ORIGINAL PAPER

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# THE EFFECT OF A REMOVABLE ACRYLIC PARTIAL DENTURE BASED ON KENNEDY'S CLASSIFICATION OF MASTICATORY ABILITY

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## ABSTRACT

**Introduction:** Tooth loss can disrupt masticatory ability and often impacts a patient's general health and quality of life. Among the variety of means to classify tooth loss, the Kennedy's classification is perhaps the most popular. The use of removable partial denture made of acrylic, based on Kennedy's classification of tooth loss may restore oral function and is therefore expected to increase patient's masticatory ability. However, not all patients wearing a denture show improved masticatory ability after using removable partial denture.

**Material and methods:** A cross-sectional study was conducted on 30 patients at the Rumah Sakit Khusus Gigi dan Mulut, Faculty of Dentistry, University of Indonesia (subjects aged 20 years and over), who used only a removable partial denture. Subjects' data were obtained, and an interview to assess masticatory ability was conducted.

**Results:** There was a significant impact ($p = 0.00$) of using a removable partial denture on tooth loss based on Kennedy's classification of masticatory ability. Kennedy classes 1 and 2, classes 2 and 3, and classes 2 and 4 removable partial dentures had a significant impact on masticatory ability. There was no significant difference between sociodemographic factors (age, gender, educational level, and income level) on tooth loss and masticatory ability.

**Conclusion:** The use of removable partial dentures based on Kennedy's classification may increase patient's masticatory ability.

**Key words:** tooth loss, Kennedy's classification, removable partial denture wearing, masticatory ability.

J Stoma 2018; 71, 4: 339-343
DOI: https://doi.org/10.5114/jos.2018.83407

## INTRODUCTION

Tooth loss is a condition caused by a variety of diseases such as caries, periodontal disease, trauma, oral cancer, and other abnormalities such as hypoplasia, attrition, cysts, and predisposing factors that derive an individual such as sociodemographic, attitude, and lifestyle [1, 2]. Futhermore, the degree and number of tooth loss are positively associated with age.

People who have experienced tooth loss often complain of masticatory dysfunction. Mastication is an individual's ability to break food into smaller parts with some specific masticatory cycles to simplify the process of swallowing [3]. The presence of masticatory dysfunction results in the interference of the mechanical destruction of food in the oral cavity and thus inhibits ingestion process, especially in hard-textured foods [4, 5].

Besides masticatory dysfunction, tooth loss also disrupts speech or phonetic abilities and results in a heavy

JOURNAL OF STOMATOLOGY
CZASOPISMO STOMATOLOGICZNE

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psychological burden due to the aesthetic appearance. These disturbances likely impact the individuals' quality of life. This severe patient impact requires rehabilitation, which is a tooth replacement using dentures to restore mastication and other functions that are lost because of lack of support from the remaining teeth [5]. There are different kinds of dentures to rehabilitate tooth loss, including fixed dentures, removable partial dentures, and implants. In this investigation, we will examine the impacts of a removable acrylic denture on tooth loss patient outcomes.

The use of removable partial dentures aims to restore the function of a missing tooth, including mastication abilities as well as the phonetic, aesthetic, and oral health of the patient [6]. A recent investigation conducted by Nakouzi et al. revealed that removable partial dentures play a deterministic role in restoring function and oral health due to the loss of teeth [7]. Another study also demonstrated that removable partial dentures can improve mastication when the denture is comfortable, and the patient can adapt to masticating using the denture [8].

The classification of tooth loss helps the dentist to determine the appropriate design of dentures by the location and the number of teeth lost. An appropriate denture design will yield a comfortable denture, improve masticatory performance, and will not injure the oral soft tissues [7, 9]. The classification that is commonly used and generally accepted is Kennedy's classification [10].

Furthermore, there are sociodemographic factors that affect masticatory ability, such as age and gender. Individual masticatory ability is related to age, as the ability to generate a forceful bite decreases with age [12, 13]. Moreover, Koc *et al.* [12] stated that gender affects masticatory ability and performance from the aspect of bite force. Men have a greater bite force, shorter duration in chewing, and chew faster than women. Other sociodemographic factors that might be related are educational level and economic income. Awareness and knowledge in oral health are associated with an individual's education level, whereas economic income serves as a benchmark of individual motivation to maintain their oral health care by routinely visiting a dentist [14].

The masticatory ability can be evaluated by two subjective and objective methods [15]. This research uses a subjective method that was conducted using a questionnaire. This questionnaire is a new measurement tool that has been validated and examines the masticatory ability from the perspective of the patient [16].

