

Those with 0–9 teeth and didn't use a denture or a bridge were 79% more likely to be socially isolated after 6 years

~Fewer teeth and no dental prosthesis use are risk factors for being socially isolated~

Social isolation of older people in Japan is a big problem. But, the association between oral health and being social isolated over time is still unknown. In this study we examined the association among number of teeth and dental prosthesis use with social isolation status after 6 years of follow-up using the data collected for the JAGES study (n=26,417). The results showed that compared to those with 20 or more teeth, those with 10–19 teeth and those with 0–9 teeth were 13% and 36% more likely to be socially isolated after 6 years of follow-up respectively. Also, compared to those who did not use a dental prosthesis, those who used a dental prosthesis were 10% less likely to be socially isolated. When these two oral health measures were combined together, compared to those with 20 or more teeth and regardless of dental prosthesis use, those who had 0–9 teeth and didn't use a dental prosthesis were 79% more likely to be socially isolated, whereas those with 0–9 teeth and used a dental prosthesis were only 23% more likely to be socially isolated. These results mean that tooth loss was a main predictor for being social isolated at follow-up, while no dental prostheses use was an additional risk factor for social isolation. Also, it means that dental prosthesis use may reduce the risk of social isolation especially in those with severe tooth loss (i.e. more than 23 teeth lost). Preservation of the remaining teeth and providing dental prostheses services could potentially reduce the burden of social isolation among those who are 65 years or older in Japan. (In this study, dental prosthesis=denture or bridge)

※The findings of this study were published on March 30th, 2022, in *Community Dentistry and Oral Epidemiology*.

For inquiries:

Department of Oral Health Promotion, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University.

Professor Jun Aida: aida.ohp@tmd.ac.jp

Department of International and Community Oral Health, Tohoku University, Graduate School of Dentistry,

Professor Ken Osaka: osaka@m.tohoku.ac.jp

PhD student Hazem Abbas: haz-60.res.koku.sai-1623@dc.tohoku.ac.jp

Figure 1. Fully adjusted interaction: the logistic regression model examining the interaction between number of remaining teeth and dental prosthesis use on social isolation after adjusting for all confounders (N=26,417)

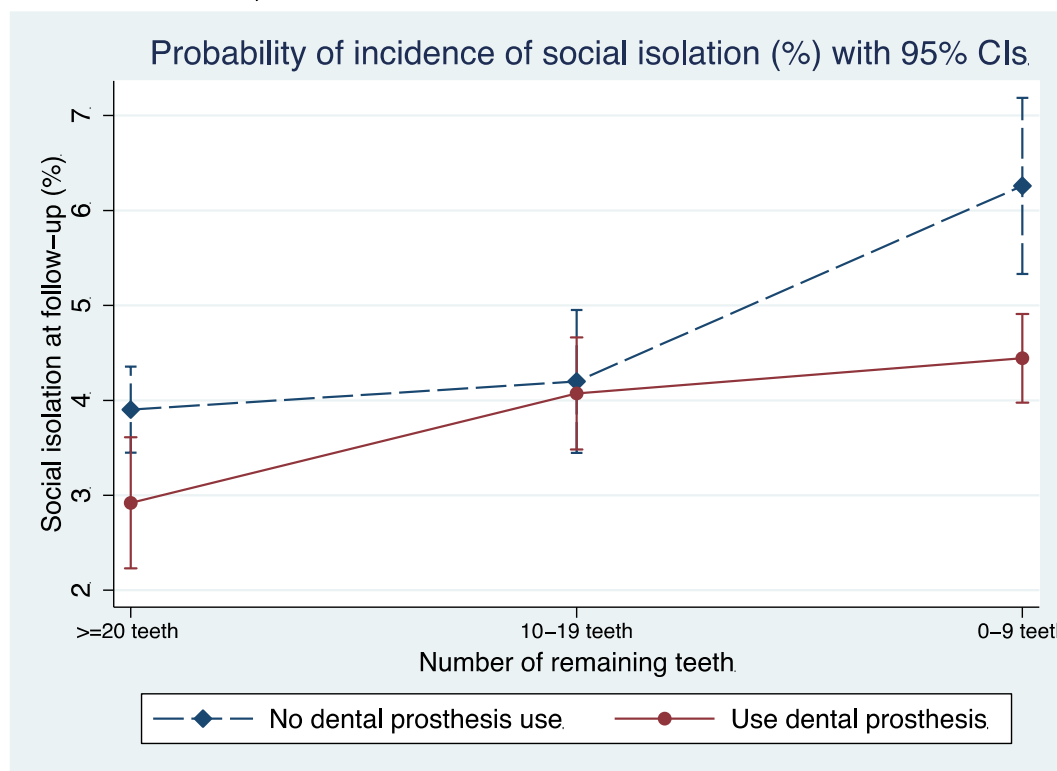


Table 1. Descriptive statistics of the number of remaining teeth and dental prosthesis use at baseline and social isolation status at follow-up (N=26,417*).

