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The effect of periodontal status and occlusal support on masticatory performance: the Suita study

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Abstract

Aim: In this study, we investigated the effect of differences in periodontal status in the masticatory performance of dentate subjects with the same occlusal supporting area.

Materials and Methods: The subjects of the analysis were classified into those of Eichner A1-3 (n = 1094) and Eichner B1-4 (n = 529). Subjects' periodontal status was evaluated on the basis of the Community Periodontal Index (CPI). The number of functional teeth and occlusal support were investigated, the latter on the basis of the Eichner Index. Furthermore, masticatory performance was investigated by means of test gummy jelly. For each group, periodontal status was classified in two different ways, either with/without moderate periodontitis (CPI Code ≤2/≥3) or with/without severe periodontitis (CPI Code ≤3/4), and masticatory performance was compared between the various groups.

Results: In subjects who were Eichner A1 and B3, masticatory performance was significantly lower in subjects with moderate periodontitis compared with those without, and in subjects with severe periodontitis compared with those without.

Conclusion: Periodontal disease affects masticatory performance not only if occlusion is established by natural dentition with no tooth loss but also if occlusal support has decreased.

Key words: community periodontal index; masticatory performance; occlusal support; periodontal disease

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Reduced masticatory ability as a result of tooth loss has an adverse effect on nutritional intake (Joshipura et al. 1996, Krall et al. 1998, Papas et al. 1998, Sheiham et al. 2001, Kanmori et al. 2003, Nowjack-Raymer & Sheiham 2003, Sahyoun et al. 2003), which causes a decline in overall health, reportedly causing activities of daily living and quality of life to decrease (Miura et al. 1998, Marshall et al. 2002, Takata et al. 2004, 2006, Ikebe et al. 2007). Previous studies have identified factors such as number of residual teeth (Tatematsu et al. 2004, Ikebe et al. 2011), occlusal support (Ikebe et al. 2010) and maximum bite force (Tumrasvin et al. 2006, Lepley et al. 2011) as factors related to masticatory ability, and should these decrease or decline, then masticatory ability is reported to decrease.

Periodontal disease is a chronic inflammatory disease that causes swelling and pain in the gingiva and destruction of alveolar bone, and together with caries is a major cause of tooth loss in Japanese adults

Conflict of interest and source of funding statement

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(Morita et al. 1994). The destruction of periodontal tissue caused by chronic periodontitis adversely affects the sensory function of the periodontal ligament, reduces mechanical support of the teeth and ultimately results in reduced masticatory ability (Johansson et al. 2006), suggesting that periodontal tissue destruction as a result of advanced periodontal disease may affect masticatory ability. Previous studies have found that the loss of periodontal supporting structures for remaining molars caused by periodontal disease has an adverse effect on masticatory performance (Borges et al. 2013), and that masticatory performance improved in patients with chronic periodontitis when they were given periodontal treatment (Pereira et al. 2012). These studies, however, addressed patients with natural dentitions, and there have been very few studies investigating the effect of periodontal status on masticatory ability in patients with a reduced number of teeth or reduced occlusal support. In particular, there has been no research on elderly people who have lost a large number of teeth, and the effect of periodontal status on masticatory ability in such individuals remains unknown.

Many studies have investigated methods of evaluating masticatory ability. These can be broadly divided into methods based on the patient's own subjective evaluations, and objective methods that use some sort of objective index for evaluation. Subjective evaluation methods include methods of judging masticatory ability on the basis of food acceptability, determined by means of medical history-taking or questionnaires on food intake (Wayler et al. 1982, Sato et al. 1989, Slagter et al. 1992). Objective evaluation methods include the following techniques. One is the sieve method, which uses peanuts (Manly & Braley 1950, Kapur et al. 1964, Yamashita et al. 2000), hydrocolloid material (Ohara et al. 2003), or silicone impression blocks (Slagter et al. 1993) and passes them through sieves that separate different degrees of grinding to measure masticatory performance. Other methods measure changes in ingredients eluted from within test materials, such as dye eluted from capsules containing pigment-coated granules (Nakashima et al. 1989) and the optical density method, which utilizes glucose eluted from gummy jelly as an indicator (Okiyama et al. 2003, Ikebe et al. 2005). Evaluation methods that focus on mixing ability include the mastication of cubes of paraffin wax (Sato et al. 2003) or colour-changeable chewing gum (Hayakawa et al. 1998) and the evaluation of the mixing of the test material (Schimmel et al. 2007). Of all these evaluation methods, the glucose elution method using test gummy jelly is a simple, clinically applicable method of measuring masticatory performance, and has been shown to provide high accuracy and reproducibility provided that the method of measurement is strictly controlled (Ikebe et al. 2005). Numerous epidemiological studies utilizing test gummy jelly have been performed, and contraction of the occlusal supporting area and reductions in occlusal force and salivary flow rate have been shown to be associated with reduced masticatory performance (Ikebe et al. 2012).

