P5-8

Visualization and analysis of droplet dynamics at dental treatment situation

Hiromitsu Morishima[1] , Tomonari Kajita[1] , Kensuke Yamauchi[1] , Jun Watanabe[2,4], Yoko Kobayashi[2,3] , Hiroyasu Kanetaka[3] , Hiroshi Egusa[3,4] , Kenji Kikuchi[5] , and Tetsu Takahashi[1]
1 Division of Oral and Maxillofacial Surgery, Tohoku University Graduate School
of Dentistry, Sendai, Japan.
2 Division of Dental Safety and System Management, Tohoku University Hospital,
Sendai, Japan.
3 Liaison Centre for Innovative Dentistry, Graduate School of Dentistry, Tohoku University, Sendai, Japan.
4 Division of Molecular and Regenerative Prosthodontics, Graduate School of Dentistry, Tohoku University, Sendai, Japan.
5 Biological Flow Studies Laboratory, Department of Finemechanics, Graduate School of Engineering, Tohoku University, Sendai, Japan.

Introduction

Aerosols and droplets generated during dental treatment have been implicated in the person-to-person transmission of viruses.
There is current interest in understanding the mechanisms responsible for the spread of Covid-19 by these means.

After COVID-19 Pandemic

Experimental investigation & simulation
Aerosol dispersion and accumulation
Effect of masks and ventilation

Visualization for dynamics of aerosol particle: high impact for understanding

➡ Experimental study for dental treatment and oral surgery

Purpose

- ✓ Analysis of the dynamic of the aerosol particle at dental treatment by an image-computing system using high-speed video camera
- ✓ Difference of dental devices at oral surgery
- ✓ Comparison between the area at incisors and molars

Materials & Methods

Instruments

Air turbine
Green Impulse, X-ML (GC)
Rotation; 300,000rpm

Ultrasonic bone cutting device
VarioSurg 3 (NSK)
Frequency; 28-32 kHz

Implant motor & handpiece
Surgic Pro (NSK)
Rotation; 1,200 rpm

Surgical intraoral evacuator
Diameter: 3mm

Position

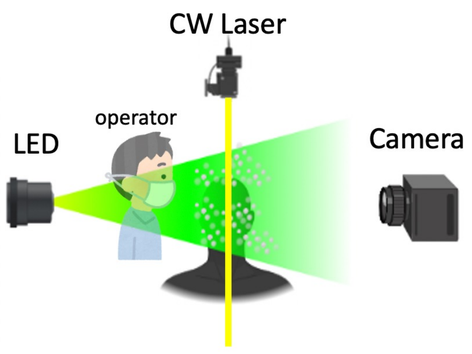
Patient model:
Reclining position (180degree)

Microparticle Visualization and Measurement

High-speed video camera
Fastscan Mini AX (Photron)
1024X1024 pixels, 6,400fps

LED Illuminator
IL-105/6X
(HARDsoft Microprocessor Systems)
CWL : 528nm, Power : 4.3W

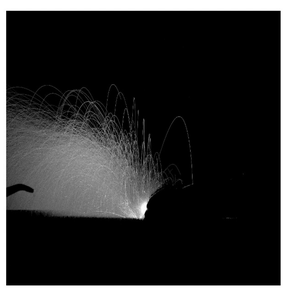
CW Laser
Ventus 532 (Laser Quantum)
CWL: 532nm, Power : 4.3W



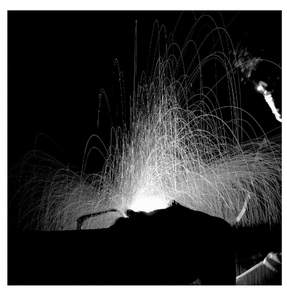
Shooting time; 20 seconds

Results

LED Laser Area: Mand. Incisors



Air turbine

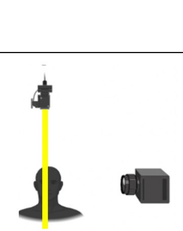


Ultrasonic bone cutting device

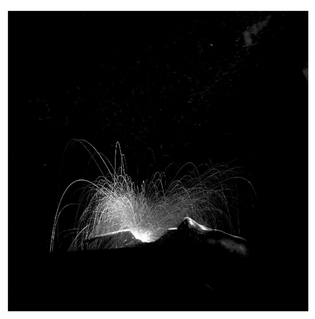
Implant motor

Results

CW Laser Area: Mand. Incisors

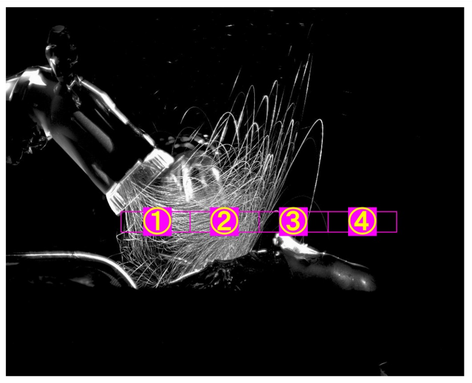


Air turbine



Ultrasonic bone cutting device

Implant motor

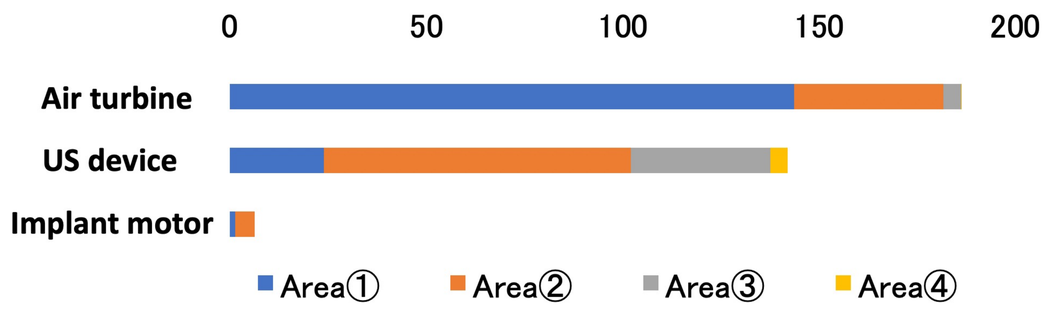


Area Analysis
① Submentum
② Mouth
③ Nose
④ Glabella

Results

Maximum Intensity Analysis

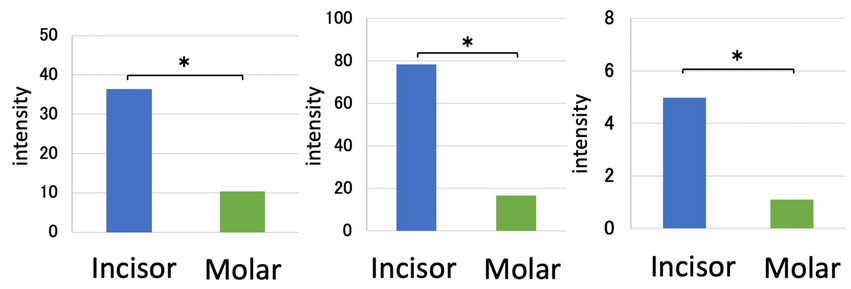
CW Laser
Location: Mand. Incisors



Maximum Intensity Analysis

CW Laser **Area 2 (Mouth)**

n=9



Student's t –test ＊: $p < 0.05$

Discussion

Implant motor was minimum generated device

Standard implant surgery

➡ Lower risk compared with general dental treatment

Incisor area was higher risk for aerosol generation

Donor site for bone graft

➡ Mandibular ramus or retromolar region is better. Chin bone using US device contains high risk of aerosol diffusion.