Change in Nutrition Intake and Nutritional Status of Pre-Elderly and Elderly After Denture Wearing

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Abstract

Posterior tooth loss can cause disruption of mastication as well as affect nutrition intake and nutritional status of pre-elderly and elderly patients. Denture may improve mastication and nutritional intake. Previous studies on denture wearing with nutrition intake and nutritional status showed inconclusive results. We analyzed the relationship between tooth loss, denture wearing, nutrition intake, and nutritional status.

An observational study was conducted on 32 patients (≥45 years old) at the Dental Hospital Faculty of Dentistry Universitas Indonesia. Oral examination was done. The Semi-quantitative Food Frequency Questionnaire and Mini Nutritional Assessment - Short Form were used to measure nutrition intake (Kcal) and nutritional status (score 0–14) at baseline and after 4, 6, and 8 weeks of denture wearing.

Significant differences were noted at baseline, and after 4, 6, and 8 weeks of denture wearing in mean nutrition intake (1895.34 ± 409.15, 1973.52 ± 395.16, 2016.70 ± 353.17, and 2022.89 ± 336.60 Kcal, respectively; $P = 0.001$) and in mean nutritional status score (9.75 ± 2.13, 11.78 ± 1.58, 11.94 ± 1.30, and 12.03 ± 1.38, respectively; $P = 0.000$). The difference between nutritional status at 4 and 8 weeks of denture wearing ($P = 0.046$) was also significant. Number of subjects at risk of malnutrition was reduced from 20 (62.5%) at baseline to 15 (47%) at 4, 6, and 8 weeks after denture wearing. Denture wearing improves nutritional intake and nutritional status of pre-elderly and elderly patients.

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Introduction

Tooth loss is a problem in the elderly and results from dental caries, periodontal problems, general and oral health, and sociodemographic factors.[1] It may lead to disruption of mastication, which in turn affects quality of life, such as the ability to eat.[2] Impaired masticatory function is more likely to be associated with posterior tooth loss due to their primary function of chewing and grinding food, while anterior tooth loss is associated more with esthetics.[3,4] The number of remaining teeth, occlusal support, and maximum bite force are related to mastication ability.[5,6]

Tooth loss also may affect food selections.[2,3] Individuals who are either edentulous or have fewer natural teeth prefer soft, easily chew food that has low nutrient density.[4] The elderly tend to adapt food intake to ease the eating process because of disruption in mastication. The majority change their meal composition and method of cooking to facilitate chewing.[7] As a result, fiber consumption in the form of fruits and vegetables is reduced as they prefer to eat softened foods.[8] Previous studies show that the number of remaining posterior teeth was associated with reduced nutrition intake in the elderly. Individuals with fewer than eight posterior occluding pairs have significant deficiencies in protein, potassium, calcium, vitamin A, vitamin D, vitamin B6, folic, and fiber intake compared to individuals with eight posterior occluding pairs.[2,4] Lack of nutrition intake in the elderly due to tooth loss may lead to

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malnutrition and a decreased immune system, physical function, and increased morbidity and mortality rates.[5] Hence, lost teeth should ideally be replaced.

Denture wearing aims to restore tooth function, including mastication. Therefore, nutrition intake may increase as mastication ability improves. A study showed that dentures have an important role in the nutritional status of the subjects.[7] The elderly wearing dentures were less prone to malnutrition compared to those who were edentulous but did not use dentures. Studies on the relationship between tooth loss, denture wearing, and nutritional status have been conducted. However, previous studies showed inconclusive results. One study reported that nutritional status in subjects increased after 1, 6, and 12 months of denture wearing,[9] while another reported no significant difference in nutritional status after wearing dentures.[3] Therefore, we analyzed the relationship between posterior tooth loss, denture wearing, nutrition intake, and nutritional status of pre-elderly and elderly subjects.

Materials and methods

This study was approved by the ethical committee of the Faculty of Dentistry Universitas Indonesia(No.102/EthicalApproval/FKGUI/IX/2017). A total of 32 patients at our dental hospital provided informed consent to participate in the study. Inclusion criteria were wearing removable dentures, age ≥45 years, ability to communicate verbally, and no systemic disease present.

Two authors performed all measurements of tooth loss, and nutrition intake and nutritional status (performed before denture insertion [baseline] and after 4, 6, and 8 weeks of denture wearing). Inter-examiner calibration was done by discussing examination protocol between the two authors to equate perception.