In this study, we carried out a large-scale survey of the general population of a Japanese city in the form of participants in the Suita Study, a prospective cohort study of cardiovascular diseases (Kokubo 2011), using test gummy jelly to measure masticatory performance to ascertain the effect of periodontal status on masticatory ability. Previous studies have shown that a decrease in occlusal support reduces masticatory performance (Ikebe et al. 2010), and in this study, we investigated the effect of differences in periodontal status in the masticatory performance of dentate subjects with the same occlusal supporting area.

Methods

Subjects

The subjects of this study were 1839 members of the general public (817 men, 1022 women, mean age 67.2 ± 7.9 years) residing in Suita City, Osaka Prefecture, who underwent a health check-up as part of the Suita Study, a prospective cohort study of cardiovascular diseases, implemented by the Department of Preventive Cardiology of the National Cerebral and Cardiovascular Center between June 2008 and June 2012. The Suita Study is a cohort study of a random sample of Suita residents that was started in 1989 by the Department of Preventive Cardiology, National Cerebral and Cardiovascular Center, Osaka, Japan and the Suita Medical Association with the aim of promoting measures to prevent cardiovascular disease in Japan. The primary cohort comprised 6485 individuals who underwent basic health checkups at the National Cerebral and Cardiovascular Center from among 12,200 individuals selected randomly by sex and age group from the register of residents of Suita City in 1989, and the secondary cohort similarly comprised 1329 individuals of 3000 selected in 1996, with the addition of 546 volunteers to make a total sample size of 8360 who in principle underwent a basic health check-up every other year.

Before the study started, the study protocol was approved by the Ethics Committee of the National Cerebral and Cardiovascular Center (M19-62), and only individuals who provided informed consent after receiving a full explanation of the study purpose and methods both in writing and orally were included among the subjects.

Oral examination

Subjects lay on a bed in the supine position, and an oral examination was performed under sufficiently bright artificial lighting. The number of functional teeth and occlusal support were investigated as factors associated with masticatory ability. Whether or not subjects wore dentures was also surveyed. Subjects' periodontal status was evaluated on the basis of the Community Periodontal Index (CPI) by means of partial 10 index teeth recording (Ainamo et al. 1982).

Number of functional teeth, occlusal support

The number of functional teeth was defined as the total number of natural and treated teeth involved in masticatory function, including pontics in fixed partial dentures and implant-supported dental prostheses, but excluding wisdom teeth that were impacted or had a high degree of torsion or slant. Occlusal support was evaluated using the Eichner

Index (Fig. 1; Eichner 1990), which is widely used for clinical prostheses (Ikebe et al. 2010).

Periodontal tissue examination

The periodontal tissue examination was performed by five dentists who had undergone calibration in advance. A total of 10 teeth were examined, comprising the maxillary and mandibular left and right first and second molars, the maxillary right central incisor and the mandibular left central incisor, and if this test could not be performed because of loss of one or both of the central incisors concerned, the same tooth on the opposite side was examined. No evaluation was performed if all the relevant teeth were missing. Periodontal status was examined using a CPI probe (YDM, Tokyo, Japan) to evaluate each tooth with respect to six periodontal pockets according to the following criteria, and the highest value code was recorded. The CPI codes were as follows. Code 0: No signs of inflammation of the gingiva; Code 1: Bleeding was evident after probing; Code 2: Dental calculus deposits (including those detected by probing up to 4 mm beneath the gingival margin); Code 3: Periodontal pocket of depth ≥4 mm but <6 mm; Code 4: Periodontal pocket of depth ≥6 mm. Cohen's κ value for the consistency between the periodontal tissue examinations of the five dentists was 0.78.

