Association between Tooth Loss and Cognitive Function among the elderly in Taipei

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Background

Denture use may contribute to maintaining cognitive function by addressing the masticatory difficulties caused by tooth loss. However, there have been inconsistent reports regarding the association between tooth loss and cognitive impairment. It remains unclear how changes in tooth number and denture use affect the development of cognitive impairment in older adults over time. This study aimed to evaluate the impact of changes in tooth number and denture use on cognitive impairment development among community-dwelling older adults.

Methods

This 7-year longitudinal prospective cohort study included 64,520 community-dwelling Taiwanese older adults aged ≥65 years. The primary outcome was cognitive impairment assessed using the Short Portable Mental Status Questionnaire.

Table 1 Baseline characteristics and demographics of the study population

Characteristics	n (%)
Age, yrs (mean±SD)	72.9 ± 6.3
Sex	
Male	33,459 (51.9)
Female	31,061 (48.1)
Married, missing data=126	47,805 (74.2)
Living alone	4,148 (6.4)
Educational attainment (years), missing data=956	
≦6	21,704 (34.2)
7–9	9,154 (14.4)
≧10	32,706 (51.4)
Low–income household	3,304 (5.1)
Current smoker, missing data=152	5,107 (7.9)
Occasional or frequent drinking, missing data=164	12,092 (18.8)
Exercise (≥20 minutes per week), missing data=838	58,890 (92.5)
BMI category, missing data=658	
Underweight	2,319 (3.6)
Normal weight	29,320 (45.9)
Overweight	20,632 (32.3)
Obesity	11,591 (18.2)
Comorbidities	
Periodontitis	37,008 (57.4)
Hypertension	24,094 (37.3)
Diabetes	7,071 (10.8)
Hyperlipidemia	4,707 (7.3)
Heart disease	10,700 (16.6)
Stroke	1,381 (2.1)
Psychiatric disorders, missing data=689	6,359 (10.0)
With use of denture	15,847 (24.6)

Notes: SD = standard deviation; BMI = body mass index.

Definition of oral status

Tooth number	Definition 1	Definition 2	Definition 3
≥20 teeth	≥20 natural teeth	≥20 natural teeth	≥20 teeth, including those with dentures
10–19 teeth	10–19 natural teeth	10–19 natural teeth with / 10–19 natural teeth without	10–19 teeth, including those with dentures
1–9 teeth	1–9 natural teeth	1–9 natural teeth with dentures / 1–9 natural teeth without dentures	1–9 teeth, including those with dentures
0 teeth	No natural teeth	No natural teeth with dentures / No natural teeth without dentures	No natural teeth without dentures
Denture use	yes or no		

Results

Based on the total tooth number, including natural teeth and dentures, older adults with 10–19, 1–9, and 0 teeth had a higher risk of developing cognitive impairment than those with >20 teeth, with adjusted odds ratios (ORs) (95% confidence intervals [CIs]) of 1.40 (1.14–1.71), 1.85 (1.40–2.43), and 2.56 (1.74–3.76), respectively. Furthermore, among older adults with 10–19 teeth (OR, 0.71; 95% CI, 0.52–0.98) or 1–9 teeth (OR, 0.43, 95% CI, 0.27–0.68) at baseline, those with an increase of more than one level in tooth number during follow-up (e.g., from 10–19 teeth and dentures at baseline to more than 20 teeth and dentures through the acquisition of dental prosthetics such as dentures, bridges, or implants) had a lower risk of developing cognitive impairment than those with a stable tooth number.

Conclusions

Our findings suggest that prompt denture use and maintaining >20 teeth (including natural teeth and dentures) mitigate the risk of cognitive impairment associated with tooth loss among community-dwelling older adults.

Table 2 Association of number of teeth and cognitive impairment by multivariable adjusted GEE analysis.

