional activity of genes related to antioxidant adaptation by specific binding to promoter regions, which affects the antioxidant adaptation and survival ability of *S. mutans*, providing new ideas and targets for the study of caries prevention.

Extracellular ATP modulates immunomodulatory property of periodontal ligament cells

<u>**May Thwe Kyaw Soe Win**</u> and Prasit Pavasant

Center of Excellence in Regenerative Dentistry, Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand.

It has been reported that ATP will be released from injured or stressed cells into extracellular environment. The role of the extracellular ATP (eATP) is involved in the process of both inflammation and anti-inflammation of the tissues. Our previous reports revealed that mechanical stimulation induced the release of ATP by periodontal ligament (PDL) cells. This eATPs were participated in the release of pro-inflammatory cytokines as well as the release and expression of osteogenic differentiation-related growth factors. However, the role of eATP on immunomodulatory property of PDL cells is still unknown. The aim of this study was to examine the role of eATP on the expression of indoleamine-pyrrole 2,3-dioxygenase (IDO) and interferon-gamma (IFNγ), two major immunomodulatory cytokines by PDL cells. PDL cells were activated with various concentrations of eATP from 0-100 μM for 24 hours. The mRNA expression of IDO and IFNγ were evaluated by reverse transcription-polymerase chain reaction, while ELISA and IDO enzymatic activity assay were used to examine the amount of IFNγ and IDO in the medium, respectively. Extracellular ATP significantly increased the expression and secretion of IDO and IFNγ in a dose dependent manner ($p<0.05$). The eATP induced IDO and IFNγ could be inhibited by the addition of EGTA, a calcium chelator and chemical P_2X_7 receptor inhibitors; KN62 and BBG, in culture medium suggesting the involvement of P_2X_7 receptor (P_2X_7R) in this process. Treatment with specific P_2X_7R agonist (BzATP) also markedly increased IDO and IFNγ expression, while silencing approach using siRNA specific for P_2X_7R attenuated the induction. In conclusion, our findings identified that eATP/P_2X_7R signaling induced immunosuppressive properties of PDL cells. Since immunosuppressive property could suppress the inflammation and induce tissue healing, it is possible that the function of eATP in PDL tissue will regulate tissue inflammation and trigger tissue healing and regeneration.

Key words: extracellular ATP, periodontal ligament, IDO, IFNγ, P_2X_7 receptor

Short CV

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Research of interest: Periodontal regeneration

P7-10   **Metronidazole and Ketoprofen Loaded Mesoporous Magnesium Carbonate for Rapid Treatment of Acute Periodontitis *in vitro***

Zhaohan Yu, Kunneng Liang, Jiyao Li

Objective. When treating acute periodontitis with drugs, it is necessary to achieve rapid eradication of periodontal pathogens and inflammation to relieve the pain of patients. When encapsulating drug molecules into mesoporous magnesium carbonate (MMC) leads to amorphous drug confined within the nanoscale pores and rapid release of drug occurs. The objective of this study was to verify MMC as a rapid drug release carrier for periodontal treatment in vitro for the first time.

Methods. Metronidazole (MET) and ketoprofen (KET) were loaded in MMC by solvent evaporation method. The MET-KET@MMC were characterized by scanning electron microscopy (SEM) and X-ray diffraction (XRD). The rapid drug release properties were also investigated through the drug release curve. The antiseptic properties were evaluated by Minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC), colony-forming unit (CFU), live/dead staining and time-kill assay. The anti-inflammatory capabilities on human gingival fibroblasts were probed by quantitative polymerase chain reaction (QPCR) and enzyme-linked immune sorbent assay (ELISA). Cytotoxicity of MET-KET@MMC were evaluated by cell counting kit-8 (CCK-8).

Results. Crystallization of MET and KET was completely suppressed in MMC. MMC induced higher apparent solubility and rapid drug release, produced up to 9.93- and 3.9-times higher release percentages of the drug, compared to the crystalline drugs, respectively. 90% of the loaded drugs content could be released in the first 10 minutes, and the antibiosis and anti-inflammatory properties of the released drugs in the first 10 minute were also verified in vitro. This novel strategy utilizing mesoporous structure shows great promise in achieving treatment of acute periodontitis.

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Tel: (+86) 18380122653
E-mail: 386737534@qq.com
Research interest: Caries epidemiology; biological materials; biomineralization

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A brief discussion on the Research Prospect of the Application of Dental Pulp Mesenchymal Stem cells in Stomatology

Yazhuo Li

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ABSTRACT

The study of dental pulp mesenchymal stem cells has been a research hotspot in the treatment of oral regeneration, because of its advantages such as convenient acquisition, safety, easy preservation and so on. In the future, we hope to apply it to the regeneration and repair of dental pulp, periodontium and bone tissue. However, at present, our research in this area is still insufficient, and the data obtained is extremely limited, so we still need to carry out in-depth research in the following aspects, such as clinical donor selection, experimental models, experimental materials and methods, evaluation criteria and so on.

INST:Dental pulp mesenchymal stem cells

In oral clinical practice, the use of some biomaterials or autologous blood derivatives for vital pulp preservation has achieved great success, but there is still a lot of research space in the use of dental pulp stem cells for dental pulp regeneration therapy. In recent years, tissue engineering technology based on autologous stem cells has developed rapidly, because it does not involve ethical disputes, has no immunogenicity, does not need to wait for donors, and can avoid the delay of treatment, and can avoid the spread of hepatitis B, AIDS and other infectious diseases, has become a research hotspot at home and abroad. In the future, we hope to apply it not only in dental pulp regeneration, but also in periodontal and maxillofacial tissue regeneration. But at present, our research methods and strategies in this area are still flawed, mainly in the following aspects:

First, in the research direction, the relevant basic research is still insufficient, the molecular mechanism of stem cell proliferation and differentiation into various tissues in vivo is not clear, and the strategy to determine the signal pathway is not perfect.

Second, in terms of experimental materials, how to select clinical donors is still a topic worthy of discussion. We need to pay attention to whether there is an upper age limit for the selection of donors, whether the apical foramen of the selected teeth is fully developed, and whether there are differences in the dryness of dental pulp stem cells at different ages.

Third, in terms of experimental methods, we may need to first explore the passage times of dental pulp stem cells and their aging degree, and clarify their aging mechanism in order to select the most appropriate passage times for research. Then we need to pay attention to the differences between the research models, including in vivo experiments, in vitro experiments and in vitro 3D model comparison and establishment methods.

Finally, we should comprehensively evaluate the characteristics of dental pulp stem cells in histology, immunology and molecular biology. Fourth, in terms of evaluation criteria, the qualitative histological and molecular biological criteria for the differentiation of dental pulp stem cells into other tissues need to be improved, such as the re-establishment of dental pulp nerves.

In summary, we believe that with the further development of material science, molecular biology, tissue engineering and the further understanding of the biological properties of dental pulp mesenchymal stem cells, the clinical application of dental pulp mesenchymal stem cells will be promoted. And it is expected to become a mature clinical technology.

武汉大学 WUHAN UNIVERSITY

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# Preparation of Graphene Oxide/ iRoot BP Compsite and Its Pulp Regeneration Performance

ZUYI CHEN

• ABSTRACT:

Dental Pulp, as the only loose connective tissue in teeth, is rich in cells,fibers, blood vessels, nerves and other extracellular matrix and it has the ability of protection, nutrition, aesthesis and dentin formation. Because of its importance, using tissue engineering and pulp stem cells to realize pulp regeneration will be the trend of endodontic treatment. Graphene Oxide, as the most impotant derivative of graphene, has fine biocompatibility. Chen et al. reported that GO can proliferation and adhesion of DPSCs and iPSCs. IROOT BP , as the regular pulp capping material, can promote the secretion of growth factors, the adhesion and proliferation of DPSCs, and the differentiation of odontoblasts. Owing to the great biological propreties of these two materials, our research team aims to succesfully combine GO and IROOT BP, and study its pulp regeneration performance in vitro.

In our study, we introduced 0%, 0.02%, 0.04%, 0.06% and 0.08% w/v into IROOT BP . We study its chemical composition using FT-IR and its surface morphology using scanning electron microscope. The 0.08% GO-IROOT BP group showed significantly high DPSCs adhesion and proliferation in vitro.