Tooth loss was classified using the Eichner Index (an occlusal support classification based on the presence or absence of occlusal contact in the posterior area). The region was divided into four support zones, two in the premolars and two in the molars. The Eichner Index classified tooth loss into three main categories, each with several subcategories [5]:

A. Category A (4 support zones posteriorly):
   1. A1 (no tooth loss)
   2. A2 (tooth loss in one support zone)
   3. A3 (tooth loss in two support zones)

B. Category B (1–3 support zones or occlusal contacts anteriorly):
   1. B1 (three support zones)
   2. B2 (two support zones)
   3. B3 (one support zone)
   4. B4 (only occlusal contacts in anterior).

C. Category C (no occlusal contact on the remaining teeth):
   1. C1 (teeth remain in both arches but no occlusal contact)
   2. C2 (teeth remain in one arch, no occlusal contact)
   3. C3 (completely edentulous)

The semi-quantitative Food Frequency Questionnaire (FFQ) consists of three main components (food list, eating frequency, and portion of food) and was used to calculate the amount of intake energy in Kcal units.[10] Images of 100 g of food listed in the semi-quantitative FFQ were used to facilitate data collection.[10,11]

The Mini Nutritional Assessment-Short Form (MNA-SF) questionnaire, a widely used, simple and validated scale, was used to estimate nutritional status of the subjects. It consists of six questions with a score of 0–3 for each question (maximum total score, 14). A total score of 0–7 indicated malnutrition, 8–11 risk of malnutrition, and 12–14 normal nutritional status.[12]

Data were processed using SPSS version 22.0 software (SPSS, Inc., Chicago, IL, USA). Univariate analysis was done to determine frequency distribution of each variable and bivariate analysis was done to determine the relationship between variables.

Results

Of the 32 study subjects, 18 (56.25%) and 14 (43.75%) were >60 and 45–60 years old, respectively, and most (*n* = 13) were classified into Eichner Index group C3. Most subjects were female (20/62.5%). An equal number of subjects wore removable partial and complete dentures. Seven subjects finished college, nine were high school graduates, four finished middle school, seven finished primary school, and five did not finish primary school (Table 1).

Characteristics	N	Percentage (%)
Eichner Index		
- B3	7	21.9
- B4	7	21.9
- C1	2	6.3
- C2	3	9.3
- C3	13	40.6
Denture Type		
- Partial Denture	16	50
- Complete Denture	16	50
Age		
- 45–60 years	14	43.8
- >60 years	18	56.2
Sex		
- Male	12	37.5
- Female	20	62.5
Educational Level		
- Do not graduate primary school	5	15.6
- Primary school	7	21.9
- Junior high school	4	12.5
- High school	9	28.1
- College/University	7	21.9

Table 1. Subjects' Characteristics.

A one-way ANOVA test showed no significant difference ($p \geq 0.05$) in nutrition intake as assessed using semi-quantitative FFQ between different tooth loss groups classified using the Eichner Index (Table 2). However, mean nutrition intake increased from 1895.34 ± 409.15 Kcal at baseline to 1973.52 ± 395.16, 2016.70 ± 353.17, and 2022.89 ± 336.60 Kcal after 4, 6, and 8 weeks of denture wearing, respectively (Table 3). A repeated ANOVA test showed a significant difference in nutrition intake at baseline and after 4, 6, and 8 weeks of denture wearing ($p = 0.001$). Post hoc analysis, however, showed no significant difference in nutrition intake between 4 and 6, 4 and 8, and 6 and 8 weeks of denture wearing (Table 3).

Eichner Index	Nutrition Intake (Kcal) Mean ± SD	p-value
- B3	1815 ± 141	0.494
- B4	1788 ± 404	
- C1	1588 ± 290	
- C2	1896 ± 20	
- C3	2042 ± 533	

*p-values statistically significant ($p<0.05$).

Table 2. Nutrition Intake Based on Remaining Posterior Tooth Contacts at Baseline.

	FFQ (Kcal)			
	Baseline	4 weeks	6 weeks	8 weeks
Subjects	($n = 32$)			
Mean	1895.34	1973.52	2016.70	2022.89
SD	409.15	395.16	353.17	336.60
Min–max	1068.47 – 2943.19	1097.63 – 2981.47	1111.86 – 2624.58	1161.15 – 2556.01
p value		0.001*	0.001*	0.001*

*p values statistically significant compared to baseline ($p<0.05$). Repeated ANOVA post hoc analysis result based on comparing each group, 4 vs. 6 weeks $p = 0.687$; 4 vs. 8 weeks $p = 0.552$; 6 vs. 8 weeks $p = 1.000$.

Table 3. Nutrition Intake at Baseline and After Denture Wearing.