There have been many other investigations about the effect of removable partial denture wearing and masticatory ability, but this study focuses on the effect of the use of acrylic removable partial denture based on Kennedy's classification concerning masticatory ability and examines the correlation between classes in the Kennedy's classification and masticatory ability.

## MATERIAL AND METHODS

This research was approved by the local ethics committee in compliance with its requirements (code 011000817) and was conducted using a cross-sectional analytical study design. The sampling was conducted over a period of 2 months using a purposive sampling method (non-probability sampling) including all patients that met the inclusion criteria. A total of 30 subjects qualified for the inclusion and exclusion criteria were willing to participate in this study and signed an informed consent. Data were collected at the Rumah Sakit Khusus Gigi dan Mulut (RSKGM), Faculty of Dentistry, University of Indonesia, by interview and masticatory ability questionnaire. The masticatory ability questionnaire contained eight questions with a score from 0 to 2 on each question. A total score of < 12 was considered poor masticatory ability, whereas a score of 12-16 was considered good masticatory ability.

### STATISTICAL ANALYSIS

All data were analyzed using SPSS software version 22. Univariate data analysis was conducted to determine the frequency distribution and percentage of each variable on the subject. A bivariate analysis ($\chi^2$ test) was used to compare unpaired categorical variables. Kruskal-Wallis and Mann-Whitney post hoc analysis were used to assess the relationship between classes in the variable of removable partial denture based on Kennedy's classification with masticatory ability. All data are presented as a mean ± the standard error of the mean, and statistical significance was set at $p < 0.05$.

## RESULTS

The majority of the 30 subjects (56.7%, 17 patients) were considered middle aged and included an equal number of male and female subjects (15 in each category). Educational level variables were divided into four classes of education, including elementary school, junior high school, high school, and bachelor's education and beyond. Most of the subjects had completed schooling through high school (56.7%, 17 patients). The percentage of subjects who used an acrylic removable partial denture with tooth loss class 1 Kennedy was 20% (6 patients), class 2 Kennedy was 23.3% (7 patients), class 3 Kennedy was 40% (12 patients), and class 4 Kennedy was 16.7% (5 patients). Based on the subject's masticatory ability, there were 11 subjects with poor masticatory ability and 19 subjects with good masticatory ability.

According to the results shown in Table 1, removable partial dentures based on Kennedy's classification have a significant correlation ($p < 0.05$) on masticatory ability.

There was a significant correlation between classes 1 and 2 Kennedy, classes 2 and 3 Kennedy, classes 2 and

4 Kennedy, and masticatory ability. Meanwhile, Tables 3 and 4 shows that there were no significant correlation between sociodemographic factors (age, gender, and educational level), and tooth loss and masticatory ability.

## DISCUSSION

This is the first investigation to examine the impact of partial denture use based on Kennedy's classification, masticatory ability, and sociodemographic factors (age, gender, and educational level). A crucial finding of this investigation was the significant differences ($p < 0.05$) between acrylic removable partial dentures based on Kennedy's classification and masticatory ability. This may indicate a correlation between the use of dentures and Kennedy's classification, as most subjects who used an acrylic removable partial denture had good masticatory ability. These findings are supported by Nakouzi *et al.* who also demonstrated that removable partial denture has a strong connection with masticatory ability due to their important role in restoring oral function and health following teeth loss. Thus, the use of dentures like the ones utilized herein may have a positive impact on patient satisfaction and quality of life [7, 17].

The study also revealed that subjects with free-end saddle removable partial dentures or classes 1 and 2 Kennedy have a poor masticatory ability compared with subjects who use bounded saddle removable partial dentures or classes 3 and 4 Kennedy. Recently, Picton and Willis demonstrated that removable partial dentures with tooth loss classes 1 and 2 Kennedy are considered more problematic; this is because the missing teeth are posterior, so the occlusal force that is given to the denture is higher.

Subjects with classes 3 and 4 Kennedy have better masticatory ability. For example, Armellini *et al.* showed that removable partial dentures have a more positive impact on the dentures that replace anterior teeth because the posterior teeth are still natural and thus, the denture does not significantly impact the masticatory process [18].

Subjects with class 1 Kennedy have lost approximately five teeth, wheras class 2 Kennedy patients have lost approximately six teeth. Given the fewer teeth remaining in these patients, this may be one reason why subjects from the present investigation with classes 3 and 4 Kennedy show better mastication abilities.

There are many factors that influence the reason why the acrylic-made removable partial dentures that were made in the RSKGM FKG UI have not been able to restore the ability of mastication on the seventh day after the insertion of the denture, even though it was convenient to use. Work conducted by Nakouzi *et al.* suggests that the average time for a person to adapt to removable partial dentures s about 32.5 days [7].