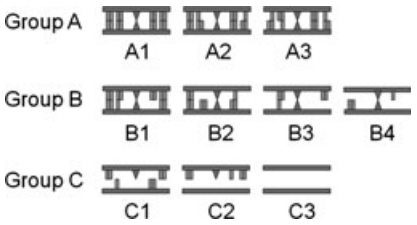

Fig. 1. Classification of occlusal support. Antagonistic occlusal contacts by natural teeth, crowns or fixed partial dentures are evaluated by Eichner Index, which describes the existing posterior occlusal support zones by dividing the occlusal status into three main groups (A, B and C). Group A has occlusal contacts in all four posterior support zones, group B has occlusal contacts in three to one zone(s) of contact or in the anterior region only, and group C has no occlusal contact at all. Group A can be divided into three subgroups; group A1 has no missing teeth in the mandible and maxilla, group A2 has at least one missing tooth in either the mandible or maxilla and group A3 has at least one missing tooth in both the mandible and maxilla. Group B can be divided into four subgroups; groups B1, B2 and B3 have posterior occlusal contact(s) in three, two and one zone(s) respectively; group B4 has occlusal contact(s) in the anterior region only. Group C can be divided into three subgroups; group C1 has at least one tooth in both the mandible and maxilla without any occlusal contact, group C2 has at least one tooth in either the mandible or maxilla and group C3 is fully edentulous in both arches.

Masticatory performance examination

The subjects were first instructed to masticate a piece of test gummy jelly (20 mm × 20 mm × 10 mm, 5.5 ± 0.5 g, UHA Mikakuto, Osaka, Japan) freely 30 times without swallowing, after which they expectorated the comminuted jelly onto a piece of cotton gauze spread over the top of a paper cup, without leaving anything in their mouths. The cotton gauze and comminuted pieces were then rinsed under running water for 30 s to remove as much of the saliva and glucose as possible adhering to their surfaces. The comminuted jelly alone was subsequently placed in a plastic container, water (35°C, 15 ml) was injected into this container and the contents were agitated for 10 s with a magnetic stirrer (PC-410D Digital Stirrer; Corning Incorporated, Tewksbury, MA, USA) (400 rpm). Immediately after this agitation, a small amount of the supernatant was collected on the tip of a set of forceps and placed in contact with the tip of a sensor fitted to a commercially available instrument for self-monitoring of blood glucose (Glutest Every; Sanwa chemical Laboratory Co., Nagoya, Japan), and the glucose concentration (mg/dl) displayed after 15 s was recorded. The increase in surface area of the comminuted jelly (in units of mm^2) was calculated from the glucose concentration using a regression formula ($y = 15x - 250$), and this was regarded as masticatory performance. For subjects who wore dentures, masticatory performance was measured while the dentures were in place.

Analytical methods

In this study, the subjects of the analysis were classified into those of Eichner A1-3 (n = 1094, 452 men, 642 women, mean age 65.0 ± 8.0 years) and Eichner B1-4 (n = 529, 249 men, 280 women, mean age 69.6 ± 6.9 years). Subjects with occlusal support of Eichner C1-3 (n = 216, 116 men, 100 women, mean age 72.5 ± 5.5 years) were excluded from the analysis because they had very few or no relevant teeth for CPI evaluation. For each group, periodontal status was classified in two different ways, either with/without moderate periodontitis (CPI Code ≤2/≥3) or with/without severe periodontitis (CPI Code ≤3/4), and masticatory performance was compared between the various groups. A similar comparison was also carried out restricted to denture wearers and non-denture wearers.

In terms of statistical procedures, masticatory performance between the groups with different periodontal status was compared using analysis of covariance (ANCOVA) adjusting for age and gender, with the level of significance set at 5%. PASW Statistics 18 (SPSS Inc., IBM, Tokyo, Japan) was used for statistical analysis.

Results

After excluding 13 subjects for whom masticatory performance could not be accurately measured, masticatory performance was measured in a total of 1610 individuals (699 men, 911 women, mean age 66.5 ± 8.0 years). With respect to occlusal support, the largest number of patients was classified as Eichner A1, and the largest number of subjects in all Eichner groups was of CPI Code 0-2. In the different Eichner groups, the proportion of teeth with CPI Code ≥3 increased in accordance with decreasing occlusal support. Only 30% of the relevant teeth had poor periodontal status in subjects who were Eichner A1, the lowest grade, but nearly 70% of them had poor periodontal status in subjects who were Eichner B3, the highest grade. The comparison of denture wearers ranged from 8% in subjects who were Eichner A2 to 95% in subjects who were Eichner B4 with a dramatic increase as occlusal support decreased (Table 1).