Variable	Model 1 aOR	Model 1 95% CI	Model 2 aOR	Model 2 95% CI	Model 3 aOR	Model 3 95% CI
Definitions 1:						
Number of natural teeth (mean±SD)						
≥20	Reference		Reference		Reference	
10–19	1.92***	1.72–2.15	1.27**	1.10–1.46	1.23**	1.06–1.42
1–9	2.53***	2.19–2.91	1.49***	1.26–1.75	1.40***	1.19–1.66
0	3.09***	2.64–3.62	1.61***	1.34–1.93	1.53***	1.27–1.83
Denture use	0.47***	0.42–0.53	0.78***	0.68–0.89	0.81**	0.71–0.93
Changes in the number of teeth						
Stable	Reference		Reference		Reference	
Dropped one level or more	0.99	0.91–1.07	0.97	0.88–1.07	0.96	0.87–1.05
Definitions 2:						
Number of teeth						
≥20	Reference		Reference		Reference	
10–19 with denture	0.94	0.82–1.08	1.05	0.91–1.22	1.06	0.92–1.24
10–19 without denture	2.16***	1.89–2.46	1.26*	1.04–1.52	1.20	0.99–1.46
1–9 with denture	1.13	0.98–1.31	1.13	0.96–1.34	1.11	0.94–1.32
1–9 without denture	3.31***	2.74–4.00	1.70***	1.33–2.16	1.59***	1.25–2.02
0 with denture	1.39***	1.21–1.60	1.21*	1.04–1.41	1.21*	1.03–1.41
0 without denture	4.93***	3.72–6.52	2.26***	1.59–3.20	2.04***	1.42–2.94
Changes in the number of teeth						
Stable	Reference		Reference		Reference	
Dropped one level or more	0.93	0.86–1.01	0.95	0.86–1.05	0.94	0.85–1.03
Definitions 3:						
Number of natural teeth and denture						
≥20	Reference		Reference		Reference	
10–19	3.00***	2.62–3.44	1.49***	1.23–1.81	1.40**	1.14–1.71
1–9	5.32***	4.31–6.56	2.02***	1.53–2.65	1.85***	1.40–2.43
0	8.54***	6.32–11.5	2.89***	1.99–4.19	2.56***	1.74–3.76
Changes in the number of teeth						
Stable	Reference		Reference		Reference	
Dropped one level or more	2.44***	2.14–2.78	1.69***	1.45–1.98	1.63***	1.39–1.92
Moved up one level or more	0.36***	0.30–0.43	0.63***	0.48–0.83	0.66**	0.50–0.87

Notes: **aOR** = adjusted odds ratio; **95% CI** = 95 % confidence interval; **SD** = standard deviation; **Dropped one level or more**: 20 or more teeth at baseline with fewer than 20 teeth at the last examination; or 10–19 teeth at baseline with fewer than 10 teeth at the last examination; or 1–9 teeth at baseline with no teeth at follow-up; **Moved up one level or more**: 10–19 teeth and denture at baseline with more than 20 teeth and denture at the last examination; or 1–9 teeth and denture at baseline with more than 10 teeth and denture at the last examination; or no teeth or denture at baseline, but more than 1 tooth and denture at follow-up. **Model 1** was adjusted for age and sex. **Model 2** was adjusted for variables in Model 1, as well as years of education, low-income household status, marital status, living alone, smoking, drinking, exercise habits, and baseline SPMSQ score. **Model 3** was further adjusted for BMI category, comorbidities, and psychiatric disorders.
$^*P < .05$, $^{**}P < .01$, $^{***}P < .001$.

Table 3 Stratified analysis of the association between changes in the number of natural teeth and dentures and the development of cognitive impairment among participants with different number of natural teeth and dentures at baseline by multivariable-adjusted GEE analysis.

	Number of natural teeth and denture							
	≥20		10–19		1–9		0	
Variable	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI
Cognitive impairme at last examination, n (%)	1,979 (3.3)		218 (7.0)		113 (11.2)		48 (15.3)	
Changes in the number of teeth								
Stable	Reference		Reference		Reference		Reference	
Dropped one level or more	1.60***	1.35–1.90	2.13**	1.30–3.50	1.02	0.28–3.73	–	–
Moved up one level or more	–	–	0.71*	0.52–0.98	0.43**	0.27–0.68	2.32*	1.13–4.76

Notes: **aOR** = adjusted odds ratio; **95% CI** = 95 % confidence interval; **Dropped one level or more**: ≥20 teeth at baseline with fewer than 20 teeth at the last examination; or 10–19 teeth at baseline with fewer than 10 teeth at the last examination; or 1–9 teeth at baseline with no teeth at follow-up; **Moved up one level or more**: 10–19 teeth and denture at baseline with more than 20 teeth and denture at the last examination; or 1–9 teeth and denture at baseline with more than 10 teeth and denture at the last examination; or no teeth or denture at baseline, but more than 1 tooth and denture at follow-up. Adjusted with age, sex, years of education, low-income household status,, marital status, living alone, smoking, drinking, exercise habits, baseline SPMSQ score, BMI category, comorbidities, and psychiatric disorders.
$^*P < .05$, $^{**}P < .01$, $^{***}P < .001$.

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