In future study, we hope to further study the molecular mechanism of Graphene Oxide/ iRoot BP Compsite in pulp regeneration.
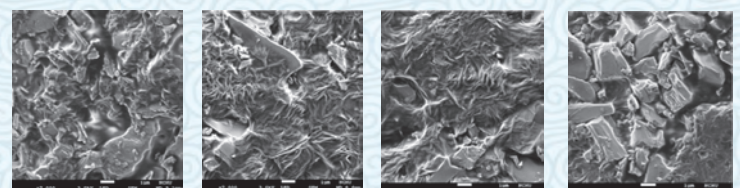
• MATERIALS AND METHODS
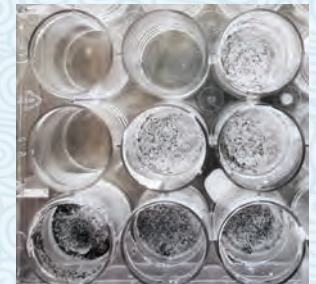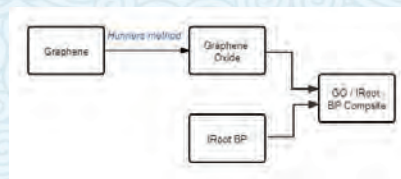
• CHARACTERIZATION
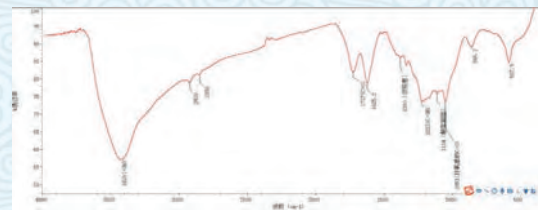
FT-IR of GO/ iRoot BP Compsite

| 0.02% | 0.04% | 0.06% | 0.08% |

SEM of GO/ iRoot BP Compsite

• EVULATION OF CELL VIABILITY

空白组	DPSCs	0.02%GO	0.04%GO	0.06%GO	bp	
0.161	1.032	1.182	1.324	1.445	1.184	1天
0.164	1.038	1.178	1.352	1.456	1.170	
0.162	1.042	1.184	1.345	1.455	1.185	
0.163	2.036	2.345	2.425	2.735	2.344	4天
0.160	2.043	2.353	2.455	2.752	2.331	
0.164	2.045	2.348	2.435	2.754	2.342	

Shear force activates secretion of immunosuppressive cytokines by PDL cells

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Abstract

Periodontal ligament (PDL) cells possess the immunomodulatory property, a property that provides PDL cells the ability to regulate function and differentiation of immune cells. This ability makes PDL cells one of the promising cells to be used in stem cell-based therapy. However, the immunosuppressive property needs the activation process, especially from inflammation. Mechanical stress has been proposed to be another activator to trigger immunosuppressive property of PDL cells. However, the influence of shear force on the immunosuppressive property of PDL cells is still unclear. The aim of this study was to examine the influence of shear force on immunosuppressive property of PDL cells. PDL cells were activated with 0, 0.5, 5 and 10 dyne/cm2 of shear force for 3 hours and then kept for another 24 hours. The expression of indoleamine-pyrrole 2,3-dioxygenase (IDO) and transforming growth factor-beta1 (TGF-β1), two major cytokines that regulate T-cells proliferation and regulatory T-cell differentiation were examined. Results revealed that shear force significantly increased the mRNA expression of IDO but not TGF-β1. Addition of cycloheximide (CHX) inhibited shear-forced induced IDO expression. Protein expression of IDO, TGF-β1 and interferon gamma (IFN-γ) as monitored by activity assay and ELISA. The results revealed that shear force increased the IDO activity in the medium and increase the amount of TGF-β1 and IFNγ in the cell lysate. It is possible that IFN-γ, is a potent activator of IDO, involved in shear force induced IDO expression. Moreover, conditioned medium from shear force-induced PDL cells decreased the proliferation of Jurkat, the CD4 cell line. In conclusion, this finding supports the role of shear force on the induction of immunosuppressive cytokines by PDL cells. This knowledge could be applied in periodontitis patients to regulate the level of inflammation and promote tissue repair and regeneration.

Key words: periodontal ligament cell, immunomodulation, TGF-β1, IDO, Shear force

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Research interest
periodontal ligament cell, immunomodulation
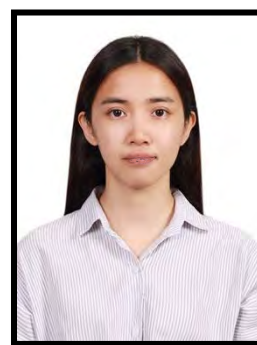
Profiling of Microbiota in Liquid Baby Formula and a Baby Drink Consumed with an Artificial Nipple

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Objectives: To clarify the characteristics and growth of bacteria that may infiltrate liquid baby formula during feeding and after storage for more than 3 h, the transfer of oral bacteria through artificial nipples, and bacterial survival in liquid baby formula and a baby drink were examined immediately after drinking and after storage at 4°C for 12 h and 24 h. **Methods:** Thirteen human subjects (aged 19–24 years) were asked to drink approximately 50 mL of liquid baby formula and a baby drink, via the artificial nipple of a baby bottle. Samples of the remaining liquid after storage at 4°C for 12 h and 24 h were inoculated onto blood agar plates and incubated anaerobically at 37°C for 7 days. Genomic DNA was extracted from individual colonies, and the bacterial species were identified by 16S rRNA gene sequencing. **Results:** The mean concentrations of bacteria in the liquid baby formula were $(2.6\pm2.8) \times 10^4$ and $(4.1\pm6.6) \times 10^4$ colony-forming unit/mL after storage at 4°C for 12 h and 24 h, respectively. *Streptococcus* (43.2%), *Veillonella* (9.3%), and *Schaalia* (8.2%) species were recovered from the remaining liquid baby formula after storage at 4°C for 12 h. In contrast, no bacteria were detected in the remaining baby drink after storage at 37°C for 24 h. **Conclusions:** The levels of bacteria immediately after drinking and after storage at 4°C for 12 h or 24 h were similar, suggesting that remaining liquid baby formula may be preserved safely in a refrigerator for more than 3 h.

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April 2020, PhD Course Student, Niigata University Graduate School of Health Sciences
March 2018, Medical Technologist
(Encouragement Award; 2020 & 2019 Japan Society of Clinical Chemistry, 2018 Japanese Association of Medical Technologists)
(Scholarship; 2018-2022 Japan Securities Scholarship Foundation)
Research interest: Profiling of oral and intestinal microbiota

Profiling of Microbiota in Sport-Drink and Orange Juice of Plastic Bottle After Drinking Directly From Plastic Bottles

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Objectives: It has been speculated that oral bacteria can be transferred to drinks in plastic bottles when it is drunk directly from the bottles, and that the bacteria can then multiply in the bottles. The bacterial survival in the remaining drinks after drinking directly from bottles were examined immediately after drinking and after storage at 37°C for 24 h. **Methods:** After obtaining informed consent, 8 healthy subjects (14 to 23 years of age) were asked to drink approximately 100 mL of a sport-drink or orange juice from a plastic bottle. Samples of the remaining drinks in the bottles were inoculated onto blood agar plates and incubated anaerobically at 37°C for 7 days. Genomic DNA was extracted from individual colonies, and the bacterial species were identified by 16S rRNA gene sequencing. **Results:** The mean amounts of bacteria were $(2.9 \pm 1.6) \times 10^3$ and $(1.6 \pm 2.2) \times 10^3$ CFU/mL from the remaining sport-drink and orange juice immediately after drinking, respectively. *Streptococcus* (59.8 and 36.5%), *Actinomyces* (13.0 and 27.6%), *Neisseria* (5.0 and 3.8%)*, Rothia* (4.6 and 1.7%)*, Veillonella* (2.7 and 11.3%), *Prevotella* (2.7 and 0.7%)*, Schaalia* (2.3 and 2.0%) and *Gemella* (2.3 and 2.4%) were predominant in the remaining sport-drink and orange juice immediately after drinking, respectively. Little bacteria were recovered from the samples 24 h after drinking. **Discussion:** Oral bacteria, *e.g.*, *Streptococcus*, *Actinomyces*, *Neisseria* and *Rothia,* were found to transfer into the sport-drink and orange juice, and their bacterial compositions were found to resemble that of human saliva. The bacterial levels of the sport-drink and orange juice were quite distinct from those of the tea drink 24 h after drinking. This was likely due to the lower pH of the sport-drink and orange juice, when compared to the neutral-pH of the tea drink, suggesting that the remaining of low-pH drinks may be preserved for a longer period.

Short CV: Miss Miho KAWACHI
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March 2020, Medical Technologist
(Encouragement Award: 2021 Japan Society of Clinical Chemistry)
Research interest: Profiling of oral microbiota

Deletion of *actJ* gene affects growth and biofilm formation of *Streptococcus mutans*

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ABSTRACT

GCN5-related N-acetyltransferases (GNAT) family proteins are a diverse group of lysine acetyltransferases (KATs) widespread in bacteria. The members of this superfamily exhibited significant influences in many cellular processes, such as DNA binding, enzymatic activity, protein-protein interactions, protein stability, or protein localization. Streptococcus mutans is the crucial pathogen of human dental caries, however, the function of acetyltransferases in S. mutans remains unknown. In this study, we found that ActJ, a member of the GNAT super-family, affects the growth rate, biofilm formation and extracellular polysaccharides (EPS) synthesis in S. mutans. When compared with the parental strain, a total of 166 differentially expressed proteins (DEPs) (>1.2-fold) were identified in the *actJ* deletion mutant by global protein expression profiling. Bioinformatics analysis indicated that the DEPs were mainly related to protein homeostasis maintenance, carbohydrate metabolism and substances transporter systems.

Short CV：

Yang Chen received the Bachelor of Medicine degree from Harbin Medical University, Heilongjiang, China, in 2018, and the master of Dental Medicine degree from Sichuan University, Sichuan, China, in 2021. Current research interests include oral health management of children and Oral microbiology.

The selective membrane affinity of novel lactotransferrin-derived peptide to *Streptococcus mutans.*

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Background: Dental caries is a primary worldwide oral disease, and *Streptococcus mutans* is considered the primary cariogenic bacterium. Lactotransferrin-derived peptide (WKLLRKAWKLLRKA) is a novel antimicrobial peptide developed in our previous study, which possessed a potential anticaries selectivity targeting *Streptococcus mutans*. The study aims to investigate the possible mechanism of the selective antibacterial activity against *S. mutans*.

Methods: *S. mutans* UA 159, *S. sanguinis* ATCC 10,556 and *S. gordonii* ATCC 10,558 were used in this study. Propidium iodide assay was applied to measure the antibacterial effect of lactotransferrin-derived peptide. Membrane affinity of lactotransferrin-derived peptide to different streptococci was evaluated by hydrophobicity assay, DISC3(5) experiment and confocal laser scanning microscopy (CLSM) observation. Transmission electron microscope (TEM) was used to observe the effect of lactotransferrin-derived peptide on bacterial morphology.