Table 1. Age, gender, clinical parameters and distribution of denture wearers for each Eichner Index

	Eichner Index						
	A1	A2	A3	B1	B2	B3	B4
N	653	326	107	201	130	117	76
Age*	63.9 ± 8.1	66.3 ± 7.7	67.2 ± 6.9	68.0 ± 7.3	69.8 ± 7.2	70.4 ± 6.5	72.4 ± 4.7
Male (%)	270 (41.3)	147 (45.1)	34 (31.8)	91 (45.0)	57 (43.8)	59 (49.2)	42 (43.4)
Number of present teeth*	27.0 ± 1.6	25.6 ± 1.8	23.4 ± 2.3	22.9 ± 2.3	20.0 ± 2.9	15.6 ± 3.9	13.9 ± 3.8
Number of CPI target teeth*	9.5 ± 1.0	8.7 ± 1.1	7.5 ± 1.4	6.4 ± 1.3	5.3 ± 1.4	4.1 ± 1.5	3.5 ± 1.9
Number of CPI 3 or 4 teeth*	3.6 ± 2.4	3.1 ± 2.0	3.4 ± 1.8	2.8 ± 1.6	2.5 ± 1.6	2.3 ± 1.4	2.0 ± 1.2
Prevalence of subjects with, %							
CPI 0-2	54.1	47.2	49.5	38.8	50.0	41.9	51.3
CPI 3	33.7	40.5	32.7	35.8	30.8	35.9	30.3
CPI 4	12.3	12.3	17.8	25.4	19.2	22.2	18.4
Median percentage of CPI 3 or 4 teeth / target teeth,%	30.0	33.3	43.6	41.4	50.0	66.7	60.0
Denture wearers,%	0.0	8.3	14.0	48.5	72.3	84.2	93.4

*Mean ± SD.

Table 2. Comparison of masticatory performance (mm^2) between subjects grouped according to periodontal status for each Eichner Index

Eichner Index	CPI 0-2 *versus* CPI 3-4					CPI 0-3 *versus* CPI 4				
	CPI 0-2		CPI 3-4		*p*-Value	CPI 0-3		CPI 4		*p*-Value
	N	Mean ± SE	*N*	Mean ± SE		*N*	Mean ± SE	*N*	Mean ± SE	
A1	353	5701 ± 84	300	5201 ± 92	<0.001*	573	5541 ± 66	80	4973 ± 178	0.003*
A2	154	5163 ± 135	172	5088 ± 128	0.686	286	5166 ± 99	40	4817 ± 265	0.217
A3	53	4702 ± 222	54	4569 ± 220	0.674	88	4690 ± 170	19	4380 ± 368	0.446
B1	78	4732 ± 177	123	4338 ± 140	0.083	150	4564 ± 128	51	4275 ± 220	0.259
B2	65	4124 ± 195	65	3640 ± 195	0.082	105	4009 ± 152	25	3347 ± 314	0.061
B3	49	3729 ± 227	68	3071 ± 192	0.031*	91	3537 ± 163	26	2690 ± 307	0.016*
B4	39	3179 ± 270	37	2808 ± 278	0.348	62	2898 ± 213	14	3443 ± 467	0.301

*$p < 0.05$ for ANCOVA comparing CPI 0-2 with CPI 3-4 and CPI 0-3 with CPI 4, adjusting for age and gender.

In subjects who were Eichner A1, masticatory performance was significantly lower in subjects with moderate periodontitis compared with those without, and in subjects with severe periodontitis compared with those without. In subjects who were Eichner B3, masticatory performance was significantly lower in subjects with moderate periodontitis compared with those without, and in subjects with severe periodontitis compared with those without. In groups other than these, no significant difference in masticatory performance with respect to periodontal status was evident (Table 2).

In an analysis limited to denture wearers, in subjects who were Eichner B2, masticatory performance was significantly lower in subjects with moderate periodontitis compared with those without. In subjects who were Eichner B3, masticatory performance was significantly lower in subjects with moderate periodontitis compared with those without, and in subjects with severe periodontitis compared with those without (Table 3).

In an analysis limited to non-denture wearers, excluding subjects who were Eichner A1, who were all non-denture wearers, there was no significant difference between any of the other groups in masticatory performance as a result of the health of periodontal tissue (Table 4).

