Impact on Dietary Intake of Removable Partial Dentures Replacing a Small Number of Teeth

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The aim of this study was to clarify the impact of wearing removable partial dentures (RPDs) replacing a small number of teeth on dietary intake. Participants had at least 20 teeth and were classified as Eichner B1 or B2. The participants underwent dental and oral examinations, and their dietary intake was assessed. Analysis of covariance showed that RPD wearers consumed more vegetables, n-3 fatty acids, calcium, vitamin A, and dietary fiber than nonwearers after adjusting for possible confounding factors. It is concluded that RPDs are effective for improving dietary intake even in participants who have lost a small number of teeth. *Int J Prosthodont 2015;28:583–585. doi: 10.11607/ijp.4306*

In Japan, patients usually request removable partial dentures (RPDs) for missing molars. Many reports have suggested that treatment with RPDs is not significantly effective in recovering oral function for shortened dental arches (SDAs),[1] and patients with SDAs require more time to chew test food particles to a suitable size before swallowing than patients with complete dental arches.[2] This study aimed to clarify the impact on dietary intake of wearing RPDs in patients who have lost a small number of teeth.

Materials and Methods

The SONIC Study[3] included 1,970 participants aged 69 to 71 and 79 to 81 years. Participants were chosen who had at least 20 teeth and were classified as Eichner B1 or B2. The final analysis sample comprised 244 participants divided into two groups according to whether or not they wore RPDs (Table 1).

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Age, sex, and socioeconomic status (SES: self-rated financial status, education level, and living area) were established via interview (Table 1). To evaluate oral function, bilateral maximal occlusal force (OF)[3] and stimulated salivary flow rate (SSFR) were measured while the participant chewed paraffin wax, and occlusal units (OUs), defined as pairs of occluding teeth in the posterior region, were assessed. A pair of premolar teeth was labelled as 1OU, a pair of molar teeth was labeled as 2OU, and the sum of OU was defined as OUs ($0 \leq OUs \leq 12$). Periodontitis was evaluated by measuring the mean of the pocket probing depth (PPD). Diet during the preceding month was assessed with a brief-type self-administered diet history questionnaire (BDHQ).[4] Values of nutrients and food intake were energy-adjusted using the density method.

Age, sex, SES, BMI, oral function, PPD, number of teeth, and energy intake were compared between RPD wearers and nonwearers. Next, analysis of covariance (ANCOVA) was conducted to compare food and nutrition intake adjusted for age, sex, SES, oral function, and PPD. $P < .05$ was considered significant.

The study protocol was approved by the Institutional Review Board (IRB) of Osaka University Graduate School of Dentistry (approval number H22-E9).

Results

The proportion of RPD wearers was significantly higher in 80-year-old participants than in 70-year-old participants (Table 1). PPD was significantly larger in RPD wearers than in nonwearers. No significant differences were found in sex, SES, BMI, oral function, number of teeth, or energy intake between the two groups.

Table 1 Characteristics of Participants

	RPD nonwearers (n = 106)		RPD wearers (n = 138)		
	n	%	n	%	*P* value
Age					.007*
70	64	60.4	58	42.0	
80	42	39.6	80	58.0	
Sex					.067*
Male	58	54.7	61	44.2	
Female	48	45.3	77	55.8	
Self-rated financial status					.648*
Dissatisfied	21	19.8	23	16.7	
Moderately satisfied	56	52.8	81	58.7	
Satisfied	29	27.4	34	24.6	
Educational level					.263*
≤ 9 years	25	23.6	33	23.9	
10–12 years	60	56.6	88	63.8	
≥ 13 years	21	19.8	17	12.3	
Living area					.198*
Urban	54	50.9	79	57.2	
Rural	52	49.1	59	42.8	
BMI (kg/m2)					.075*
< 18.5	4	3.8	11	8.0	
18.5–25	77	72.6	108	78.3	
≥ 25	25	23.6	19	13.8	
Evaluations of oral function	Median	IQR	Median	IQR	*P* value
Occlusal force	471	320, 628	418	289, 586	.062†
Occlusal units	5	3, 6	5	3, 6	.913†
Stimulated salivary flow rate (mL/min)	1.4	0.9, 2.1	1.4	0.9, 2.1	.554†
Mean probing pocket depth (mm)	3.0	2.6, 3.3	3.1	2.8, 3.6	.010†
Number of teeth	23	22, 24	23	21, 24	.078†
Energy intake (kcal/day)	2,056	1,664; 2,421	1,918	1,597; 2,338	.347†

*Chi-square test was used for categorical variables.
†Mann-Whitney U test was used for continuous variables.