Results: Lactotransferrin-derived peptide showed selective antibacterial activity against *S. mutans* in the Propidium iodide assay. The most remarkable changes occurred in the membrane hydrophobicity and potential of *S. mutans* after the treatment with LF-1. CLSM revealed that FITC-labelled lactotransferrin-derived peptide displayed the strongest fluorescence intensity in the *S. mutans* biofilm. TEM observation reflected that 16 μmmol/L lactotransferrin-derived peptide could induce mesosome-like structures in *S. mutans*, while there was no significant morphological change in *S. sanguinis* and *S. gordonii*.

Conclusion: Lactotransferrin-derived peptide has selective antibacterial activity against *S. mutans* through its selective membrane affinity and strong membrane disturbance on *S. mutans*. The selectivity targeting *S. mutans* confer lactotransferrin-derived peptide with noble anticaries potential in caries prevention.

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Research interests: Oral microbiology, caries prevention, and anticaries drug discovery.

Discrimination of periodontal pathogens using Raman spectroscopy combined with machine learning algorithms

Yiping Liu[1,#], Hongxiao Li[2,#], Shisheng Cao[1], Xin Li[1], Jing Cao[1], Baoxin Fan[1], Xingtong Mu[1], Ying Li[1,*], Xiaoxi Dong[2,*], Juan Zhang[1,*]

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Abstract: Periodontitis is closely related to many systemic diseases linked by different periodontal pathogens. To unravel the relationship between periodontitis and systemic diseases, it is very important to correctly discriminate major periodontal pathogens. To realize convenient, efficient, and high-accuracy bacterial species classification, the authors use Raman spectroscopy combined with machine learning algorithms to distinguish three major periodontal pathogens. Periodontal pathogens *Porphyromonas gingivalis (Pg)*, *Fusobacterium nucleatum (Fn)*, and *Aggregatibacter actinomycetemcomitans (Aa)* were considered in this study. After obtaining Raman spectra of the three bacteria, eight well-known powerful machine learning algorithms were used to find out the best classifier for distinguishment of the above-mentioned three major periodontal pathogens. The result shows that this novel method can successfully discriminate the three above-mentioned periodontal pathogens. Moreover, the classification accuracies for the three categories of the original date were 94.7% at the sample level and 93.9% at the spectrum level by the machine learning algorithm extra trees. The linear discriminant analysis trained on the Fourier transformed data produced the optimal classifier at both sample (accuracy of 94.7%) and spectrum (accuracy of 88.7%) levels. This study provides a fast, simple, and accurate method which is very beneficial to differentiate periodontal pathogens.

Short CV

Yiping Liu, Graduate Student. She received her Bachelor's Degree of Stomatology from Hebei Medical University in 2015. She is now studying for a Master's degree of Stomatology at Tianjin Medical University, Tianjin, China. She is a member of the professional committee of temporomandibular joint diseases and occlusion of the Chinese Stomatological Association.
Research interests: dentistry and oral Sciences; basic and clinical research of temporomandibular joint diseases.

Effect of glucose, nitrate and nitrite on the nitrite-producing activity of oral *Actinomyces* species

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Introduction
Actinomyces is one of the major nitrite (NO_2^-)-producing bacteria in oral microbiome. NO_2^- is produced from nitrate (NO_3^-), that is abundant in the oral cavity because foods such as green leafy vegetables contain a lot of NO_3^-, and a part of NO_3^- ingested is known to be continuously secreted as a saliva component. NO_2^- is known to have antibacterial effect and to normalize the blood pressure and subsequently contribute to maintaining systemic health. Our previous report (Appl Environ Microbiol, 2020) clarified that NO_2^- producing-activity by oral *Veillonella*, another major nitrite-producing oral bacteria, was increased by lactate, and induced by NO_3^- and NO_2^-. However, these effects on NO_2^- production by oral *Actinomyces* is still unknown. Hence, this study aimed to elucidate the effects of environmental factors on the NO_2^--producing activity of *Actinomyces*.

Materials and Methods
Actinomyces naeslundii ATCC 12104 was cultured anaerobically in the medium with or without 1 mM potassium nitrate (KNO_3) or 0.1 mM potassium nitrite (KNO_2), harvested and washed. Bacterial cells were incubated aerobically or anaerobically for 30 min at 37°C with 1 mM KNO_3 in the presence of 0.5 % glucose or 1 mM sodium lactate in 40 mM potassium phosphate buffer (pH 7.0) for the analysis of NO_2^--producing activity. The NO_2^- production was measured by Griess reagent kit.

Results and Discussion
The NO_2^- producing-activity was 1.6±0.2 fold higher under anaerobic conditions ($p<0.05$). Glucose enhanced this activity 1.9±0.2 fold ($p<0.05$) under aerobic and 2.3±0.5 fold ($p<0.05$) under anaerobic conditions, while lactate did 1.3±0.1 and 1.4±0.2 fold ($p<0.05$), respectively. NO_3^- or NO_2^- in the growth medium significantly decreased the NO_2^--producing activity. These characteristics are different from those of oral *Veillonella*, suggesting that oral *Actinomyces* can utilize glucose/lactate-derived reducing power to reduce NO_3^- to NO_2^-, which feeds back negatively and represses enzymes responsible for NO_2^- production.
(299/300 words)

Short CV:
2019. 3, D.D.S., Tohoku University School of Dentistry
2019. 4- Dental resident, Tohoku University Hospital
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Research Interest:
Oral Biochemistry (Metabolism of Oral bacteria) / Orthodontics

Direct effect of periodontitis-associated bacteria on the glucose metabolic activity of host cells

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Abstract

Introduction: Periodontitis causes the destruction of periodontal tissues. The pathogenesis of periodontitis has been investigated by many previous studies; however, the onset of periodontitis, especially the direct effect of periodontitis-associated bacteria on periodontal tissues is still unclear. Therefore, in this study, we investigated the effects of culture supernatants of representative periodontitis-associated bacteria on host cells, especially glucose metabolism which is an essential cellular function and a sensitive indicator of cell activity.

Materials and Methods: We used *Porphyromonas gingivalis* wild-type strain ATCC33277 (WT), its gingipain-defective mutant KDP136 (DM), *Prevotella intermedia* ATCC25611 and *Fusobacterium nucleutum* ATCC25586. As host cells, HaCaT (human skin keratinocyte) cells were used. These bacterial strains were grown anaerobically and the culture supernatants were collected. The effects of the culture supernatants on the glucose metabolism of the host cells were evaluated. Glucose metabolic activity of host cells was evaluated using a pH-stat system that can monitor the amount of acid produced from glucose by host cells. The organic acids in the culture supernatants were analyzed with HPLC, and the effects of organic acids on host cells were also examined similarly.

Results and Conclusion: The culture supernatants of *P. gingivalis* WT inhibited the glucose metabolic activity of host cells significantly, but those of *P. gingivalis* DM, *P. intermedia* and *F. nucleatum* did not inhibit. Heat-treatment (80°C for 15 min) abolished the inhibitory activity of the culture supernatants of *P. gingivalis* WT. Organic acids detected in culture supernatants of *P. gingivalis* WT had no effect on the glucose metabolic activity of the host cells. These results suggest that gingipains or gingipain-associated proteins derived from *P. gingivalis* inhibits the glucose metabolism of host cells, although further studies are needed to identify the molecules involved in metabolic inhibition. This inhibitory function of *P. gingivalis* could relate to the onset of periodontitis.

Research interest
Periodontology, Biochemistry

Short-CV

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2019 – present, Ph.D. course student, Tohoku University Graduate school of Dentistry,

Regulatory effect of miR-126 on M1 type polarization of macrophages under high glucose environment

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Corresponding author: Shaoyun Jiang

Objective: Studies shown that miR-126 plays a protective role in periodontitis, and macrophage polarization plays an important role in the pathogenesis of periodontitis and diabetes. However, it is unknown whether microRNA-126 (miR-126) affects the polar phenotype of macrophages in diabetic periodontitis. This study was aimed to investigate the regulation of miR-126 on the polarization of macrophages under the high glucose enviroment, and to provide experimental evidence for exploring the pathogenesis of diabetic periodontitis.

Method: THP-1 monocytes with 50 nM phorbol ester (PMA) for 48 h, then incubate the macrophages with low-glucose (5.5 mmol/L) and high-glucose (25 mmol/L) medium for 48 h. Real-time polymerase chain reaction (RT-PCR), enzyme-linked immunosorbent assay (ELISA), Western blot detection of miR-126 and macrophages polarization related factors, inducible nitric oxide synthase (iNOS), arginase-1 (Arg-1) and inflammatory factors: tumor necrosis factor-α (tumor necrosis factor-α, TNF-α), interleukin 10 (IL-10), inflammation-related pathways: nuclear factor kappa-B (NF-κB) and mitogen-activated protein kinase (mitogen-activated protein kinase, MAPK) changes. After high glucose stimulation, miR-126 mimics were used to transfect macrophages. RT-PCR, ELISA, Western blot were used to detect the effects of miR-126 on macrophage polarization .