Discussion

To our knowledge, this is the first large-scale study of a random sample of the general public to have shown that the state of health of periodontal tissue affects masticatory performance. The study had a number of limitations. First is the use of the CPI by means of the partial examination method for evaluating periodontal disease, which meant that not all remaining teeth were evaluated. Previous studies, however, have found that the partial examination method identified approximately 85% of individuals with periodontal disease compared with those identified by the CPI by means of full mouth recording (Shirone et al. 2007), and in the context of mass screenings, where time is limited, its use may be regarded as valid. In this study, we also used two different methods of categorizing periodontal status, with the aim of compensating for the deficiencies of the CPI partial examination method.

Table 3. Comparison of masticatory performance (mm^2) between denture wearers grouped according to periodontal status for each Eichner Index

Eichner Index	CPI 0-2 *versus* CPI 3-4					CPI 0-3 *versus* CPI 4				
	CPI 0-2		CPI 3-4		*p*-Value	CPI 0-3		CPI 4		*p*-Value
	N	Mean ± SE	*N*	Mean ± SE		*N*	Mean ± SE	*N*	Mean ± SE	
B1	43	4931 ± 238	55	4476 ± 210	0.157	77	4768 ± 178	21	4340 ± 347	0.280
B2	49	4232 ± 223	45	3507 ± 233	0.028*	74	4015 ± 184	20	3404 ± 357	0.134
B3	41	3759 ± 244	58	2962 ± 205	0.015*	75	3516 ± 179	24	2593 ± 318	0.013*
B4	37	3121 ± 280	34	2770 ± 292	0.395	58	2834 ± 222	13	3483 ± 487	0.238

*$p < 0.05$ for ANCOVA comparing CPI 0-2 with CPI 3-4 and CPI 0-3 with CPI 4, adjusting for age and gender.

Table 4. Comparison of masticatory performance (mm^2) between non-denture wearers grouped according to periodontal status for each Eichner Index

Eichner Index	CPI 0-2 *versus* CPI 3-4					CPI 0-3 *versus* CPI 4				
	CPI 0-2		CPI 3-4		*p*-Value	CPI 0-3		CPI 4		*p*-Value
	N	Mean ± SE	*N*	Mean ± SE		*N*	Mean ± SE	*N*	Mean ± SE	
A1	353	5701 ± 84	300	5201 ± 92	<0.001*	573	5541 ± 66	80	4973 ± 178	0.003*
A2	141	5177 ± 139	158	5118 ± 131	0.759	264	5164 ± 101	35	5008 ± 279	0.600
A3	43	4609 ± 240	49	4708 ± 225	0.768	74	4729 ± 180	18	4385 ± 367	0.403
B1	35	4470 ± 264	68	4234 ± 189	0.470	73	4347 ± 183	30	4235 ± 287	0.743
B2	16	3794 ± 404	20	3938 ± 361	0.793	31	3970 ± 286	5	3280 ± 718	0.380
B3	8	4014 ± 761	10	3352 ± 649	0.588	16	3632 ± 402	2	3753 ± 1198	0.926
B4	2		3			4		1		

*$p < 0.05$ for ANCOVA comparing CPI 0-2 with CPI 3-4 and CPI 0-3 with CPI 4, adjusting for age and gender.
There were only a few subjects who were Eichner B4, so they were excluded from analysis.

The second limitation is that because occlusal support was classified using the Eichner Index, and the effect of periodontal status on masticatory performance was investigated within groups with the same level of occlusal support, the sample size of some of the groups was necessarily small, meaning that their statistical power was low.

In this study, we first classified patients in each Eichner group as with/without moderate periodontitis (CPI Code ≤2/≥3). To investigate whether this difference in masticatory performance changes between individuals with more advanced periodontal disease and others, we then classified them as with/without severe periodontitis (CPI Code ≤3/4), and compared masticatory performance between the different types of periodontal status. We found that in both cases, in subjects who were Eichner A1 or B3, masticatory performance was significantly lower among those with poorer periodontal status. With the exception of subjects who were Eichner B4 and classified as with/without severe periodontitis, there was no significant difference between any of the other groups as a result of the presence of moderate or severe periodontitis, although the mean values of masticatory performance were lower. It is extremely interesting that periodontal status had a pronounced effect on masticatory performance only in subjects who were A1, with the best-established occlusal support, and B3, on the brink of tooth loss.

