Comparison of the effects of two different types of retainers used in implant-supported overdenture prosthesis on patient satisfaction

İmplant destekli hareketli protezlerde kullanılan iki farklı tutucu tipinin hastaların memnuniyetleri üzerine etkilerinin karşılaştırılması

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Received: 21 October 2018
Accepted: 5 July 2019
doi: 10.5505/yeditepe.2020.71676

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SUMMARY

Aim: This study aimed to investigate the effects of two different types of retainers, i.e., the locator system and ball attachment, on patient satisfaction, in patients using conventional complete denture in the maxilla and two implant-supported overdentures (IOD) in the mandible.

Material and Methods: This study was carried out in 113 patients using ten questions selected from the OHIP–49 questionnaire. The patients were divided into ball attachment (BALL) and locator (LOC) group according to the retainer type used in their IOD prostheses, and their effects on patient satisfaction were evaluated. Also, changes in satisfaction levels were examined in terms of gender and age. The data were then analyzed statistically.

Results: All the 113 study participants were found to be satisfied with IODs, regardless of age and sex, with a score of 10.5 (±7.5) out of 40 points, which was the highest dissatisfaction score. Of the 55 patients (10.07 ±7.94) in the BALL group and 58 patients (10.91 ±7.19) evaluated in the LOC group, no statistically significant difference was observed on the basis of the retainer type in terms of general satisfaction and factors like age and sex.

Conclusion: Based on the satisfaction scores of IOD, it was concluded that it had a positive effect on the quality of life of the patients, which remained unaffected by the retainer type and factors like gender and age.

Keywords: Dental implant, implant supported overdenture, ball attachment, locator, patient satisfaction

ÖZET

Amaç: Bu çalışmanın amacı, üst çenede konvansiyonel total protez ve alt çenede 2 implant destekli hareketli protez (IDO) kullanan hastaların, IDO protezlerden genel memnuniyetlerinin ve en sık kullanılan tutucu tiplerinden olan locator sistem ve ball ataşmanların, bu memnuniyet üzerine etkilerinin araştırılmasıdır.

Gereç ve Yöntem: Yapılan bu araştırmada, 113 hastanın katılımıyla, OHIP-49 testi sorularından seçilen 10 sorudan yararlanılarak, üst çenede konvansiyonel tam protez, alt çenede IDO kullanan hastaların, öncelikle IDO protezlerinden genel memnuniyetleri ve ardından hastaların tutucu tiplerine göre ball ataşman (BALL) ve locator grubu (LOC) olarak ayrılmasıyla, bu iki tutucu tipinin hastaların memnuniyetleri üzerindeki etkileri değerlendirilmiştir. Ayrıca her iki koşulda cinsiyet ve yaş faktörlerine göre bu memnuniyetlerdeki değişimler incelenmiştir. Elde edilen veriler istatistiksel olarak analiz edilmiştir.

Bulgular: Çalışmaya katılan 113 hastanın yaş ve cinsiyet faktörlerinden bağımsız olarak, genel anlamda IDO'lardan, en yüksek memnuniyetsizlik puanı olan 40 puan üzerinden 10,5 (±7,5) puan ile memnun olduğu tespit edilmiştir. Tutucu tipine göre değerlendirme yapıldığında; BALL grubunda 55 hastada elde edilen 10,07 ± 7,94 ve LOC grubunda 58 hastada elde edilen 10,91 ± 7,19

memnuniyet skorlarına göre, tutucu tipinin hem genel hem de yaş-cinsiyet faktörlerine göre ayrı ayrı değerlendirildiğinde, hasta memnuniyetleri açısından istatistiksel olarak anlamlı bir fark oluşmadığı tespit edilmiştir.

Sonuç: Bu çalışmanın sınırları dahilinde, IDO protezlerin yarattıkları memnuniyet skorlarına göre, hastaların yaşam kaliteleri üzerinde olumlu etkisinin olduğu ve bu memnuniyetin kullanılan tutucu tipinden ve cinsiyet-yaş faktörlerinden etkilenmediği sonucuna varılmıştır.