Results: After the macrophages were stimulated by high glucose for 48 hours, the expression of miR-126 and M2 type markers (Arg-1, IL-10) decreased significantly, while M1 type-related cytokines (iNOS, TNF-α), and p-p65, p-ERK, p-p38 increased significantly. After transfection of miR-126 mimics under high glucose stimulation, the expression of M1 type-related cytokines (iNOS, TNF-α) mRNA and protein levels decreased significantly, while M2 type markers (Arg-1, IL-10) expression levels increased significantly, and the expressions of p-p65, p-ERK, and p-p38 decreased significantly.

Conclusion: high glucose can promote macrophage M1 polarization and inflammatory response. This effect can be inhibited by miR-126, indicating that miR-126 may play

a protective role in diabetic periodontitis.

pH-sensitive Tertiary Amine Monomer for the Prevention of Dental Caries

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State Key Laboratory of Oral Diseases & National Clinical Research Center for Oral Diseases, Department of Cariology and Endodontics, West China Hospital of Stomatology, Sichuan University

Previous researches indicated that there is an aggregate of microorganism in dental caries which takes part in promoting the occurrence of dental caries, but few studies on anti-caries materials for these 'core microbiome' were developed. Objective: To explore the effect of pH-sensitive tertiary amine monomer (DMAEM) on the core microbiota of dental caries, and to further study its anti-caries effect. Methods: The core microbiome of caries (including *Veillonella parvula, Fusobacterium nucleatum, Prevotella denticola, Leptotrichia wadei, Streptococcus mutans*)were anaerobically co-cultured, then treated with DMAEM(6.25mg/ml) and PBS in acidic and neutral condition for 10 minutes every 24 hours, repeated three times. We conducted methylthiazolyl tetrazolium colorimetry (MTT), lactic acid detection, transverse microradiography (TMR), confocal laser scanning microscopy (CLSM), quantitative polymerase chain reaction (qPCR) and rat model test to study the cariogenic ability changes of the flora. Results: ①Under acidic conditions, DMAEM can inhibit the formation of 'core microbiome' biofilm, reduce acid production and demineralization in vitro. ②DMAEM can significantly inhibit the cariogenic ability of the core microbiome in vivo. Conclusion: DMAEM can response to acidic condition and effectively inhibit the growth and cariogenic ability of the core microbiome of caries, and it is a promising pH-sensitive materials for caries prevention and treatment.

Presenting Author: Bina Yang
Education Experience: Master student in West China School of Stomatology, Sichuan University, Chengdu, China.
Research Interest: Research of intelligent anti-caries materials

The Sec secretion system of *Streptococcus mutans* regulates the formation of persisters by affecting EPS production

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Biofilms are crucial for bacterial resistance and refractory infections, which contain a high proportion of persister cells. *Streptococcus mutans* acts as the main cariogenic bacterial species. Persisters of *S. mutans* in biofilms significantly increased their ability to produce exopolysaccharides (EPS). However, the specific mechanism is still unclear. In this study, we investigated the mechanism of *Streptococcus mutans* drug-tolerant persister cells induced by novel quaternary ammonium: dimethylaminododecyl methacrylate (DMADDM). We also found a higher proportion of EPS in persisters, and the transcriptome sequencing result showed the expression of genes related to EPS production and transmembrane transport was significantly upregulated. Most genes in the Sec secretion system, a transmembrane transport system, were significantly upregulated. Thus, gene knockout and complement strains of the sec secretion system were constructed. The CFU count and death-live staining experiments verified that after 24 hours, the number of persisters of gene-knockout strains decreased significantly, and the deletion strains ΔsecA, ΔsecY, ΔyidC2 formed the least persisters. At the same time, confocal staining indicated EPS production was reduced in sec secretion system gene-knockout strains. Our research found the sec secretion system could affect EPS production and secretion, thereby regulating the formation of persister cells. secA, secY, and yidC2 played essential roles in EPS production and secretion in the Sec secretion system. To the best of our knowledge, our findings described the effect of the sec secretion system on the formation of persister cells in Streptococcus mutans for the first time. Genes in the Sec secretion system that have the most significant influence on the formation of persisters have been discovered, providing a new therapeutic target for eliminating persister cells.

Huang Yuyao is a graduate student of West China School of Stomatology, Sichuan University, who interested in oral microbe, persister cells and antibacterial material.

Effect of Methicillin-resistant *Staphylococcus aureus* on the

Proliferation of Oral Squamous Cell Carcinoma Cells

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Oral squamous cell carcinoma (OSCC) is the most common tumor in oral cavity. Methicillin-resistant *Staphylococcus aureus* (MRSA) were highly detected in OSCC patients, however, the interactions and mechanisms between drug resistant bacteria (MRSA) and OSCC are not clear. The purpose of this study was to investigate the promotion of MRSA on the development of OSCC. 13 MRSA clinical isolates were employed and 4 MSSA strains were served as the drug sensitive control. All of the MRSA strains significantly increased the proliferation of OSCC cells and MRSA arrested the cell cycles of OSCC cells in the S phase. MRSA was capable to activate the expression of TLR-4, NF-κB and c-fos in OSCC cells. MRSA also promoted the development of squamous cell carcinoma in the subcutaneous tumorigenicity mouse model. The virulence factor *fnbpA* gene was significantly upregulated in all of the clinical MRSA isolates. By neutralizing FnBPA, the promotions of MRSA on OSCC cell proliferation and development of squamous cell carcinoma were significantly decreased. Meanwhile, the activation of c-fos and NF-κB by MRSA was also significantly decreased by FnBPA antibody, indicating that the MRSA upregulated the virulence factor FnBPA to activate the c-fos, NF-κB pathways to promote the proliferation and development of OSCC. We for the first time identified that MRSA promoted the development the OSCC and the FnBPA protein was the critical virulence factor. Our results also suggested that targeting virulence factor is a new candidate way to block the interaction between drug resistant pathogen and the development of tumors.

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Research interest: Pathogenic microorganisms; Oral Diseases prevention; Microbial interaction; Microorganism and host interaction.

Modulations of circular RNAs on characteristics of *Streptococcus mutans* biofilm

Yalan Deng, Lei Lei, Tao Hu* (*Corresponding author: hutao@scu.edu.cn)
Streptococcus mutans (*S. mutans*) is a major contributor to oral biofilm and cause dental caries. Circular RNAs (circRNAs), a novel class of ncRNAs, contributes to diverse biological functions in eukaryotes. However, whether circRNAs take a significant part in post-transcriptional regulations of *S. mutans* remains unknown. The goal of this study was to investigate the effects of circRNAs in *S. mutans* on biofilm formation as well as its morphological characteristics. By circRNA expression profile analysis of *S. mutans* UA159, several circular-like RNAs were screened out. Sanger sequencing, RT-PCR using divergent primers and RNase R digestion analysis were used to confirm the closed loop structure. Here, we found circular-structure RNAs and circular-like RNAs that might account for sucrose degradation and biofilm formation of *S. mutans*. Scanning electron and atomic force microscopy were applied to observe the morphology of biofilms, which indicated an even biofilm surface and an increased adhesion force of circular-like RNA overexpression strain. Crystal violet staining was used to quantify the biomass, and overexpression of circular-structure RNA slightly enhanced its ability of biofilm formation. Distribution of the extracellular polysaccharides (EPS) was evaluated by confocal laser scanning microscopy, in which EPS/bacteria ratios of biofilms of circular-like RNA overexpression strain were dramatically higher. What's more, biofilms formed by circular-structure RNAs overexpression strain produced more lactic acid. Taken together, circRNAs could modulate EPS production and acidogenic capacity of *S. mutans* biofilms, which might induce its cariogenicity. This study brings us implications on an in-depth understanding of bacterial post-transcriptional regulation conducted by regulatory RNAs.

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Research subject: microbiology in caries and noncoding RNAs; competitions of circRNAs to endogenous msRNAs involved in the regulation of exopolysaccharides metabolism and cariogenicity of *Streptococcus mutans*

Research interest: post-transcriptionally regulatory mechanism of *Streptococcus mutans*

Publication: Deng Y[#], Yang Y[#], Lei L*, Hu T*, et al. The *vicK* gene of *Streptococcus mutans* mediates its cariogenicity via exopolysaccharides metabolism. *INT J ORAL SCI*. doi:10.1038/s41368-021-00149-x.

Anatomical Limitations and Influencing Factors

for Molar Distalization

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Presenter: Yaxin Xie, Postgraduate, Department of Orthodontics and Pediatric Dentistry, West China Hospital of Stomatology, Sichuan University, Chengdu, China
Research interest: My main area of interest is the mechanisms between the growth of the craniofacial complex and orthodontic tooth movement. Molar distalization can relieve the dental crowding for non-extraction treatment. I can possibly propose to analyze the anatomical boundary of molar distalization, and the correlation with facial growth pattern.

Objective: Molar distalization depends strongly on the clinician's thorough understanding of the topography of posterior region of the alveolar bone, previous studies revealed variations in the available distance and cortical bone thickness (CBT) for molar distalization. Therefore, the purpose of this study was to define the said region, and analyze the anatomical limitations and influencing factors of maxillary and mandibular retromolar regions for molar distalization using cone-beam computed tomography (CBCT).

Materials and Methods: 120 standard-compliant patients were classified into equal groups of skeletal Class II and Class III, and subsequently stratified by vertical growth pattern, age, sex and presence of third molar. The CBCT scans of the patients were taken and a posterior occlusal line (POL) was drawn to represent the axis of distalization (AOD). The available distance along AOD and the corresponding CBT were measured at different mesial-distal and coronal-apical levels of the retromolar regions of Class II maxilla and Class III mandible respectively.