	No isolation		Isolated		Total
	N	%	N	%	



Number of Teeth (Model 1)					
≥20 teeth	10245	96.8	338	3.2	10583
10-19 teeth	6745	96.0	283	4.0	7028
0-9 teeth	8300	94.3	506	5.7	8806
Dental prosthesis use (Model 2)					
No dental prosthesis use	12321	95.7	552	4.3	12873
Use dental prosthesis	12969	95.8	575	4.2	13544
Number of teeth & dental prosthesis use (Model 3)					
≥20 teeth with or without dental prosthesis use	10245	96.8	338	3.2	10583
10-19 teeth with dental prosthesis	4202	96.1	171	3.9	4373
10-19 teeth without dental prosthesis	2543	95.8	112	4.2	2655
0-9 teeth with dental prosthesis	6271	94.9	338	5.1	6609
0-9 teeth without dental prosthesis	2029	92.4	168	7.6	2197
Total	25290	95.7	1127	4.3	26417

* Those who were not socially isolated at baseline were followed.

Table 2. Summary of the findings of the logistic regression analyses of the number of remaining teeth and dental prosthesis use at the baseline and the incident social isolation at follow-up (N=26,417††)

	Crude model		Fully adjusted model†	
	Odds ratio	95% CI	Odds ratio	95% CI
Number of Teeth (Model 1)				
≥20 teeth	1.00		1.00	
10-19 teeth	1.27*	1.08 1.49	1.13	0.96 1.33
0-9 teeth	1.85*	1.61 2.13	1.36*	1.17 1.58
Dental prosthesis use (Model 2)				
No dental prosthesis use	1.00		1.00	
Use dental prosthesis	0.99	0.88 1.12	0.90	0.80 1.02
Number of teeth & dental prosthesis use (Model 3)				
≥20 teeth with or without dental prosthesis use	1.00		1.00	
10-19 teeth with dental prosthesis	1.23*	1.02 1.49	1.12	0.93 1.35
10-19 teeth without dental prosthesis	1.33*	1.07 1.66	1.16	0.93 1.44
0-9 teeth with dental prosthesis	1.63*	1.40 1.91	1.23*	1.05 1.45
0-9 teeth without dental prosthesis	2.51*	2.07 3.04	1.79*	1.46 2.19

Model 1: Independent variable was the number of teeth.

Model 2: Independent variable was the dental prosthesis use.

Model 3: Independent variable was the combination of the number of teeth and dental prosthesis use.

†The fully adjusted model was adjusted for age, sex, educational attainment, equivalised income level, independence in activities of daily living, living area, and having depressive symptoms measured by the geriatric depression scale (GDS-15).

†† Those who were not socially isolated at baseline were followed.

**Abbreviations: CI= Confidence interval***** p-value <0.05****■ Introduction**

Social isolation is an objective multidimensional concept that includes withdrawal from the surrounding society in the form of lack of social contacts and interactions with family members, friends, and the surrounding community. But, there is no consensus on a clear definition of social isolation. Social isolation is considered a global public health concern in the modern world, especially in aging societies such as Japan. It was associated with increased all-cause mortality alongside numerous adverse health outcomes. Few previous cross-sectional studies linked poor oral health to social isolation. But, to date, the longitudinal association between oral health and social isolation has not been studied. The aim of this study was to examine the longitudinal association among self-reported number of remaining teeth and dental prosthesis use measured at baseline and incident social isolation after 6 years of follow-up. (In this study, dental prosthesis=denture or bridge)

■ Subjects and methods

This longitudinal prospective study used the self-reported panel data gathered between 2010 and 2016 for the Japan Gerontological Evaluation Study (JAGES) that was collected through postal surveys. In this study, a comprehensive multidimensional variable to measure social isolation was used. A 5-point index was derived from the binary responses to the following five domains of questions that were collected at follow-up in 2016: (1) being married or cohabitating with a partner; (2) living with one's own children or grandchildren or had someone to provide emotional or instrumental social support; (3) having immediate family members or relatives who could provide emotional or instrumental social support; (4) only had face-to-face contact with friends less than once a month or did not have any friends who could provide emotional or instrumental social support; and (5) participation in any volunteer group, leisure activity group, senior citizen club, neighborhood or residents' association, and industrial or trade association. A score of zero indicated no social isolation, and a score of five indicated severe social isolation. Following a data driven approach, a binary variable was derived from this 5-categorical variable as follows; Scores 0 to 3 were not socially isolated, and scores 4 and 5 were socially isolated. To measure oral health, two self-reported questions about the number of remaining teeth and the dental prosthesis use collected at the baseline in 2010 were used. The question "How many natural teeth do you have in your mouth?" was used to identify the number of remaining teeth. Its four responses were; "20 or more teeth", "10 to 19 teeth", "1 to 9 teeth", and "no natural teeth". However, the last two categories were combined into "0 to 9 teeth" category due to the small frequency of these participants. The binary (yes/no) response to the question, "Do you wear dentures or bridges (non-removable dentures)?" was used to determine dental prosthesis use. Following a conservative approach, age, sex, educational attainment, income, activities of daily living, living area, and having depressive symptoms were used as confounders in this study. The data collected at the baseline in 2010 for these confounders were used. For the data analyses, a descriptive analysis was performed to examine the baseline

