

Correlation Between Masticatory Performance and Quality of Life in Patients with Posterior Implant-supported Single Crown

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Abstract

We sought to analyze the relationship between mastication performance (objectively and subjectively) and quality of life among patients with posterior implant-supported single crowns.

A mastication performance evaluation was conducted on 60 respondents with posterior implant-supported single crowns. An analysis was conducted to determine the relationship between mastication performance and quality of life and its correlation with age, sex, education, number of implants and how long since the implant was installed.

There was a significant correlation between quality of life with mastication performance assessed subjectively ($p = 0.000$) but no significant correlation between quality of life and mastication performance assessed objectively ($p = 0.864$). There was no significant relationship between mastication performance assessed objectively and that assessed subjectively ($p = 0.818$). Quality of life showed a significant correlation only with age ($p = 0.002$).

There was a significant correlation between mastication performance assessed subjectively and quality of life among patients with posterior implant-supported single crowns.

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Introduction

Tooth loss can cause difficulty in chewing and biting food or a disruption of the function of mastication, requiring abstinence from certain types of food. Tooth loss can be caused by several occurrences, including trauma, caries, and periodontal and iatrogenic diseases. In addition to changing mastication performance, such also causes disruptions in phonetic function and aesthetic and alveolar bone changes and, if not addressed immediately, alterations in vertical dimensions and oral health status.¹⁻³

Rapid technological development in the last few years has led to the growing popularity of the use of implant-supported single crowns to replace missing teeth. The high success rate (97%) has led more people to be interested in

receiving this type of treatment, further increasing the public expectation of dental implants both in terms of functional and aesthetic outcomes.⁴

The patient's perception is important when determining indications and estimating the results of implants in dental treatment. The domains for examining the long-term success of dental implant treatment include survival/longevity, functional, economic, and psychological. In the psychological domain, function factors, cleanliness, comfort, aesthetics, and patient satisfaction are the benchmarks by which to measure the success of treatment. Objective measurements for the success of implant-supported single crowns include survival rates, tissue and bone responses, and masticatory performance, while subjective examinations consist of patient satisfaction, confidence, and body language as well as improvements in quality of life. Quality of life based on the definition of the World Health Organization is an individual's assessment of their position in life, within the scope of the culture and social values in which they live, and is related to goals, expectations, standards, and life priorities.^{5,6} In the field of dentistry, oral health-related quality of life is a concept

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examining the quality of life related to oral health, which emphasizes the patient's perception of his or her own quality of life. The Oral Health Impact Profile (OHIP-14) was developed as a simple assessment that can be used to follow clinical examinations. Slade showed that the OHIP-14 demonstrates good validation and reliability in measuring the condition of a person with regard to their functional limitations and discomfort caused by dental and oral health conditions. In OHIP-14, the consequences associated with disease in the mouth are related to the level of biology (impaired function), to the level of habits (limited function, discomfort, and limitations), and to the level of disability. OHIP-14 is a short-form questionnaire widely used in research and which has been previously validated in Bahasa Indonesia.^{7,8}

In recent years, dental implants have been widely used in the field of prosthodontics. Posterior implant-supported single crowns are often used to address the loss one or two teeth both anteriorly and posteriorly. Mitigating tooth loss with dental implants shows a high success rate and does not cause complications among the neighboring teeth. The advantage of implant-supported single crowns include the high success rate, a reduction in the risk of endodontic treatment, facilitates ease in cleaning the proximal part, increases the aesthetics of the teeth, prevents bone resorption, reduces the sensitivity of neighboring teeth, reduces the loss of supporting teeth in treatment with rigid fixed bridges and beneficial psychological factors.⁹⁻¹¹

Various methods of assessing mastication performance both subjectively and objectively have been developed to evaluate both partial- and full-dentures patients, but, to our knowledge, this assessment has never been conducted among patients with posterior implant-supported single crowns, especially in Indonesia. Objective measurements of mastication performance involve using color-changeable chewing gum and applying a mastication performance questionnaire that has been validated by the Universitas Indonesia.¹⁰ The measurement of the mastication performance objectively can determine the level of patient satisfaction, which assists with improving treatment outcomes.

