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The impact of anatomical, prosthetic features, and implant location on quality of life among locator-retained mandibular overdenture wearers

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Abstract

The aim of this study is to evaluate the impact of anatomical, prosthetic features and implant location on quality of life (QoL) after treatment with locator-retained mandibular overdentures. Thirty patients with locator-retained mandibular overdentures were included in this study. The study examined the following: (1) demographic characteristics, (2) intraoral measurements, (2a) the age of the prosthesis, (2b) the distance between the implants, (2c) the distance between the alveolar crest and the hypothetical line that crosses two implants (2d) the crest section, (2e) tissue quality, (2f) the arc form, (3) measurements of the prosthesis, (3a) freeway space, (3b) the distance between the canines, (3c) the top of the canine/the distance between the distal teeth of the second molar tooth, (3d) the canine/molar angle, and (3e) the arc form saved. After the measurements were made, patients were asked to mark the VAS (100 mm) scale to indicate their satisfaction with their prostheses and to complete the OHIP-14 questionnaire. A multivariate linear regression analysis was performed using OHIP-14 and VAS variables. The multivariate linear regression analysis showed gender and the distance between the alveolar crest and the hypothetical line that crosses two implants (2c) as the most important factor affecting anatomic, prosthetic features and implant location on QoL ($p < 0.05$). The satisfaction of patients using mandibular overdenture prosthesis may vary depending on many factors. According to this study, the implants should be positioned on the same linear line and at the most distant position for patient satisfaction.

Keywords: Overdenture, implant, quality of life, satisfaction

Introduction

Edentulism is a dentition defect that is defined as the loss of all permanent teeth in the maxilla and/or mandible [1]. It has a serious impact on eating, talking, facial appearance and quality of life (QoL). Therefore, completely edentulous patients are disabled according to the World Health Organization's (WHO) criteria [1, 2]. The prevalence of edentulism has declined, according to patient age, and is expected to decline further in the future, as quality of life and life expectancy have increased and are expected to continue to increase [3].

The basic goal of oral rehabilitation is to improve patients' impaired oral functions.[4] The conventional treatment for edentulism was a complete denture;[5] however, conventional complete denture wearers have common complaints such as poor retention and stability of mandibular dentures [6], decreased chewing ability, and residual bone resorption [2,7]. Studies have shown that insufficient complete denture retention and stability are related to patient

satisfaction or QoL [8,9]. Treatment with endosseous implants significantly improves chewing ability, retention, and stability [10]. While the choice of a complete denture still depends upon the patients' requirements and wants, the treatment of edentulous mandibula using 2 implant-retained overdentures has become the first option of rehabilitation for edentulous patients [11,12].

A number of QoL questionnaires might be used for evaluating patient satisfaction [13]. Many factors are affected by oral health-related quality of life (OHRQoL), such as age, pathologies, periodontal diseases, tooth loss, and prosthesis wear and age, as well as sociodemographic, educational, psychosomatic, dietetic, and economic factors [14]. The Oral Health Impact Profile (OHIP-49 [15,16] OHIP-20, OHIP-14 [17]) questionnaire is the most accepted measurement document in the literature. The OHIP survey was reliable and valid relating to valuation of OHRQoL. OHIP-14, OHIP-20 and the OHIP-EDENT are short forms of this survey that have received reassuring assessments of reliability and validity [18]. Some other questionnaires in the literature related to prostheses are the visual analogue scale (VAS) [19], oral health-related quality of life (OHRQoL) [10], quality of life related to function, aesthetics, socialization, and thoughts (QoLFAST-10) [20], quality of life with implant-prostheses (QoLIP-10) [21], oral

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aesthetic-related quality of life (OARQoL), and quality of life associated with dental aesthetic satisfaction (QoLDAS-9) [22].

Prosthodontics research has mainly revolved around the QoL of completely edentulous patients whose oral health and functions have been restored with implant-retained overdentures. The satisfaction of patients using mandibular overdenture prosthesis may vary depending on many factors. However, it is not clear in the literature which factor most impacts their QoL. The aim of this study was to evaluate the impact of prosthetic and anatomical features on the QoL for individuals with locator-retained mandibular overdentures. The null hypotheses tested were that 1) oral anatomy, 2) prosthesis features and 3) implant location have no impact on QoL.