Anahtar kelimeler: Dental implant, implant destekli hareketli protez, ball ataşman, locator, hasta memnuniyeti

INTRODUCTION

With an increase in the use of dental implants, implant-supported overdenture (IOD) prostheses are rapidly replacing the conventional complete dentures. It has not been too far in the past when partially edentulous patients who fell in free-end saddle categories or completely edentulous patients were doomed to use conventional complete dentures. Moreover, owing to tooth loss, especially occurring at an early age, the alveolar crest of the patients often has severe atrophy. Consequently, the use of complete dentures is even more difficult.[1-3] IOD prosthesis provides greater comfort to the patient in terms of chewing and retention by reducing the problems of conventional complete dentures, especially in completely edentulous patients and in those where bone support is inadequate for the retention of complete dentures.[4,5]

Since the beginning, many varieties of retainer types have been introduced for the IOD prosthesis.[1,6,7] Many clinical and biomechanical studies have shown that the type of retainer used is a determinant for the short and long-term success of implants and prostheses. In addition, these factors are important as they directly affect the patient's comfort, satisfaction, and cost.[8-11] Kronstrom et al.[12] carried out a study on 116 prosthodontists from 33 countries, regarding the opinions and clinical applications of the edentulous mandible with IOD prosthesis. Of the prosthodontists, 84% agreed that they used two implants for mandibular IODs. The most commonly used retainer systems for mandibular IOD prosthesis are the locator system (70.4%) and ball attachment (25.9%). The prosthodontists reported that the primary factor influencing their preferences about the number of implants and retainer type was the total cost.

This study aims to investigate the effects of two types of implant retainers on the patients' overall satisfaction while using mandibular IOD prosthesis in completely edentulous patients. The satisfaction of 113 participants was compared by using 10 questions, selected from Oral Health Impact Profile–49 (OHIP–49) questionnaire, which were regarded as suitable for the evaluation of removable dentures.

MATERIAL AND METHODS

This is a retrospective study comprising 113 patients who reported to the Istanbul Aydın University, Faculty of Dentistry, between 2011 and 2017 for complete edentulousness. Dental implants were applied to these patients in the Oral and Maxillofacial Surgery Department of the Istanbul Aydın University Hospital. Further, a conventional prosthesis for the maxilla and two implant-supported overdentures for the mandible were then fabricated and delivered to the patients in the Department of Prosthodontics.

Patients having both, upper and lower edentulous arches, were included in the study. Apart from this, the other inclusion criteria were patients without any systemic diseases, patients not receiving any chemotherapy or radiotherapy, patients not using any bisphosphonate type of drugs, patients without any oral soft or hard tissue inflammation, patients who maintained adequate oral hygiene, mentally healthy individuals, patients who were able to fill the questionnaire without any help, and patients who were using the newly fabricated prosthesis since at least one year. At last, 113 patients were found suitable for the study. These 113 patients were all using IOD and were divided, according to their retainer types, into two groups comprising 55 patients with two implant-supported ball attachments (BALL) in one group and 58 patients with two implant-supported locator systems (LOC) in the other group.

Ten questions related to the use of a removable prosthesis, which were selected from the OHIP–49 scale, were used to assess the satisfaction level of the patients (Table1).

Table 1. The satisfaction survey directed to the participants in our study

	Never 0	Rarely 1	Sometimes 2	Frequently 3	Very frequently 4
1. Have you had trouble pronouncing any words because of problems with your dentures?					
2. Have you felt that your sense of taste has worsened because of problems with your dentures?					
3. Has your diet been unsatisfactory because of problems with your dentures?					
4. Have you had to interrupt meals because of problems with your dentures?					
5. Have you ever felt embarrassed because of your dentures?					
6. Have you ever noticed that your dentures retained food?					
7. Have you found it uncomfortable to eat any foods because of problems with your dentures?					
8. Have you ever felt that your dentures were not correctly fit?					
9. Are you satisfied with your upper denture?					
10. Are you satisfied with your lower denture?					

The OHIP-49 scale is a specific scale whose reliability and validity have been established for many languages and geographies.[3,13-18] Basol et al.[19] conducted a study on the Turkish version of OHIP and proved its reliability, validity, intelligibility, and reproducibility. The data obtained were analyzed statistically and the effects of different retainers on patient satisfaction with the use of the prosthesis were then investigated.

The patients were detailed beforehand about the content of the study. Those who accepted to participate in the study then underwent a clinical examination and it was confirmed whether they meet the selection criteria. Later, the selected patients were asked to complete the satisfaction questionnaire comprising of 10 questions (Table 1). The patients were asked to answer all questions by considering only the lower IOD prostheses, except for the 9th question which dealt with the satisfaction of the upper prosthesis. While the patients filled in the form, a researcher sat next to the patients to ensure that they understood the questions clearly and addressed doubts. The Likert response system was used for the evaluation of the questionnaire. The answers to the questionnaire were evaluated as 0 points for "Never", 1 point for "Rarely", 2 points for "Sometimes", 3 points for "Frequently" and 4 points for "Very Frequently". The highest score was 40 while the lowest score was 0. Since all questions contained negative meanings, higher scores indicated lower satisfaction level.