**TABLE 1.** Relationship between removable partial denture based on Kennedy's classification and masticatory ability

| Removable partial denture based on Kennedy's classification | Masticatory ability *n* (%) | | *p* |
|---|---|---|---|
| | Poor | Good | |
| Class 1 Kennedy | 3 (50) | 3 (50) | 0.00 |
| Class 2 Kennedy | 7 (100) | 0 | |
| Class 3 Kennedy | 1 (8.3) | 11 (91.7) | |
| Class 4 Kennedy | 0 | 5 (100) | |
| Total | 11 (36.7) | 19 (63.3) | – |

**TABLE 2.** Post hoc tests between removable partial denture based on Kennedy's classification and masticatory ability

| Masticatory ability | *p* |
|---|---|
| Class 1 vs. class 2 Kennedy | 0.040 |
| Class 1 vs. class 3 Kennedy | 0.051 |
| Class 1 vs. class 4 Kennedy | 0.077 |
| Class 2 vs. class 3 Kennedy | 0.000 |
| Class 2 vs. class 4 Kennedy | 0.001 |
| Class 3 vs. class 4 Kennedy | 0.519 |

Oral tissues need time to adapt to the denture because it will cause a foreign taste in the mouth and will interfere with the sensory function when talking or chewing [8]. Considering the fact that the subjects herein were only wearing the dentures for 7 days, it could be the reason why the subject with classes 1 and 2 Kennedy showed poor masticatory ability. The adaptation process for each is personal and subjective and depends on the individual's psychological factors [7].

The Kruskal-Wallis assessment of sociodemographic factors (age, gender, and educational level) with tooth loss showed no significant differences ($p \geq 0.05$). Many studies have examined the pattern of tooth loss in different populations and countries, and almost all studies showed no correlation between gender and tooth loss [19, 20]. In contrast to the correlation between age and tooth loss based on Kennedy's classification, Jeyapalan states in his study that the younger population was more likely to have classes 3 and 4 tooth loss. This is because the first molar that first grew had a high-risk of caries and at a young age, the maxillary incisors have a high-risk of trauma. While elderly individuals were more likely to have classes 1 and 2 Kennedy (free-end saddle), the risk of missing teeth is high [19].

Regarding education level, it is assumed that the higher the individual's education, the higher his knowledge of maintaining oral health, thus preventing tooth loss.

**TABLE 3.** Relationship between sociodemographic factors and tooth loss

| Factor | Kennedy's classification , *n* (%) | | | | *p* |
|---|---|---|---|---|---|
| | Class 1 | Class 2 | Class 3 | Class 4 | |
| Age | | | | | |
| Adult | 1 (12.5) | 2 (25) | 3 (37.5) | 2 (25) | 0.752 |
| Middle-aged adult | 4 (23.5) | 3 (17.6) | 9 (52.9) | 1 (5.9) | |
| Elderly | 1 (20) | 2 (40) | 0 | 2 (40) | |
| Gender | | | | | |
| Man | 1 (6.7) | 4 (26.7) | 7 (46.7) | 3 (20) | 0.171 |
| Woman | 5 (33.3) | 3 (20) | 5 (33.3) | 2 (13.3) | |
| Educational level | | | | | |
| No school | 0 | 0 | 0 | 0 | 0.237 |
| Elementary | 0 | 0 | 0 | 0 | |
| Junior high school | 0 | 0 | 0 | 1 (100) | |
| High school | 5 (29.4) | 4 (23.5) | 5 (29.4) | 3 (17.6) | |
| Bachelor | 1 (8.3) | 3 (25) | 7 (58.3) | 1 (8.3) | |

**TABLE 4.** Relationship between sociodemographic factors and masticatory ability

| Factor | Masticatory ability, *n* (%) | | *p* |
|---|---|---|---|
| | Buruk | Baik | |
| Age | | | |
| Adult | 4 (50.0) | 4 (50.0) | 0.610 |
| Middle-aged adult | 5 (29.4) | 12 (70.6) | |
| Elderly | 2 (40.0) | 3 (60.0) | |
| Gender | | | |
| Man | 6 (40.0) | 9 (60.0) | 1.000 |
| Woman | 5 (33.3) | 10 (66.7) | |
| Educational level | | | |
| No school | 0 | 0 | 0.705 |
| Elementary school | 0 | 0 | |
| Junior high school | 0 | 1 (100.0) | |
| High school | 6 (35.3) | 11 (64.7) | |
| Bachelor | 5 (41.7) | 7 (58.3) | |

However, in this study, there was no significant correlation between educational level and tooth loss. This challenge our understanding of the impacts of socioeconomic status on oral health and warrants further investigation.