In this study, the assessment of the correlation between mastication performance assessed objectively using color-changeable chewing gum and subjectively using a

mastication performance questionnaire and the quality of life using the OHIP-14 among patients with posterior implant-supported single crowns was conducted. In addition, various influencing factors such as the age, sex, education, number of implants, and how long since the implant was installed were assessed.

Materials and methods

The evaluation of masticatory function was completed both subjectively and objectively. Patients completed self-administered questionnaires and masticatory performance was clinically evaluated with color-changeable chewing gum. The study included 60 participants—33 women and 27 men—aged 23 to 68 years with posterior implant-supported single crowns who had been rehabilitated at Rumah Sakit Gigi Mulut, Faculty of Dentistry, Universitas Indonesia and recalled in this study. The study design was prospective with a cross-sectional nature. Eligibility criteria included having posterior implant-supported single crowns for least four months, willingness to participate, good general health, opposing natural teeth, and normal occlusion and articulation. Exclusion criteria were unwillingness to participate, temporomandibular disorders, and disease that caused dysfunction of the masticatory muscles.

The current study was performed with the approval of the Faculty of Dentistry, Universitas Indonesia ethical committee (no. 24/ethical approval/FKGUI/2019) and informed consent was obtained from all respondents prior to their inclusion.

Respondents filled out the OHIP-14 questionnaire and mastication performance questionnaire (consisting of eight questions) after receiving an explanation of the study. The original OHIP-14 consisted of 14 questions, divided into seven conceptual dimensions of impact (or subscales) as follows: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. The interviewed patients were asked to indicate how often they experienced a specific impact. Responses for each question were structured on a five-point Likert scale encoded as follows: never (0), hardly ever (1), occasionally (2), fairly often (3), and very often (4).⁸⁻¹² Masticatory performance was objectively evaluated by chewing a piece of

color-changeable chewing gum (Figure 1) (Xylitol; Lotte, Tokyo, Japan). The respondents were asked to chew as they would conduct habitual chewing for 60 strokes for 60 seconds measured by metronome; the gum was then removed pressed into a thickness of 1.5 mm between two glass plates and the color analyzed with a color chart. This gum base contained red, yellow, and blue dyes; citric acid; and xylitol. The red dye is pH-sensitive and appears under neutral or alkaline conditions. As the pH inside the chewing gum is kept low by the citric acid, the color of the chewing gum remains yellowish-green before chewing. With the progression of chewing, the color of the chewing gum turns from yellowish-green to red because the yellow and blue dyes seep into the saliva and the red dye appears as a result of elution of the citric acid.^{1,2,13-20} In other words, the gum initially had a greenish color and became increasingly reddish with the duration and intensity of chewing, with a strong correlation between color-change and masticatory performance and ability (Figure 1).



Figure 1. (a) Color-changeable chewing gum and (b) color chart.

Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences version 22.00 software program (IBM Corp., Armonk, NY, USA), while the Spearman and Mann–Whitney U tests were used to analyze the correlation between mastication performance objectively or mastication performance subjectively among quality of life and while considering factors such as age, sex, education, number of implants, and how long the implant was placed.

Results

Table 1 presents the distribution of subjects based on age, gender, education, and number of implants. From the analysis, there was a significant correlation observed between mastication performance subjectively with quality of life ($p < 0.05$), while there was no significant

correlation between mastication performance subjectively and objectively ($p > 0.05$) (Table 2).

Variable	Frequency	Percent (%)
Age (years)		
17–25	1	1.7
26–35	11	18.3
36–45	12	20.0
46–55	15	25.0
56–65	17	28.3
> 65	4	6.7
Gender		
Male	27	45
Female	33	55
Education		
Middle	19	31.67
High	41	68.33
Number of implants		
1	41	68.3
> 1	19	31.7

Table 1. Subject distribution based on age, sex, education, and number of implants.