Table 2 Comparison of Energy-Adjusted Food and Nutrient Intakes Between RPD Wearers and Nonwearers

	RPD nonwearers (n = 106)		RPD wearers (n = 138)			
Dietary intake	Mean	95% CI	Mean	95% CI	*P* value	% Difference*
Food						
Cereals (g/1,000 kcal)	207	195–219	201	191–212	0.506	-3.0
Vegetables (g/1,000 kcal)	161	145–177	184	170–198	0.035	12.5
Fish and shellfish (g/1,000 kcal)	56	50–62	62	57–67	0.175	9.7
Meat (g/1,000 kcal)	28	25–32	33	30–36	0.061	15.2
Nutrient						
n-3 fatty acid (% energy)	1.4	1.3–1.5	1.5	1.4–1.6	0.032	6.7
Calicium (mg/1,000 kcal)	334	313–355	383	363–402	0.001	12.8
Vitamin A (μg retinol equivalent/1,000 kcal)	435	379–491	525	475–575	0.020	17.1
Vitamin C (mg/1,000 kcal)	80.0	73.6–86.2	85.1	79.2–90.9	0.271	6.0
Vitamin E (mg/1,000 kcal)	4.3	4.1–4.5	4.5	4.3–4.7	0.135	4.4
Dietary fiber (g/1,000 kcal)	7.3	6.8–7.8	7.9	7.5–8.3	0.042	7.6

Analyses of covariance were conducted controlling for age, sex, SES, OF, OUs, SSFR, and PPD between RPD wearers and nonwearers.
*Mean for (RPD wearers – nonwearers) / RPD wearers × 100 (%)

The ANCOVA showed that intake of vegetables, n-3 fatty acids, calcium, vitamin A, and dietary fiber were significantly higher in RPD wearers when adjusted for age, sex, SES, oral function, and PPD (Table 2).

Discussion

RPD wearers ate more vegetables, n-3 fatty acids, calcium, vitamin A, and dietary fiber than did nonwearers. These nutrients are important for the prevention of cardiovascular disease and cancer. Attitudes toward health were not considered to be remarkably different between the two groups since their SES was not significantly different. Because the number of occlusal units, occlusal force, and salivary flow were not significantly different between the two groups, we suggest that RPDs play a different role in dietary intake. One possibility is that RPDs facilitate bolus formation by separating the oral vestibule and oral cavity proper,[5] allowing food particles to be carried onto the occlusal surface smoothly and effectively. This would enable RPD wearers to take in more foods considered to be difficult to chew than could nonwearers.

Conclusions

RPDs appear to be effective in improving dietary intake even in participants who have lost a small number of teeth.

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References

1. Aras K, Hasanreisoğlu U, Shinogaya T. Masticatory performance, maximum occlusal force, and occlusal contact area in patients with bilaterally missing molars and distal extension removable partial dentures. Int J Prosthodont 2009;22:204–209.
2. Kreulen CM, Witter DJ, Tekamp FA, Slagter AP, Creugers NH. Swallowing threshold parameters of subjects with shortened dental arches. J Dent 2012;40:639–643.
3. Inomata C, Ikebe K, Kagawa R, et al. Significance of occlusal force for dietary fibre and vitamin intakes in independently living 70-year-old Japanese: From SONIC Study. J Dent 2014; 42:556–564.
4. Kobayashi S, Murakami K, Sasaki S, et al. Comparison of relative validity of food group intakes estimated by comprehensive and brief-type self-administered diet history questionnaires against 16 d dietary records in Japanese adults. Public Health Nutr 2011; 14:1200–1211.
5. Kaneda K, Tsuchida Y, Kohno S. Significance of unilateral free-end removable partial dentures on masticatory efficiency [in Japanese]. J Jpn Prosthodont Soc 1999;43:592–601.

Literature Abstract

Loss of Teeth Opposing Implant-Supported Prostheses in The Posterior Mandible: A Retrospective Survey in Dental Clinics

It may be hypothesized that natural teeth opposing implant-supported prosthetic teeth are more likely to be lost because of increased loading. A natural tooth moves apically more than an implant under similar loads due to the presence of periodontal ligaments, which provide a cushioning effect. The aim of this retrospective study was to investigate the incidence of loss of natural teeth opposing implant-supported prosthetic teeth in the posterior mandible. Surveys were sent to 42 dentists in Japan for information on patients who have had implants placed on one side of the posterior mandible before December 2009. Natural teeth were divided into three groups: opposing teeth, control teeth, and other teeth. Data collected on 383 patients showed that 1.72% of opposing teeth, 1.84% of control teeth, and 0.98% of other teeth were lost during a mean observation period of 72 months post implant prosthesis placement. Opposing teeth loss was significantly higher than other teeth loss; however, no significant differences were found between opposing teeth loss and control teeth loss. This observation may be due to other teeth, such as the incisors, being generally more durable compared to molar teeth. It was concluded that implant-supported prosthesis in the posterior mandibular region are not considered to be a risk factor for opposing natural teeth loss. This study was limited by relatively short observation periods, and its authors suggest that future studies should include a longer-term observation period and also provide more details about pre-existing conditions like periodontal status, chewing patterns, and bruxism.

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