The responses obtained were used to compare the general satisfaction level of participants with IOD prostheses and then the satisfaction of IOD prostheses in terms of factors like gender and age was then compared among all the participants. After this, the participants were divided into two groups according to the retainer type and then again, the satisfaction level of the patients was compared in general and according to their gender and age.

Statistical Analysis

Data were analyzed using the SPSS software. Descriptive statistics are shown as mean ±standard deviation or median (minimum-maximum) for continuous variables. The significance of the difference between the groups was evaluated by Student's t-test since the number of independent groups was two. The Kruskal-Wallis test investigated the significance of the difference between the groups pertaining to the median values. If one-way analysis of variance or the results of Kruskal-Wallis test were found to be important, non-parametric multiple Comparison tests of post hoc including Tukey's HSD or Conover were used to determine the conditions that brought the difference. Pearson's Chi-Square test examined the categorical variables. Spearman's correlation test was used to determine whether there was a significant relationship between the continuous variables. The results with p <0.05 were considered statistically significant.

RESULTS

Of all the 113 patients included in the study, 35 were males and 78 were females, with a mean age of 62.8 years. Of the 55 patients in the BALL group, 17 were males and 38 were females; the mean age of males was 66.8 years, while the average age of females was 62.3 years, and the average age of the whole group was 63.7 years. Of the 58 patients in the LOC group, 18 were males and 40 were females; the mean age was 63.8 years for males, 61.2 years for females and 62 years for the entire group. In the BALL group, 26 patients were younger than 65 years with a mean age of 55.5 years and 29 patients were older than 65 years with a mean age of 71 years. In the LOC group, 37 patients were younger than 65 years with an average age of 56.9 years and 21 patients were older with a mean age of 71 years (Table 2).

Table 2. The average scores of the participants' answers to the survey questions

	BALL	BALL (MALE)	BALL (WOMAN)	BALL (65+)	BALL (65-)	LOC	LOC (MALE)	LOC (WOMAN)	LOC (65+)	LOC (65-)
PARTICIPANTS	**55**	**17**	**38**	**26**	**29**	**58**	**18**	**40**	**21**	**37**
AGE	**63,7**	**66,8**	**62,3**	**55,5**	**71**	**62**	**63,8**	**61,2**	**71**	**56,9**
QUESTION 1	0,49	0,70	0,39	0,26	0,68	0,53	0,22	0,67	0,23	0,70
QUESTION 2	0,63	0,23	0,81	0,80	0,48	0,89	0,33	1,15	0,42	1,16
QUESTION 3	0,85	0,58	0,18	0,23	0,37	0,31	0	0,45	0,19	0,37
QUESTION 4	0,58	0,41	0,65	0,65	0,51	0,44	0,16	0,57	0,23	0,56
QUESTION 5	0,45	0,05	0,63	0,26	0,62	0,41	0,11	0,55	0,14	0,56
QUESTION 6	2,94	2,76	3,02	2,80	3,06	2,81	2,61	2,90	2,71	2,86
QUESTION 7	1,76	1,35	1,94	2,23	1,34	1,70	1,22	1,92	1,42	1,86
QUESTION 8	0,90	0,70	1	1,11	0,72	1,20	0,83	1,37	0,80	1,43
QUESTION 9	0,90	0,94	0,89	1,15	0,68	1,37	1,66	1,25	1,47	1,32
QUESTION 10	1,07	0,82	1,18	1,26	0,89	1,20	1,11	1,25	1,09	1,27
TOTAL	**10,07**	**8,59**	**10,74**	**9,72**	**10,37**	**10,91**	**8,28**	**12,10**	**9,16**	**11,77**

The mean satisfaction score of the 113 participants in the questionnaire was 10.5 (±7.5) (Table 2). Considering that the highest possible dissatisfaction value is 40, it can be concluded that patients are generally satisfied with IOD prostheses, based on a score of 10.5 (±7.5). Besides, no statistically significant difference was found between the scores of female and male patients among the participants (P = 0.074). Similarly, no statistically significant difference (p = 0.202) was found among the patients in the under 65-year and over 65-year old age groups (Table 3).