Results: The minimum available distance and corresponding CBT of the Class II maxilla was 4.06 ± 1.93 and 1.00 mm at a level 3mm from CEJ, while that of the Class III mandible was 2.80 ± 1.96 and 2.24 mm at a level 9mm from CEJ. Regarding on the other individual factors, patients with hyperdivergent growth pattern have the smallest available space among the three vertical growth patterns, which showed exceptionally strong correlations in Class III mandible. However, there were no significant variations in age, sex and presence of third molar.

Conclusions:

The anatomical limitation for molar distalization in the Class II maxilla is closer to coronal level, and that of the Class III mandible is closer to apical level. Vertical growth patterns affect available distance for distalization of both jaws. As such, CBCT evaluation of retromolar region three-dimensionally is recommended before molar distalization.

Oral status and homebound status: A 6-year bidirectional exploratory prospective cohort study

Hazem Abbas, Jun Aida, Sakura Kiuchi, Katsunori Kondo, Ken Osaka

Objectives

Little is known about the association between oral status and homebound status, and there is a possibility of a bidirectional relationship between them. In this exploratory prospective cohort study, we examined the association between four oral status measurements and being homebound bidirectionally.

Methods

We used 2010–2016 panel data gathered from the Japan Gerontological Evaluation Study. All functionally independent participants aged 65 years or older ($n = 26{,}579$) were included in this study. Multiple imputation and Poisson regression were used for analyses. We adjusted for age, sex, education, comorbidity, and depressive symptoms.

Results

In the fully adjusted model, the prevalence ratio (PR) of being homebound at follow-up was 1.42 for having <20 remaining teeth, 1.28 for having chewing difficulty, 0.99 for having choking experience, and 0.94 for having dry mouth at baseline. Reversely, being homebound at baseline predicted having chewing difficulty at follow-up (PR = 1.17), while no significant association was demonstrated with having <20 teeth (PR = 1.00), choking experience (PR = 1.06), and dry mouth (PR = 1.02).

Conclusion

Chewing difficulty and having <20 remaining teeth predicted homebound status after 6 years. Reversely, homebound status at baseline only predicted having chewing difficulty at follow-up. These findings may help to determine the oral frailty assessment measures for older people.

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Research interest: Dental Public Health and Social Epidemiology.

P9-5

Research: An image quality comparison study between homemade and commercial dental cone-beam CT systems

Abstract

Purpose: Cone-beam computed tomography (CBCT) has been widely applied in dental and maxillofacial imaging. Several dental CBCT systems have been recently developed in order to improve the performance. This study aimed to evaluate the image quality of our prototype (YMU-DENT-P001) and compare with a commercial POYE Expert 3DS dental CBCT system (system A).

Methods: The Micro-CT Contrast Scale, Micro-CT Water and Micro-CT HA phantoms were used to evaluate the two CBCT systems in terms of contrast-to-noise ratio (CNR), signal-to-noise ratio (SNR), uniformity (U), distortion, and linearity in the relationship between image intensity and calcium hydroxyapatite concentration. We also fabricated a proprietary thin-wire phantom to evaluate full width at half maximum (FWHM) spatial resolution. Both CBCT systems used the same exposure protocol, and data analysis was performed in accordance with ISO standards using a proprietary image analysis platform.

Results: The SNR of our prototype system was nearly five times higher than that of system A (prototype: 159.85 ± 3.88; A: 35.42 ± 0.61; $p < 0.05$) and the CNR was three times higher (prototype: 329.39 ± 5.55; A: 100.29 ± 2.31; $p < 0.05$). The spatial resolution of the prototype (0.2446 mm) greatly exceeded that of system A (0.5179 mm) and image distortion was lower (prototype: 0.03 mm; system A: 0.285 mm). Little difference was observed between the two systems in terms of the linear relationship between bone mineral density (BMD) and image intensity.
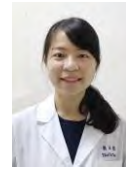
Conclusions: Within the scope of this study, our prototype YMU-DENT-P001 outperformed system A in terms of spatial resolution, SNR, CNR, and image distortion.

Locational effects on oral microbiota among long-term care patients

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Introduction:

Dysbiosis impairs both oral and general health, and modifying the microbiota may be a new approach to managing diseases. However, few Asia-based studies have evaluated whether modifying the dental treatment offered to long-term care patients receiving home care or outpatient care based on oral microbiota analysis may minimize the risk of pneumonia and improve their safety and quality of life.

Methods:

Next-generation sequencing (NGS) was used to identify the oral bacterial composition and abundance in 40 patients receiving long-term care: 20 from the dental outpatient department (OPD) of special needs and 20 community-dwelling patients. Their basic clinicodemographic information was obtained, and NGS was used to analyze the microbiota composition in each patient's tongue plaque.

Results:

Both groups had different bacterial richness and evenness, and their dominant bacterial species were also significantly different. Species richness and evenness was higher in the OPD group than in the home care group, which suggests that the bacterial species were more balanced in the OPD group. Furthermore, within-group comparisons revealed that the microbiota of home care patients were more divergent than that of OPD patients. The important bacterial species at the genus level such as *Actinomyces*, *Prevotella* in OPD patients and *Pseudomonas* in home care patients. Together, these findings indicate that home care patients have a higher risk of oral or general disease because of the existence of specific and dominant species as well as a more unstable oral environment.

Conclusion:

Under the limitation of this study, we would like to concluded that a significant difference exists in the oral microbiota between long-term care patients receiving treatment at OPD and those receiving home care. The oral microbiota of home care patients was less diverse than that of OPD patients, and specific pathogen species was dominant, which may lead to dysbiosis.

CV:

National Yang Ming Chiao Tung University, Institution of Oral Biology, Ph.D. study in school.

Kaohsiung Medical University, Department of Oral Hygiene, Master of Oral Hygiene.

P9-7

Research Interest : **Prosthodontics**

SHORTENING DENTAL ARCH IN MINI DENTAL IMPLANT

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ABSTRACT

Backround : Shortened dental arches consisting of anterior and premolar teeth have been shown to meet oral functional demands. The World Health Organization indicates that a functional, esthetic, natural dentition has at least 20 teeth. This treatment option for the partially dentate patient may provide oral functionality, improved oral hygiene, comfort, and, possibly, reduced costs. **Objective**: To explain the case shortening dental arch with splint crown in mini dental implant. **Case Report :** A male patient, 40-years-old, came to Dental Hospital Universitas Airlangga with a complaint to replace the lower right and left teeth that had been extracted 1 year ago with a denture that could not be removed. The patient wants to make dentures to make them more comfortable when chewing. The tooth extraction was performed ± 1 year ago in the lower left posterior tooth region caused caries. **Case management :** Based on the existing clinical conditions in patient, we examined the thickness of the existing bone. Then we performed to insert an implant fixture 3.0x10 mm type TS III SA in region 34 and 3.5x10 mm type ET III SA Osstem in region 35. This treatment using one stage surgery with splint crown restoration. **Conclusion :** In this case, patient refused invasive surgical procedure as bone augmentation. Shortening dental arch was chosen due to the loss of the antagonist teeth. Implant supported splint crown can be another solution because it's able to maintain the long term of mini dental implant especially in the posterior region.

KEYWORDS: Shortening dental arch , Mini dental implant, Splint Crown.

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Influence of Nd:YAG laser irradiation on enamel after Interproximal enamel reduction

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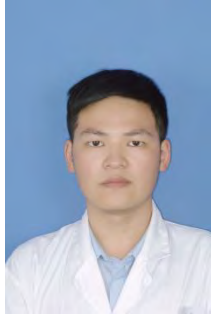
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Abstract

Objective: Caries prevention after Interproximal enamel reduction(IPR) has gradually attracted widespread attention in orthodontics.This study aimed to evaluate the surface topography and bacterial adhesion and the temperature change in pulp chamber of teeth with IPR after 532nm Nd:YAG laser irradiation and discuss the feasibility of preventing caries with laser irradiation after IPR.

Methods: The extracted teeth were used as IPR model samples and divided into control group, fluorine preparation group and different power laser irradiation combined with synergist group.The enamel surface topography was evaluated by scanning electron microscope(SEM).The streptococcus mutanswas(S.M) inoculated in sample teeth in all groups.The amount of streptococcus mutans adhesion was measured by the Plate Count and Microplate reader detection method.The temperature change in pulp chamber of teeth when irradiated by different power lasers was measured by a K type thermocouple thermometer .

Result: The surface topographies measured by SEM in the 2.2W and 2.4W laser irradiation groups were significantly smoother compared to other groups . Bacterial plate counts in 24 H showed that the amount of bacterial adhesion on the enamel surface in groups excluding the 2.8W and 3.0W laser groups was less than that of the control group (P<0.05), and the 2.4W laser irradiation group had the minimum amount of bacterial adhesion. the absorbance of the bacterial liquid in each treatment groups, excluding the 3.0W laser group, was lower than that of the control group, indicating that the bacterial liquid concentration was lower than the control group (P < 0.05),and 2.2W laser irradiation group had the minimum absorbance. When the laser irradiation power reached 2.8W and above, the temperature change in pulp chamber increased by more than 5.5° (P<0.05).

Conclusion: Nd:YAG laser irradiation combined with synergist can safely and significantly reduce the surface roughness and bacterial adhesion of enamel with IPR. In this study, 2.2W may be the best laser power.