Material and Methods

The present study is a retrospective analysis on 30 patients (9 male, 21 female; 44-83 years old, Figure 1) whose implant supported prosthetic restorations were conducted in the Department of Prosthodontics, Inonu University. The experimental protocol was approved based on the ethical standards of the Declaration of Helsinki. Prior to the study, the approval was obtained from the Ethics Committee of Inonu University. (20/11/2018)

The following measurements were recorded:

1. Demographic characteristics
2. Intraoral measurements
 - a. The age of the prosthesis
 - b. The distance between the implants (linear, millimeter)
 - c. The distance between the alveolar crest and the hypothetical line that crosses two implants
 - d. Crest section (round/retentive/sharp/irregular)
 - e. Tissue quality (firm /hyperplastic/mobile)
 - f. Arc form (square/oval/triangle)
3. Measurements of the prosthesis
 - a. Freeway space
 - b. The distance between the canines (millimeter)
 - c. The top of the canine/the distance between the distal teeth of the second molar tooth (millimeter)
 - d. Canine/molar angle
 - e. Arc form (square/oval /triangle)

The volunteers then answered the OHIP-14 questionnaire. After the measurements were made, patients were asked to mark the VAS (100 mm) scale to indicate their satisfaction with their prostheses.

The OHIP is a validated and reliable questionnaire that includes 7 base problems such as functional limitation, pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap [6,23]. All items were scored on a Likert scale ranging from 0 (very positive) to 4 (very negative) that were summed to calculate an overall score ranging from 56 showed the maximum negative score, to 0 a perfect QoL appreciation. The volunteers' responses were scored as very often, 4; fairly often, 3; occasionally, 2; hardly ever, 1 and never, 0.

Analyses were performed with statistical software (IBM SPSS

Statistics v23.0; IBM Corp). The relationship among implant location, oral anatomy, prosthesis features and QoL was investigated, and a stepwise multivariate linear regression was conducted. The statistical analyses were performed with the significance level set at p values of 0.05

Result

This study included 30 patients with a mean age of 62 that 21 were females with a mean age of 59 years, and nine were males with a mean age of 66 years. The average OHIP score of females was 7.1 and 3.6 for males. The averages of VAS scores were 79.2 % and 86.5 % respectively for females and males. The age of the prosthesis was found to be close to the average values for females (23.5 months) and males (22 months). The QoL with OHIP mean score was used as a dependent variable, whereas age, gender, age of the prosthesis, the distance between the implants, the distance between the alveolar crest and the hypothetical line that crosses two implants, crest section, tissue quality, arc form crest, freeway space, the distance between the canines, the top of the canine/the distance between the distal teeth of the second molar tooth, canine/molar angle, and arc form prostheses were used as independent variables (Table 1). After a multivariate linear regression analysis (Table 2), it was shown that among the factors evaluated, gender and the distance between the alveolar crest and the hypothetical line that crosses two implants (2c) were significantly associated with QoL of locator-retained mandibular overdenture wearers ($p < 0.05$). The other factors showed no significant effect ($p > 0.05$). The model constructed for 2c showed the value of adjusted R²; 0.321 and the model constructed for 2c and gender showed the value of adjusted R²; 0.413 (Table 2). There was no statistically significant effect between VAS scores and independent variables.

Table 1. Multiple linear regression analysis results (Stepwise)

Independent variables	Beta In	t	sig	Partial Correlation
1.age	-0,241	-1,522	0,141	-0,297
Gender	-0,333	-2,213	0,037	-0,412
2a. age of the prosthesis	,019	0,104	0,918	0,021
2b. distance between the implants	,054	0,284	0,779	0,058
2d. Crest section/round	-,196	-1,208	0,239	-0,239
2d. Crest section/sharp	,196	1,208	0,239	0,239
2e. Tissue quality/firm	-,218	-1,334	0,195	-0,263
2e.Tissue quality/ hyperplastic	-,022	-0,135	0,894	-0,028
2e. Tissue quality/mobil	,229	1,382	0,18	0,271
2f. Arc form/square	-,218	-1,334	0,195	-0,263
2f. Arc form/oval	-,022	-0,135	0,894	-0,028
2f. Arc form/ triangle	,229	1,382	0,18	0,271
3a. freeway space	,035	0,213	0,833	0,043
3b. distance between the canines	,084	0,4	0,693	0,081
3c. distance between the canine and molar	,058	0,351	0,729	0,071
3d. Canine/molar angle	-,207	-1,297	0,207	-0,256
3e. Arc form/square	-,094	-0,567	0,576	-0,115
3e. Arc form/oval	,022	0,135	0,894	0,027