Variable	r	p-value
OHIP and mastication subjectively	-0.452	0.000
OHIP-14 and mastication objectively	-0.023	0.864
Mastication objectively and mastication objectively	-0.030	0.819
Spearman correlation		
*Significance ($p < 0.05$)		

Table 2. Correlation between OHIP-14, mastication performance subjectively, and mastication performance objectively.

Variable	p-value
Age	0.002*
Gender	0.524**
Education	0.580**
Number of implants	0.980**
Time of implant placement	0.051*
* Spearman test, **Mann–Whitney U test	
Significance ($p < 0.05$)	

Table 3. Correlation between OHIP-14 and other variables (age, gender, education, number of implants, and how long the implant was placed).

Per Table 3, the data supported that only age was significantly correlated with quality of life ($p < 0.05$). Table 5 showed that there was a significant correlation between education level and how long since the implant was installed and mastication performance objectively, but this correlation was statistically weak. There was no

significant correlation ($p > 0.05$) seen between mastication performance subjectively and other factors like age, gender, education, number of implants, and how long the implant was placed) (Table 4). Table 5 showed that there was a significant correlation between education level and how long since the implant was installed and mastication performance objectively, but this correlation was statistically weak.

Variable	p-value
Age	0.300*
Gender	0.957**
Education	0.136**
Number of implant	0.195**
Time of implant placement	0.350*
* Spearman test ** Mann–Whitney U test Significance ($p < 0.05$)	

Table 4. Correlation between mastication performance subjectively with other variables (age, gender, education, number of implants, and how long the implant was placed).

Variable	p-value
Age	0.906*
Gender	0.124**
Education	0.034**
Number of <u>implant</u>	0.076**
Time of implant placement	0.031*
* Spearman test ** Mann–Whitney U test Significance ($p < 0.05$)	

Table 5. Correlation between mastication performance objectively and other variables (age, gender, number of implants, and how long the implant was placed).

Discussion

Analyses to reveal correlations were performed by the Spearman and Mann–Whitney U tests because the distribution of the data was not normal. The results of this study showed that there was a significant correlation between mastication performance subjectively and quality of life. This may be related to the findings of subjective examinations given the results of the perception responses of patients to questionnaires are very subjective and can be

influenced by many factors such as life experience, education level, culture, and socioeconomic aspects. In this study, there was no significant correlation between mastication performance and quality of life. Based on several studies, quality of life is affected by various factors such as the maturity of thinking, life experiences, culture, socioeconomic conditions, and the environment.^{25,29–31}

In this study, mastication performance subjectively and quality of life have a significant correlation because they both measure patients' perceptions; some patients may feel their mastication performance is fine because they have used implant restorations to replace lost teeth, so the patient feels comfortable and the patient's quality of life improves. Researchers assumed from the analysis that the results of treatment with a posterior implant-supported single crown in the Universitas Indonesia Faculty of Dentistry Hospital could be said to be good because almost all subjects reported a good quality of life and masticatory performance (assessed both subjectively and objectively). This is consistent with the results of research by Goshima and colleagues that supported that the installation of implant-supported crown will improve quality of life and mastication performance.^{5,21-26}

There was a significant correlation between age and quality of life in this study, where older people had a better quality of life. This is probably due to the level of maturity having a positive effect on answering the quality of life questionnaires given. In previous studies, elderly respondents tend to have less anxiety or complaints when compared with younger ones who may be more aware of the condition of their oral cavity. Overall, the elderly paid less attention to their quality of life in comparison with younger adults.²⁷⁻³¹

Conclusions

There was a significant correlation between mastication performance subjectively and quality of life in respondents who received posterior implant-supported single crown. Age also showed a significant correlation with quality of life in this study.

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Declaration of Interest

The authors declare that there are no conflicts of interest.

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