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The human Oral – nasopharynx Microbiome as a Risk Screening Tool for Nasopharyngeal Carcinoma

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Abstract

NPC (Nasopharyngeal carcinoma) is a common head and neck cancer with poor prognosis. Finding a simple and convenient screening tool for early detection and risk screening of NPC is urgent. A total of 139 microbial samples were collected from 40 healthy people and 39 patients with nasopharyngeal biopsy, including 40 and 39 oral, eight and 27 nasal cavity, nine and 16 nasopharyngeal microbial samples. A risk screening tool for NPC was established by 16S rDNA sequencing and random forest. Patients with nasopharyngeal biopsy had significantly lower nasal cavity and nasopharynx microbial diversities than healthy people. The oral microbiome based on beta diversity was significantly different between the two groups. The NPC screening tools based on nasopharyngeal and oral microbiomes have 88% and 77.2% accuracies, respectively. The nasopharyngeal biopsy patients had significantly higher *Granulicatella* abundance in their oral cavity and lower *Pseudomonas* and *Acinetobacter* in the nasopharynx than healthy people. This study established microbiome-based non-invasive, simple, no radiation, and low-cost NPC screening tools for high-risk NPC examination. It is beneficial to guide people with a high risk of NPC for further examination which might improve the early detection of NPC and save public health costs.

Viscometry study on residual saliva using ultra micro-volume viscometer: a preliminary study on the method for collection of residual saliva

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The rheological properties of the residual saliva may affect its coating as well as lubrication capacities. However, its viscosity has never been documented so far, because the quantity of collectable sample of residual saliva is so less that its viscometry is unavailable using conventional viscometers. Recently, an ultra micro-volume viscometer (RSM-MV1), which measures the liquid viscosity even with a smallest volume of 5 μL was developed by Kurihara et al., and paved the way for the viscosity measurement of the residual saliva. This study aimed to develop the collection method of residual saliva samples from various sites of the oral cavity in humans. The requirements for the specification included that the collectable amount from a circular area on the mucosal surface with a diameter of 15 mm far exceeds the requisite amount for viscometry, and that the collection itself has no effect on the viscosity of collected saliva sample. We used glass capillaries and rubber pipettes to collect saliva samples. With the approval of the study protocols by the Institutional Review Board at Tohoku University Graduate School of Dentistry, residual saliva samples were collected from various sites of the oral cavity in general volunteers (3 males). The quantity of salivary samples was evaluated by weighing the capillaries. In addition, effects of saliva collection using capillaries on measured viscosity was evaluated using the unstimulated whole saliva collected from a volunteer. In every part other than the anterior part of tongue dorsum, the amount of collected residual saliva was much greater than 5 μL. The viscosity of unstimulated whole saliva showed no significant change before and after the collection using the capillaries. The findings suggest that the method used in this study could be a promising way for the viscometry study of the residual saliva.

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Research interests include rheological and tribological properties of saliva and their relations with oral function

Research interest   : **Prosthodontics**

NTI-tss as a Therapy for Temporomandibular Joint Disorder
(A Case Report)

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ABSTRACT

Introduction: TMD are disorders related to the masticatory system, which are considered the main musculoskeletal cause of orofacial pain. A large proportion of the global population is affected by TMD, with an estimated 25% of adults presenting signs and/or symptoms. The most common TMD diagnosis are from masticatory muscle disorder, and myofascial pain is the most common symptom.

Case Report: 23-year-old female came to Universitas Airlangga Dental Hospital with a chief complain of clicking sound and pain in the last 2 years. Pain was felt when eating and localized around the ear. Pain has been getting worse since 20 days ago.

Patient was assessed with DC/TMD. The pain comes and goes, stiff when opening the mouth and pain when chewing hard food. Opening pattern is uncorrected to the left. Click TMJ noises during open, close, and eccentric movement. Pain on Masseter and lateral pole TMJ on the right side. According to the decision tree, the diagnoses are myalgia and disc displacement with reduction.

Case Management: Prescribed with muscle relaxant and N-position exercise, but there is no improvement. So, the patient is treated with NTI-tss device for 3 and the symptom and pain are reduced. Pain free opening raised from 30 mm to 40 mm. Maximum unassisted opening from 44 mm to 46 mm. Maximum assisted opening from 48 mm to 49 mm. Lateral and protrusive movement from 8 mm to 9 mm. left lateral from 6.5 mm to 10 mm. Protrusion from 6 mm to 10 mm.

Conclusion: NTI-tss device is a treatment option for TMD patients with myofascial pain of the masticatory muscles. This could be attributed to an increase activation of periodontal mechanoreceptors surrounding incisor teeth that show a much higher sensitivity at low force levels compared to posterior teeth.

Keyword: TMD, DC-TMD, NTI-tss, Myofascial pain

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Three-dimensional volumetric evaluation of dental pulp cavity/ tooth ratio in anterior open bite malocclusion using cone beam computed tomography

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Abstract

Objectives: To assess and compare pulp cavity/ tooth volume ratio of maxillary permanent teeth between patients exhibiting anterior open bite malocclusion and those exhibiting anterior normal overbite using cone beam computed tomography (CBCT).

Materials and Methods: 3D dental images from 44 patients aged between 15 and 29 years were analyzed. The DICOM files of all dental images were imported into an image processing software for calculating pulp cavity volume and tooth volume. Differences of pulp cavity volume, tooth volume and pulp cavity/ tooth volume ratio of each tooth type from both types of occlusions were analyzed using the independent t-test. The intra-class correlation coefficient was used to evaluate intra-examiner reliability.

Results: The means of pulp cavity/ tooth volume ratio in anterior open bite group were significantly greater than those in anterior normal overbite group (central incisor $p = 0.001$; lateral incisor $p = 0.00025$ and canine $p = 0.004$). The means of root canal/ root volume ratio in anterior open bite group were significantly greater than anterior normal overbite group (central incisor $p = 0.00001$; lateral incisor $p = 0.00007$ and canine $p = 0.001$), whereas there were no significant differences of the means of pulp chamber/ crown volume was observed.

Conclusion: Anterior open bite malocclusion might lead to an increase of the pulp cavity volume and decrease of the tooth volume due to occlusal hypofunction.

Clinical relevance: Orthodontic force should be carefully determined in anterior open bite patient due to the greater root canal volume and lesser root volume.

Keywords: Anterior Open Bite, Dental Pulp Cavity, Root Canal, Pulp Chamber, Computed Tomography

Mr. Kachaphol Kuharattanachai

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Research Interests and Activities

Orthodontics, Anterior Open Bite Malocclusion, Cone Beam Computed Tomography, Finite element analysis, Biomechanics

P9-13

The relationship between the maximum bite force and the amount of overjet and overbite in anterior open bite patients: A pilot study.

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Pannapat Chanmanee, Chidchanok leethanakul

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Abstract

Maximum bite force acts as an important factor in the vertical stability after orthodontic treatment and prevents the relapse after anterior open bite correction. Objective: Is to study the relationship between the maximum bite force and the amount of overjet and overbite in anterior open bite patients. Methods: 17 anterior open bite patients (overbite 0-4 mm), 14 females and 3 males aged 26.18±1.929 years were included in this study. Lateral cephalograms were taken prior to treatment and were used to assess skeletal and dental characteristics. The maximum bite forces were also measured before treatment by Flexiforce Taskan. The relationship between the maximum bite force and the amount of overjet and overbite were analyzed by Spearman rank correlation coefficient. Results: The maximum bite force and the amount of overbite showed statistically significant positive correlation (r=0.753, P=0.000). But for overjet, trivial negative correlation with no statistically significant (r=-0.159, P=0.543) were found. Conclusions: There is a very strong positive relationship between the amount of overbite and the maximum bite force but no statistically significant relationship found on amount of overjet in anterior open bite patients.

Enhancement of orthodontic tooth movement and root resorption in ovariectomized mice

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Abstract: Osteoporosis is one of the major diseases of postmenopausal women, which is characterized by bone degradation, and is therefore an important public health issue and a topic of significant research interest worldwide. As the number of patients with osteoporosis requiring orthodontic treatment is increasing with the aging of society, it is necessary to evaluate the relations between bone metabolism in old age and orthodontic tooth movement (OTM). In addition, root resorption may occur as a side effect associated with orthodontic treatment. Root resorption, which is thought to be caused by odontoclasts as well as bone resorption by osteoclasts, is frequently observed as an unwanted side effect of orthodontic treatment and has yet to be resolved. However, the effects of changes in bone metabolism due to osteoporosis on OTM and root resorption are still unclear. Therefore, we investigated the effects of OTM and root resorption in a mouse ovariectomy (OVX)-induced osteoporosis model. Eight-week-old female wild-type mice underwent OVX or sham surgery (Sham) as controls. One month after treatment, a nickel titanium coil spring was used to apply a mesial force to the maxillary left first molars of OVX or Sham mice for 12 days. The distance between the maxillary first molar and the second molar changed due to OTM and osteoclast formation was evaluated. The odontoclast formation and root resorption along the root surface of the distobuccal root of the first molar was also evaluated by histological analysis and scanning electron microscopy. Distance of tooth movement and osteoclast formation were significantly increased in OVX mice compared to Sham controls. Furthermore, root resorption in the mesial surface of the distal molars induced by orthodontic force was significantly increased in OVX mice.

Research interest: Tooth movement, Odontoclast, Root resorption

Short CV:

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The effect of high-frequency vibration with light orthodontic force to accelerate tooth movement in rat models.

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Field of Interest: Biological of tooth movement
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Introduction: Orthodontic treatment has an effect on improving quality of life by correction of occlusion, esthetic, and psychological problems. Nevertheless, long duration of treatment time also increases risks of dental caries, periodontal health, and patient burn out. The mechanical vibration is one of the several methods to accelerate orthodontic tooth movement which provides the advantages, such as non-invasive, painless, and fewer complications. However, the effect of mechanical high-frequency vibration (HFV) is still controversy.