Nutritional status was determined using the MNA-SF questionnaire. Based on characteristics, 20 subjects (62.5%) were classified as at risk of malnutrition at baseline. However, after 4, 6, and 8 weeks of denture wearing, nutritional status improved and 17 subjects (53.13%) were classified as having a normal status. Friedman analysis showed a significant difference ($p = 0.000$) in nutritional status between baseline and after 4, 6, and 8 weeks of denture wearing. A post hoc Wilcoxon test further demonstrated no significant differences between 4 and 6, and between 6 and 8 weeks of denture wearing. However, there was a difference in nutritional status between 4 and 8 weeks of denture wearing ($p = 0.046$; Table 4).

	MNA-SF			
	Baseline	4 weeks	6 weeks	8 weeks
Subjects	(n = 32)			
Malnutrition	4 (12.5%)	–	–	–
At risk of malnutrition	20 (62.5%)	15 (46.9%)	15 (46.9%)	15 (46.9%)
Normal	8 (25%)	17 (53.1%)	17 (53.1%)	17 (53.1%)
MNA-SF Score	(Range = 0–14)			
Median	10	12	12	12
Min–max	6–14	8–14	10–14	9–14
p value		0.000*	0.000*	0.000*

*p values statistically significant compared to baseline ($p< 0.05$). Wilcoxon post hoc analysis, baseline vs. 4, 6, and 8 weeks, $p= 0.000$; 4 vs. 6 weeks $p= 0.129$; 4 vs. 8 weeks $p= 0.046$; 6 vs. 8 weeks $p= 0.257$.

Table 4. Nutritional Status at Baseline and After Denture Wearing.

Discussion

There are several ways to determine nutrition intake and each has its own advantages and disadvantages. This study used FFQ to determine subjects' total energy consumption in

Kcal. This questionnaire has advantages, such as it can be applied in different populations because the food list in the questionnaire can be adjusted to the diet of the population studied. This adjustment can improve accuracy of the study. However, this questionnaire relies on subjects' memory and is unable to measure absolute intake for specific nutrients.

In this study, the Eichner Index was used because it could determine how many occlusal contacts were available that might influence mastication ability. The number of posterior occluding pairs is considered to be important in determining mastication ability.[5,6] There was no significant difference between different numbers of teeth and nutrition intake. This finding is contrary to that of other studies reporting a significant relationship between number of teeth and nutrition intake.[13,14] This might be because the nutrition intake calculation in our study was measured in Kcal, while in other studies nutrition intake is calculated for specific nutrients.[13,14] Our subjects belonged to Eichner Categories B3 to C3, who all had reduced mastication ability with none to a maximum of one pair of posterior tooth contact. Another study with subjects having two to four pairs of posterior tooth contacts (Eichner Categories A2–B2) reported no decrease in masticatory performance of the subjects.[6]

The highest nutrition intake was found in group C3. This is slightly above the recommended daily intake for elderly in Indonesia (1900 Kcal for males, 1550 Kcal for females).[15] Consumption of several key nutrients and certain food groups, for example vitamin A, vitamin C, and vegetables, is known to decrease among subjects with fewer numbers of teeth.[13] However, intake of carbohydrate, rice, and confectioneries increased in that study.[13] This might help explains the higher calories intake in our study.

Mean FFQ increased with longer denture wearing time. There was a significant difference in nutrition intake between baseline and after 4, 6, and 8 weeks of denture wearing. This corresponded with a study reporting that denture wearing had a significant effect on nutrition intake.[16] However, there was no difference in nutrition intake between 4 and 6 weeks, 4 and 8 weeks, and 6 and 8 weeks of denture wearing. This might be due to the short follow-up time so that the subjects were still on the same diet.

Denture wearing significantly improved subjects' nutritional status ($p < 0.05$). The significant difference was found between baseline and after 4, 6, and 8 weeks of denture wearing. This is in accordance with a study reporting a relationship between denture wearing and nutrition status.[17] The improved nutritional status might be caused by improvement in mastication after denture wearing.[18] However, it was contrary with a study reporting no significant difference in MNA-SF score after 1, 6, and 12 months of denture wearing.[9] MNA-SF is an objective measure that takes anthropometric measurements into account. The improvement in mastication coupled with types of food selected (carbohydrates, confectioneries, soft food) might contribute to the improved nutrition intake as shown in the increased number of kilocalories, which further increased nutritional status.

We did not investigate specific nutrients and types of food consumed by the subjects before and after wearing dentures. Therefore, future research also should consider specific nutrients and types of food consumed over a longer period of time.

Conclusions

Denture wearing affects patient nutrition. There are significant differences in nutrition intake and nutritional status after wearing removable dentures. Nutrition intake continues to increase from baseline to 4, 6, and 8 weeks of denture wearing. Nutritional status improves after denture wearing compared to baseline.

Declaration of Interest

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