characteristics of the participants and the descriptive statistics of social isolation at follow-up. Followed by 3 models of logistic regression analyses to calculate the odds ratio (OR) for incidence social isolation at follow-up. The difference between these 3 models was the oral health variable used. Oral health was modeled as a combination of number of remaining teeth and dental prosthesis use in model 1. And, was modeled as number of remaining teeth only in model 2. While it was modeled as dental prosthesis use only in model 3. For all regression analyses a crude analysis followed by a fully adjusted analysis was used to analyze the association between number of remaining teeth and dental prosthesis use at baseline and social isolation at follow-up. The interaction between number of teeth and dental prosthesis use on social isolation was also examined.

■ Results

The mean age of the participants at baseline was 72.3 (SD=5.0). A total of 1,127 (4.3%) participants were socially isolated at follow-up. Of these, 338 (3.2%) had ≥ 20 teeth (with or without using dental prosthesis), 171 (3.9%) had 10–19 teeth and used dental prosthesis, 112 (4.2%) had 10–19 teeth and did not use dental prosthesis, 338 (5.1%) had 0–9 teeth and used dental prosthesis, and 168 (7.6%) had 0–9 teeth and did not use dental prosthesis. Fully adjusted logistic regression models showed that the OR of incident social isolation was higher for those with fewer teeth; OR=1.13 (95%CI=0.96–1.33) for those with 10–19 teeth and OR=1.36 (95%CI=1.17–1.58) for those with 0–9 teeth, compared to those with ≥ 20 teeth. The OR of incident social isolation was lower for those who used a dental prosthesis [OR=0.90, 95%CI=0.80–1.02] compared to those who did not use a dental prosthesis. The interaction between number of teeth and dental prosthesis use demonstrated that the latter mitigated the incidence of social isolation for participants with tooth loss. Compared to those with ≥ 20 teeth (with or without prosthesis use), participants with 0–9 teeth who did not use a dental prosthesis were 79% [OR=1.79, 95%CI=1.49–2.19] more likely to be socially isolated, whereas participants with 0–9 teeth who used a dental prosthesis were only 23% [OR=1.23, 95%CI=1.05–1.45] more likely to be socially isolated.

■ Discussion

Fewer remaining teeth and no dental prosthesis use were associated with social isolation after 6 years follow-up. Tooth loss was the main predictor for social isolation at follow-up, while no dental prostheses use was an additional risk factor. The findings could be explained through several pathways, for example, having fewer natural teeth and not using dental prosthesis have adverse effect on conversational ability, self-esteem and facial attractiveness, and subsequently, it might contribute to withdrawal from the surrounding society and eventually lead to social isolation. Additionally, dental prosthesis use increases overall quality of life, and accordingly could enhance the possibility of social interaction. Furthermore, tooth loss compromises chewing abilities, influence food intake, and quality of nutrients leading to malnutrition which was associated with underweight and frailty among the older population. Also, poorer oral health was also associated with future depression. These factors have a negative effect on general health and consequently increase the chances of social isolation indirectly.



■ Significance

Dental prosthesis use may reduce the risk of social isolation especially in those with severe tooth loss (>23 teeth lost). Preservation of the remaining teeth and the provision of dental prostheses could potentially reduce the burden of social isolation among older people.

■ Published paper

Abbas, H, Aida, J, Cooray, U, et al. Does remaining teeth and dental prosthesis associate with social isolation? A six-year longitudinal study from the Japan Gerontological Evaluation Study (JAGES). *Community Dent Oral Epidemiol.* 2022; 00: 1- 10. doi:10.1111/cdoe.12746

■ Acknowledgments

We are grateful to the study participants.

No specific funding was received for the study.

The authors declare that they have no conflicts of interest.

This study used data from the Japan Gerontological Evaluation Study (JAGES).

The JAGES was supported by JSPS (Japan Society for the Promotion of Science, grant number: 19H03860, 20H00557), Health Labor Sciences Research Grant (H28-Choju-Ippan-002, H30-Junkanki-Ippan-004, 19FA2001, 19FA1012), Japan Agency for Medical Research and Development (AMED) (JP17dk0110017, JP18dk0110027, JP18ls0110002, JP18le0110009, JP20dk0110034, JP20dk0110037), Open Innovation Platform with Enterprises, Research Institute and Academia (OPERA, JPMJOP1831) from the Japan Science and Technology (JST), a grant from Innovative Research Program on Suicide Countermeasures (1-4), a grant from Sasakawa Sports Foundation, a grant from Japan Health Promotion & Fitness Foundation, a grant from Chiba Foundation for Health Promotion & Disease Prevention, the 8020 Research Grant for fiscal year 2019 from the 8020 Promotion Foundation (adopted number: 19-2-06), a grant from Niimi University (1915010), grants from Meiji Yasuda Life Foundation of Health and Welfare, and the Research Funding for Longevity Sciences from National Center for Geriatrics and Gerontology (29-42, 30- 22).