Material and methods: The forty-eight of rat molars were randomly assigned to control and 3-experimental groups: Vibration (HFV), Light force (LF), Light force with HFV (LFV). The NiTi close coil springs were delivered 5 g constant force on maxillary 1st molar. The modified electrical toothbrush (Oral-B$^{®}$) was used to generate HFV on occlusal surface of maxillary 1st molar for 125 Hz, 5 mins per day. Tooth movement was measured with micro-CT on days 14, 21. The root resorption was analyzed with a three-dimensional root volume.

Results: The amount of tooth movement of the LFV showed significantly greater than LF. The vibration caused a 1.8 and 2-fold significantly increased amount of tooth movement on day 14 and 21 respectively (0.22 ± 0.018 mm vs 0.125 ± 0.008 mm, 0.354 ± 0.039 mm vs 0.178 ± 0.013 mm), ($p<0.05$). The volumetric analysis of mesial, distobuccal, and distopalatal roots showed no significant difference among all groups.

Conclusions: Supplement of the HFV with light force has the accelerated effect of tooth movement without changing the root volume
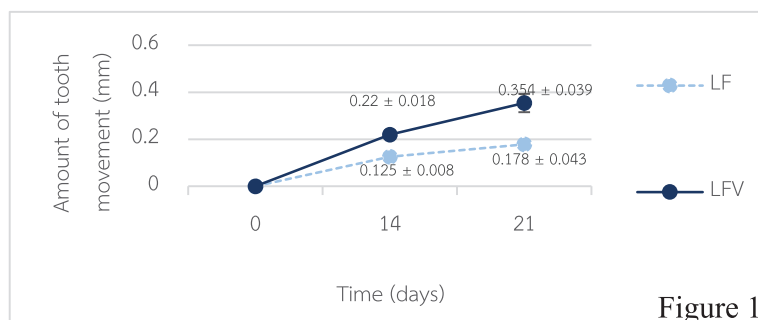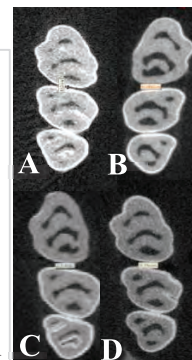

Figure 1: Cumulative amount of tooth movement from starting the experiment until day 21.
Figure 2: Micro-CT images (A: LF, 14 d, B: LFV, 14 d, C: LF, 21 d, D: LFV, 21 d)

Intelligent pH-responsive dental sealants to prevent long-term microleakage

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Abstract

Objectives: Microleakage is a determinant factor of failures in sealant application. In this study, DMAEM (dodecylmethylaminoethyl methacrylate), a pH-responsive antibacterial agent, was incorporated into resin-based sealant for the first time. The objectives of this study were to: (1) investigate the long-term performance of DMAEM-modified sealants against oral microbial-aging; and (2) investigate the long-term preventive effect of DMAEM-modified sealants on microleakage.

Methods: Depth-of-cure and cytotoxicity of DMAEM-modified sealants were measured. Then, an aging model using biofilm derived from the saliva of high caries experience children was conducted. After aging, microhardness and surface roughness were measured. Biofilm activity, lactic acid production and exopolysaccharide (EPS) production were measured. 16S rRNA gene sequencing were also performed. The effects of DMAEM on microleakage were tested using an *in vitro* microleakage assessment.

Results: The addition of DMAEM with a mass fraction of 2.5–10% did not affect

depth-of-cure values and cytotoxicity of sealants. Adding 2.5-10% DMAEM did not affect the surface roughness and microhardness after aging. Compared to control, adding 2.5-10% DMAEM reduced biofilm metabolic activity by more than 80%. The lactic acid production and EPS production were reduced by 50% in DMAEM groups. DMAEM-modified sealants maintained the microbial diversity of biofilm after aging, they also inhibited the growth of *lactobacillus*. The 5% and 10% DMAEM groups exhibited a significant reduction in microleakage compared to control.

Significance: The long-term antibacterial activities against oral microbial-aging and the long-term microecosystem-regulating capabilities enabled DMAEM-modified sealant to prevent microleakage in sealant application and thus prevent dental caries.
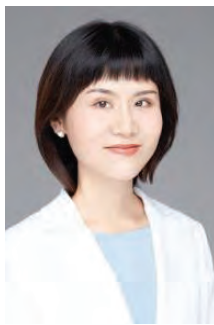
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Research Interest：

- Bacterial resistance to Quaternary Ammonium Compounds in Oral streptococci.
- Antifungal effects of pH-responsive materials and their effects on the extracellular vesicles of *Candida albicans.*

P10-4

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Research interest: Oral cancer, Microbiology

A pH-sensitive Smart Material for Oral Squamous Cell Carcinoma Inhibition

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Abstract

Oral cancer is the eighth most prevalent cancer worldwide, and more than 90% of oral cancers are oral squamous cell carcinoma (OSCC). The 5-y survival rates for individuals with oral cancer are below 50%, therefore, the invention of anti-cancer materials is urgent. Dysregulated pH emerging as is a hallmark of cancer with an increased intracellular pH (pHi) and a decreased extracellular pH (pHe). The mean value for pHe is between 6.56 and 6.97 in oral cancer, suggesting an acidic microenvironment. Here, we synthesized a pH-sensitive smart monomer named dodecylmethylaminoethyl methacrylate (DMAEM) and studied the anti-cancer effect of DMAEM in neutral (pH 7.3) and acidic (pH 6.7) culture medium. It showed that DMAEM inhibited proliferation, migration, and invasion of OSCC, and promoted apoptosis of OSCC in both pH 7.3 and pH 6.7 medium. Besides, the cancer inhibition effect was enhanced in the acidic medium compared to the neutral medium, indicating the pH-sensitive manner of this anti-cancer material. Through RNA-seq, qRT-PCR, and western blot, we found the mechanism by which DMAEM inhibiting OSCC is via inducing autophagy. The expression of autophagy-marker protein LC3B and autophagy-related genes (*ATG2A*, *ATG9B*, *ATG13*) was improved by DMAEM in a pH-dependent manner. Furthermore, in a subcutaneous transplanted tumor model, DMAEM liquids surrounded the OSCC tumors and limited the growth of OSCC. Tumor volume and expression of ki67 were lower by DMAEM treatment, verifying the anti-cancer effect of DMAEM. In summary, our study focused on the acidic tumor microenvironment, and our data suggested the potential of DMAEM as a novel pH-sensitive smart material for oral cancer treatment.

The study on magnetic nanoparticles modified antibacterial root canal sealer

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Objective: Persistent apical periodontitis is a critical challenge for endodontists. Complex root canal system anatomy and continuous infection of microorganisms and biofilms are the main reasons for its occurrence. Therefore, development of root canal filling materials with continuous antibacterial effect and tightly sealed root canals is an important strategy to avoid failure of root canal therapy and prevent persistent apical periodontitis. Adding Dimethylaminododecyl methacrylate (DMADDM) with a mass fraction of 2.5% and MNP with different mass fractions to the EndoREZ root canal sealer respectively or in a mixture. The objectives of this study were to: (1) investigate its effects on the material properties and biological safety; and (2) investigate the antibacterial effect on the single and multi-species biofilms in the root canal.

Methods: 2.5% DMADDM and different mass fractions of MNP (0%, 1%, 2%) were added to EndoREZ root canal sealer individually or together. This study compared the effects of DMADDM and different mass fractions of MNP added to EndoREZ sealer on their biological safety, solubility, apical sealing ability, and percentage of penetration under the influence of magnetic fields. This study tested the antibacterial properties and composition of multi-species biofilms composed of *Enterococcus faecalis, Lactobacillus acidophilus, Streptococcus gordonii, Actinomyces naeslundii.*

Result: Adding 2.5% DMADDM and 1% MNP to EndoREZ sealer had no significant effect on its cytotoxicity, solubility and apical sealing performance. And under the action of the external magnetic field, it could increase the percentage of penetration. The modified EndoREZ root canal sealer could effectively inhibit the formation of single-species and multi-species biofilms.

Conclusion: DMADDM and MNP modified root canal sealers had material properties and could increase root canal sealer percentage of penetration under the action of magnetic fields. They had significant inhibitory effects on and multi-species biofilms and prospects for clinical applications.

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Research Interest：

- Prevention and treatment of periapical diseases.
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The study on modified root canal sealer in Single-cone technique

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Abstract

Objective: The key to successful root canal therapy is to completely remove the infectious material in the root canal and to fill the root canal tightly. In this experiment, Dimethylaminododecyl methacrylate and Magnetic nanoparticles were used to modify EndoREZ, a commercial root canal sealer, to study the long - term antibacterial and sealing properties in Single-cone technique (SCT) of modified root canal sealer.

Methods: The single-strain enterococcus faecalis biofilm model was constructed in vitro and treated with modified root canal sealer, EndoREZ and iRoot SP. The long - term antibacterial effect of modified root canal sealer was evaluated in before aging, aging for 1 and 4 weeks through colony forming unit, scanning electron microscopy, death-live staining observation. Human teeth with single root canal were collected and filled with SCT using the above three root canal sealers respectively. Evaluate filling quality and dentinal tubule penetration by Micro-CT and Confocal Laser Scanning Microscope.