Table 2. Multiple linear regression analysis for quality of life

Model	B	Std. Error	Beta	t	Sig.	F	p
(Constant)	1.000	1.617		0.618	0.542		
^a Distance between the alveolar crest and the hypothetical line that crosses two implants	1.500	0.411	0.590	3.649	0.001		
(Constant)	5.901	2.677		2.204	0.37	13.315	0.001
Distance between the alveolar crest and the hypothetical line that crosses two implants	1.532	0.383	.602	4.004	0.001		
^b Gender	-3.755	1.697	-.333	-2.213	0.037	10.145	0.001
^a ; R ² (Adj): 0.321 ^b ; R ² (Adj): 0.413							

Discussion

Patient satisfaction is the most important factor determining the success criteria of implant-retained mandibular overdenture prostheses, one that depends on many anatomical factors such as salivary fluidity, viscosity, quality of the alveolar crest, and resilience of soft tissues. Other factors that impact a patient's satisfaction with the prosthesis are chewing, speech, aesthetics, psychological effects, and the use of a metal or acrylic base prosthesis, retention and stability. In addition, some other factors such as location and number of implants, type of prosthesis and holder type may affect the QoL. This study investigated the relationship between QoL and anatomical, prosthetic features and implant location. The H1 and H2 hypotheses were accepted, and H3 hypothesis was rejected.

In this study, the distance between the alveolar crest and the hypothetical line that crosses two implants impact on QoL was found to be 32 % ($p < 0.05$). The fulcrum axis is the hypothetical line that crosses two implants where rotation movement occurs due to the location of the implant in implant-retained mandibular overdenture prostheses. In order to prevent this movement, the implants must be placed at the most distal and most anterior location. This ratio increased to 41 % when gender factor was added.

Significant consensus has been reached that implant-retained mandibular overdentures can provide important advantages to edentulous patients compared with complete dentures [1]. The effects of various prostheses on QoL have been investigated in many studies, but there are no studies determining which of the anatomical and prosthetic features impact patients' degree of satisfaction. Preciado et al. [14] only investigated how demographic features, implant-retained overdenture prosthesis features and oral lesion presence impact QoL. They reported that overdenture prostheses with implant retainers improve QoL regardless of implant location, retentive system and antagonist.

The major finding of this study is that the distance between the alveolar crest and the hypothetical line that crosses two implants is the most important factor impacting QoL. This is directly related to implant location. Scherer et al. [24] evaluated effect of implant location and different attachment systems on the retention and

stability of 2-implant mandibular implant overdentures that was positively affected QoL and concluded the retention and stability is significantly affected by implant location and abutment type. The vertical retention, horizontal stability and anteroposterior stability increased when the implant position was located distally. Similar results were found in this present study. In addition Ball and Locator attachments have higher levels of retention and stability than O-ring and ERA.

Shayegh et al. [25] evaluated the effect of distance between the implants on the retention of overdentures and the 23 mm distance was found better performance. This present study, mean of distance between the implants was showed 24.3 mm.

One limitation of the research protocol followed here is that the included patients were all from a university dental clinic and the small sample size. Second limitation is that patients who have more than two implants were not included in the study. Lee et al. [26] found no statistically significant difference between 2 and 4 implants for the quality of life of the mandibular implant retained overdentures wearers in their systematic review about the number of implants. Another limitation is that different types of implant-supported overdenture have not been compared. Trakas et al. [27] mentioned their review that there is no significant difference in patient satisfaction either by ball or bar/clip attaching mechanisms. Naert et al. [28] concluded that ball attachment group was showed the best retention and patient satisfaction at year 10. Fernandez-Estevan et al. [29] found that mandibular overdentures retained with the locator system produced good outcomes in terms of QoL and females were more dissatisfied than male. In addition, they found that age factor had a significant effect on OHIP scores. In this present study, the degree of satisfaction was lower in females than males.

In this study, the factors such as anatomical, prosthetic features, and implant location were investigated in terms of affecting the quality of life and the effect percentages. Factors such as the number of implants, attachment type, implant angulation, different opposite arc prostheses, salivary viscosity, changes of nylon retention, relining, and readjustments should be part of future studies. More number of patients and a longer period of observation would yield more consistent results.

Conclusion

Locator-retained mandibular implant overdentures improve the quality of life of edentulous patients. The satisfaction of patients using mandibular overdenture prostheses may depend on many factors, but the location of the implants is very effective in increasing their satisfaction. Within the limitations of the current investigation, the following conclusion may be drawn; the implants should be positioned on the same linear line but at the most distal position to increase patient satisfaction and females were more dissatisfied than male among locator-retained mandibular overdenture wearers.

Competing interests

The authors declare that they have no competing interest.

Financial Disclosure

All authors declare no financial support.

Ethical approval

The approval was obtained from the Ethics Committee of Inonu University. (20/11/2018).

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