Furthermore, the sociodemographic factor was also tested for its correlation with masticatory ability, and there was no significant difference in any tested parameter ($p \geq 0.05$). This result is in line with research conducted by Pratama *et al.*, which states that there is no relationship between age and gender and masticatory ability [8]. Research from Hatch et al. also states that physiological changes due to age do not affect mastication ability, as long as the individual still has appropriate posterior teeth contact [19]. The discrepancy between sociodemographic factors and tooth loss and mastication may be due to a low number of subjects included in the present investigation. Therefore, these results should be interpreted with caution.

## CONCLUSIONS

Based on this study, we found that there is a correlation between removable partial denture based on Kennedy's classification and masticatory ability. There is a significant relationship between classes 1 and 2 Kennedy, classes 2 and 3 Kennedy, and classes 2 and 4 Kennedy with mastication ability. There is no correlation between sociodemographic factors (age, gender, and educational level) and tooth loss. There is no correlation between sociodemographic factors (age, gender, and educational level) and masticatory ability.

## ACKNOWLEDGMENTS

The publication of this manuscript is supported by the Directorate of Research and Community Engagement of the Universitas Indonesia.

## CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## References


1. Information Center of Indonesian Minsitry of Health [Internet]. Data and Infornation Center of Indonesian Ministry of Health, Jakarta 2014; 1-5.
2. Riadiani B, Dewi RS, Ariani N, Gita F. Tooth loss and perceived ability in post-menopausal women. J Dent Indones 2014; 21: 11-15.
3. Carr A, Brown D. McCracken's Removable Partial Prosthodontics. 13th ed. Mosby, St. Louis 2015; 3, 5-7, 16-20, 21-28, 175-177.
4. Smith M. Adults, teeth for life? Aspects of oral health status influencing the nutrition of older. Nutr Diet 2008; 65: 211-215.
5. Bagewitz I, Soderfeldt B, Palmqvist SNK. Oral prostheses and oral health-related quality of life: a survey study of an adult Swedish population. Int J Prosthodont 2007; 20: 132-142.
6. Henderson D. McCracken's Removable Partial Prosthodontics. 5th ed. Elsevier Mosby, St. Louis 1977; 1-6.
7. Nakouzi J, Villegas F, Vildosola P. Influence of adaptation of removable partial denture on masticatory performance. J Oral Res 2016; 5: 279-284.
8. Pratama S, Koesmaningati H, Kusdhany L. The effect of various factors on the masticatory performance of removable denture wearer. J Phys Conf Ser 2017; 884: 012074.
9. Tyson K, Yemm R, Scott BJ. Understanding Partial Denture Design. Oxford University Press, Oxford 2007; 4-6, 11-16, 41.
10. Galagali G, Mahoorkar S. Critical evaluation of classification systems of partially edentulous arches. Int J Dent Clin 2010; 2: 45-52.
11. Nassani MZ, Tarakji B, Baroudi K, Sakka S. Reappraisal of the removable partial denture as a treatment option for the shorthened dental arch. Eur J Dent 2013; 7: 251-256.
12. Koc D, Dogan AB. Bite force and influential factors on bite force measurements: a literature review. Eur J Dent 2010; 2: 223-232.
13. Hatch J, Shinkai R, Sakai S, et al. Determinants of masticatory performance in dentate adults. Arch Oral Biol 2001; 46: 641-648.
14. Moynihan P, Petersen PE. Diet, nutrition and the prevention of dental diseases. Public Health Nutr 2004; 7 (1A): 201-226.
15. Ishikawa Y, Watanabe I, Hayakawa I, et al. Evaluations of masticatory performance of complete denture wearers using color-changeable chewing gum and other evaluating methods. J Med Dent Sci 2007; 54: 65-70.
16. Hanin I. Relationship between masticatory ability (analyzed with masticatory ability assessment tool) and quality of life in pre-elderly and elderly women. Fakultas Kedokteran Gigi Universitas Indonesia, 2012.
17. Fueki K, Yoshida E, Igarashi Y. A systematic review of prosthetic restoration in patients with shortened dental arches. Japan Dent Sci Rev 2011; 47: 167-174.
18. Armellini D, Heydecke G, Witter D, Creugers NH. Effects of removable partial denture on the quality of life in people with shortened dental arches. Ned Tijdschr Tandheelkd 2009; 116: 687-693.
19. Jeyapalan V, Krishnan C. Partial edentulism and its correlation to age, gender, socio-economic status and incidence of various Kennedy's classes – a literature review. J Clin Diagnostic Res 2015; 9: ZE14-ZE17.
20. Araby YA, Almutairy AS, Alotaibi FM. Pattern of partial edentulism in correlation to age and gender among a selected Saudi population. Int J Dent Sci Res 2017; 5: 1–4.