Results: Compared with the control group, the modified root canal sealer showed significant antibacterial properties both before aging and after aging ($P < 0.05$). Micro-CT showed that the root canal filling rate of the modified antibacterial root canal sealer using SCT was (95.684%±1.516), which was not significantly different from the iRoot SP group (96.544%±1.750), and both were higher than the EndoREZ group (91.027%±2.259) (P<0.05), this advantage was more significant in middle and coronal third part. The dentin penetration rate of the modified antibacterial root canal sealer (94.596%±7.856) was significantly higher than that of iRoot SP (37.044%±27.649) and EndoREZ group (68.122%±20.863) (P<0.05), the difference was found in apical, middle and coronal third part.

Conclusion: Modified antibacterial root canal sealer can effectively inhibit enterococcus faecalis biofilm, which has laid a preliminary laboratory foundation for its application in SCT in the future.

Anti-caries effect of disaggregated nano-hydroxyapatite with enhanced antibacterial and mineralization properties

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Abstract

The major contributor of development and progression in dental caries is the demineralization of dental hard tissue caused by acid produced by dental plaque metabolism. Accordingly, inhibition of cariogenic microorganisms and promotion of remineralization are considered as two effective strategies to control caries. Nano-hydroxyapatite (nHap) has an excellent ability to promote remineralization but no antibacterial property. Considering antibiotic resistance and the possible long-term harmful effects of ionic (Zn^{2+}, Cu^{2+}, Ag^+, F^-, etc.) substituted hydroxyapatite on human body, it is necessary to enhance the antibacterial performance of nHap itself. Therefore, we combined dispersant and ultrasonic cavitation to develop a kind of disaggregate nHap (dnHAP). In this study, we evaluated the remineralization ability and inhibitory effect on the regrowth of cariogenic biofilms of dnHAP, and explored its potentials in regulating oral microecology. The anti-caries performances of dnHAP were: (1) Better ability to promote remineralization than nHap; (2) inhibit the regrowth of cariogenic biofilm resulting in a reduction in metabolic activity, lactic acid production and exopolysaccharides (EPS) synthesis of regrown biofilms; (3) did not disturb oral microbiome diversity, while reducing the proportion of *Streptococcus mutans* and promoting the growth of certain probiotics. In conclusion, our study provided a feasible and convenient method for deagglomerating nano-hydroxyapatite, which enhanced its properties of antibacterial and antifungal effects without causing dysbiosis in oral microbiome.

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Education Experience: Master student in West China School of Stomatology, Sichuan University, Chengdu, China.
Research Interests: Antibacterial nanocomposite, prevention and treatment for dental caries;

Metal-organic framework-based nanoplatform accelerates soft tissue healing for treating periodontitis

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Periodontitis, a chronic inflammatory disease of the teeth, may destroy surrounding soft and hard tissue and contribute to systemic inflammation. The destruction of gingiva and periodontal ligament leads to the damage of collagen fibers and the formation of periodontal pockets, which would expedite bacterial invasion and inflammatory progression. Therefore, it is essential to accelerate soft tissue healing in the treatment of periodontitis. Herein, a versatile metal-organic framework (MOF)-based nanoplatform is fabricated using mesoporous Prussian blue (MPB) nanoparticles to load baicalein (BA), named MPB-BA. CCK-8 test revealed that the established nanoplatform MPB-BA promotes fibroblast cell proliferation. Then, transwell and wound healing experiments demonstrated that MPB-BA facilitates cell migration. Vinculin staining showed that MPB-BA favored the formation of focal adhesion. In addition, upregulated gene expression of integrin alpha 5 and beta 1 suggested increased cell adhesion. Moreover, the *in vivo* effect of MPB-BA were verified using a rat experimental periodontitis model. H&E and Masson staining revealed improved anti-inflammatory efficacy and collagen fiber reconstruction effects after MPB-BA nanoplatform application. This work may provide a novel insight into the treatment of periodontitis.

short CV

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2. Education and qualification

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Master and Ph.D.: Tianjin Medical University (2017.09-Now)

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Awards: 2019-2020 Tianjin Medical University's Excellent Graduate student

2020-2021 National Scholarship for Graduate Students

2020-2021 Tianjin's Outstanding University Students

3. Representative Publications

(1). **Yujuan Tian#**, Ying Li*, et al. Photothermal Therapy with Regulated Nrf2/NF-KB Signaling Pathway for Treating Bacteria-Induced Periodontitis. *Bioactive Materials,* 2022 Mar; 6:428-445.

(2). **Yujuan Tian#**, et al. Hierarchical Microgroove/Nanopore Topography Regulated Cell Adhesion to Enhance Osseointegration Around Intraosseous Implants *in vivo*. *Biomaterials Science*, 2021 Dec.2. DOI: https://doi.org/10.1039/d1bm01657a.

(3). Huimin Zheng#, **Yujuan Tian#**, et al. Hierarchical Micro-Nano Topography Promotes Cell Adhesion and Osteogenic Differentiation *via* Integrin α2-PI3K-AKT Signaling Axis. *Frontiers in Bioengineering and Biotechnology*, 2020 May 19;8:463.

(4). *Chinese utility model patent*: Dental tray for impression-taking ZL. 202122131023.4
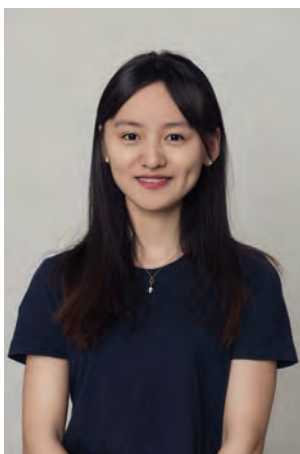
4. Research interest

(1). Nanomedicine (2). The treatment of periodontitis and mechanism research (3). Implant surface modification to promote osseointegration and soft tissue sealing.

Controlled release of dopamine coatings on titanium bidirectionally regulate osteoclastic and osteogenic response behaviors

Bone diseases, for example, osteoporosis, cause excessive differentiation of osteoclasts and decreased bone formation, resulting in imbalance of bone remodeling and poor osseointegration, which can be considered a relative contraindication for titanium implants. Dopamine (DA) might provide a solution to this problem by inhibiting osteoclasts and promoting osteoblasts at different concentrations. However, current commercial implants cannot load bone-active molecules, such as DA. Therefore, this study aimed to develop a surface modification method for implants to achieve a controlled release of DA and enhance the resistance of titanium implants to bone resorption and bone regeneration. DA-loaded alginate-arginine-glycine-aspartic acid (RGD) (AlgR) coatings on a vaterite-modified titanium surface were successfully assembled, which continuously and steadily released DA. In vitro studies have shown that materials showing good biocompatibility can not only inhibit receptor activator of nuclear factor-kappa B (NFκB) ligand (RANKL)-induced osteoclastogenesis but also enhance the adhesion and osteogenic differentiation of human bone marrow mesenchymal stem cells (hBMSCs). The optimal DA-loaded concentration of this bidirectional regulation is 100 μM. Interestingly, DA more effectively attenuated osteoclastogenesis when released in a sustained manner from titanium coatings than it did via traditional, free administration, and the alginate-RGD coating and DA clearly exhibited great synergy. This study provides a design of titanium implant surface modification to improve bone remodeling around implants.

<u>Mingyue Wang</u>, Ph.D candidate. Received a bachelor's degree from Wuhan University School and Hospital of Stomatology in 2017. Studied at Peking University School and Hospital of Stomatology from 2017 to now.

Mainly research in the surface modification of implants and the osteogenic differentiation mechanism of stem cells, has published 2 SCI articles as the first author, with a cumulative impact factor (IF) of 10.696.

Research and application of graphene oxide based materials in stomatology

ABSTRACT

Graphene oxide sheet is the product of chemical oxidation and stripping of graphite powder. Graphene oxide is a single atomic layer arranged into a two-dimensional honeycomb lattice. Therefore, its structure spans the typical scale of general chemistry and material science. Graphene oxide can be regarded as a non-traditional soft material with the characteristics of polymer, colloid, film and amphoteric molecules. The application of graphene and its series of nano materials, such as graphene oxide (GO) and reduced GO (RGO), provides various technical opportunities because they have excellent electrical, thermal, optical and mechanical properties. Graphene and its derivatives have a wide range of practical applications, including Nano Electronics (such as transistors and sensors), antibacterial paper and many biomedical applications, such as drug delivery, imaging, treatment and cell protection.

In addition to its superior physical and chemical properties, graphene oxide has good biocompatibility. A large number of studies have proved that graphene oxide will not have adverse effects on cell proliferation in a limited concentration range. Besides, graphene oxide induces three-dimensional matrix adhesion of osteoblasts with high cell viability and provides a microenvironment similar to that in vivo, which can further explain the effect of graphene oxide on cell proliferation.

Recently, more and more studies have focused on the application of graphene oxide and its nano materials in the field of oral cavity. It has been reported that graphene oxide can induce osteogenic differentiation of mesenchymal stem cells and neural differentiation of dental pulp stem cells. Therefore, we believe that graphene oxide can be used as a biological scaffold in pulp regeneration therapy to promote pulp regeneration

However, there is still a lack of clinical research on graphene oxide as pulp regeneration treatment, which needs us to further explore its feasibility.
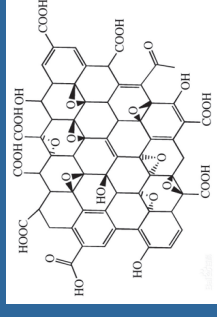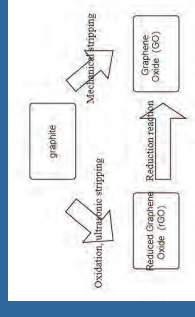
FIGURE1 Molecular structure of GO

FIGURE2 Preparation of GO

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SHORT CV

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