Alkan et al. (2006) measured maximum occlusal force in healthy individuals who still had all their teeth and individuals suffering from periodontal disease, and found that the latter exhibited significantly lower values than the former (Alkan et al. 2006). Okiyama et al. measured maximum occlusal force and masticatory performance in healthy young individuals with natural dentition, and reported that there was a significant positive correlation between these two factors. Borges et al. used alveolar bone level and wobbling of remaining teeth as indices of the progress of periodontal disease, and investigated their association with masticatory performance. They found a significant positive correlation between alveolar bone level and masticatory performance, and a tendency towards a negative correlation between wobbling and masticatory performance. In this study, we did not measure either the alveolar bone level or the wobbling of remaining teeth, but as individuals with a CPI Code ≥3 had teeth with pockets more than 4 mm deep, meaning that there was a high possibility of both a lower alveolar bone level and of wobbling, this probably had an effect on masticatory performance. These results of previous studies suggest the existence of a mechanism whereby in individuals with natural dentition, wobbling caused by worsening periodontal status induces a decrease in occlusal force, further lowering masticatory performance. Our finding that worsening periodontal status resulted in significantly lower masticatory performance among subjects who were Eichner A1, with the best-established occlusion by natural dentition, also supports this mechanism. Although

subjects who were Eichner A1 had a low proportion of teeth suffering from periodontal disease among those examined for the CPI, they may have had a high number of teeth suffering from periodontal disease (Table 1), with many of these teeth having been preserved rather than extracted, and it may be conjectured that they probably suffered from symptoms such as tooth wobbling and gingival pain that would hinder mastication. The situation of subjects who were Eichner B3 differed from that of those who were Eichner A1, with both the number of teeth and occlusal support reduced, and they were characterized by a high proportion of teeth with periodontal disease. Denture wearers accounted for the vast majority, 84%, of subjects who were Eichner B3, and wobbling of the abutment tooth as a result of periodontal disease in such denture wearers would reduce the stability of the denture, making it easy to understand why the effect on masticatory performance was so obvious.

In this study, we also divided subjects into denture wearers and non-denture wearers to investigate the effect of wearing dentures on masticatory performance (Liedberq et al. 1995). Here, too, it is extremely interesting that from subjects who were Eichner A2 to Eichner B1, with three of four occlusal support points preserved, there was no reduction in masticatory performance as a result of periodontal disease irrespective of whether or not dentures were worn, but for subjects who were Eichner B2 or B3, with two or fewer occlusal support points, denture wearers exhibited a reduction in masticatory performance as a result of periodontal disease. The reason for the lack of effect of periodontal disease in subjects from Eichner A2 to B1 may have been that these subjects were capable of masticating with teeth other than those with poor periodontal status, whereas for denture wearers, teeth with good periodontal status can be chosen as abutment teeth, meaning that dentures tend to be stable and there is less likelihood of a reduction in masticatory performance. If the occlusal supporting area becomes even smaller, however, mastication with the remaining teeth alone becomes difficult and there is less scope for choosing the abutment tooth, and when added to the fact that wobbling caused by periodontal disease may make it difficult to obtain adequate maintenance stability for dentures as well as to restrain rotational movement of distal extension saddles, the generation of a significant effect on masticatory performance can be envisaged. Almost all the subjects who were Eichner B4, who had lost all occlusal support in the molar region, were denture wearers, and rather than the periodontal status of the remaining teeth, it is possible that the state of the alveolar ridge, the quality of dentures, and the ability to make the best use of dentures may have exerted a greater effect on masticatory performance. Among non-denture wearers, excluding subjects who were Eichner A1, who were all non-denture wearers, there was no significant difference between any of the other groups in masticatory performance as a result of the state of health of periodontal tissue. This may have been because of the existence of factors that had a greater effect on masticatory performance than periodontal disease, such as the fact they did not wear dentures despite tooth loss and comminuted jelly therefore became caught in the gaps between teeth, preventing the progression of mastication, as well as unstable masticatory jaw movement.

Conclusions

Our finding in this study that periodontal disease affects the masticatory performance of elderly people not only if occlusion is established by natural dentition with no tooth loss but also if occlusal support has decreased and is now being established by dentures, suggesting that keeping periodontal tissue healthy is important to maintain masticatory performance. These findings may be valuable for the provision of dietary guidance to elderly people with tooth loss or periodontal disease.

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Clinical Relevance

Scientific rationale for the study: Little is known about the effect of periodontal status on masticatory performance in patients with a reduced number of teeth or reduced occlusal support.

Principal findings: Periodontal disease affects masticatory performance not only if occlusion is established by natural dentition with no tooth loss but also if occlusal support has decreased and is now being established by dentures.

Practical implications: These findings should provide important information for the provision of dietary guidance to elderly people with tooth loss or periodontal disease.