Table 3. General satisfaction scores and statistical analysis based on all participants and gender - age subgroups

DESCRIPTIVE STATISTICS

	N	Minimum	Maximum	Mean	SD
SATISFACTION	113	1,00	40,00	10,5044	7,54643
Valid N (Listwise)	113				

	GENDER				
	Female		Male		p
	Mean	SD	Mean	SD	
SATISFACTION	11,44	8,05	8,43	5,86	0,074

	AGE				
	Age 65-		Age 65+		p
	Mean	SD	Mean	SD	
SATISFACTION	11,16	7,59	9,48	7,44	0,202

*Mann Whitney U test

When satisfaction according to the retainer types was examined, no statistically significant difference (p= 0.347) was found in score values between BALL (10.07 ±7.94) and LOC (10.91 ±7.19) groups. Similarly, when the LOC and BALL groups were compared according to gender and age of the participants, no statistically significant difference was found between the subgroups in terms of patient satisfaction (Table 4).

Table 4. Satisfaction results and statistical analyzes between the BALL and LOC groups based on the retainer type based on all participants and gender-age subgroups

	ATTACHMENT GROUPS				
	2 IMP BALL		2 IMP LOC		p
	Mean	SD	Mean	SD	
SATISFACTION	10,07	7,94	10,91	7,19	0,347

		AGE				
		Age 65-		Age 65+		p
		Mean	SD	Mean	SD	
ATTACHMENT GROUP	2 IMP BALL	10,37	7,92	9,72	8,12	0,617
	2 IMP LOC	11,77	7,37	9,16	6,66	0,225

		GENDER				
		Female		Male		p
		Mean	SD	Mean	SD	
ATTACHMENT GROUP	2 IMP BALL	10,74	8,62	8,59	6,14	0,459
	2 IMP LOC	12,10	7,52	8,28	5,76	0,077

*Mann Whitney U test

When the questions were evaluated individually, the only question that took over 2 points (sometimes) out of 4 points, between all examined groups and factors, without any exception, was the sixth question, which read as "Have you ever noticed that your dentures retained food?". Participants' answers to this question varied between 'sometimes' and 'frequently', fetching the lowest value of 2.61 in all groups. This value is even closer to the 'frequently' response. The only other question that exceeded the threshold of 2 points was "Have you ever avoided eating anything due to problems with your mouth or dentures?", which was the seventh question; and among study participants under the age of 65 years in the BALL group, it fetched a score of 2.23 points (Table 2).

DISCUSSION

IODs have superior properties in terms of retention, stability, and function as compared to conventional prostheses. Both, McGill5 in 2002 and the York consensus[4] decisions in 2009 emphasized that IODs must be considered as the first treatment option for the rehabilitation of an edentulous mandible.

One of the factors affecting the long-term success, patient satisfaction, retention and stability of prosthesis when considering both, the patients and the clinicians, is the retainer attachment type that provide the implant-denture connection.[8,10,12,20,21] There is still no consensus on the ideal type of retainer for both maxillary and mandibular IOD prostheses or the cost of IOD prostheses in the literature. IOD prostheses are most commonly used with bar holders, ball attachments, locator systems, and magnet holders.[6,7] While choosing among retainer systems, some differences between the systems are taken into consideration, and for the patient and the clinician, these differences affect factors like retention and stability of the prosthesis, the total cost of the system, the need for maintenance, and the long-term bone loss around the supporting implants.[8-10,18,21,22] There is still no consensus on the ideal retainer type for both maxillary and mandibular IOD prostheses in the literature. Different studies highlight the use of different retainer types, considering the various advantages and disadvantages.[18,21,23-25]

Several studies in the literature emphasize the numerous advantages of ball attachment, which is a relatively old system, suggesting its use in IOD prostheses. Scherer et al.[26] obtained the best retention and stability results with ball attachments and reported that even a single implant and one ball attachment could provide sufficient retention. In their in-vitro study, Sultana et al.[27] compared ball attachment and locator retainer systems used in IOD prosthesis with two parallel or two 20-degree angled implants. The locator system reported a significantly higher initial retention value as compared to the ball attachments; however, it was also reported that the locator system had a significantly faster retention loss (100 days) in Comparison to the ball attachment system (200–300 days) as a result of wear, depending on use. In the study, it was also determined that ball attachment systems also give better results on angular placed implants. Persic et al.[22] investigated the effects of ball attachment, bar, and locator systems on patient satisfaction and peri-implant health in 122 patients who had been using mandibular IOD for at least three years but not more than five years. In their study, ball attachment systems were found to be more advantageous in terms of both, patient satisfaction and peri-implant health as compared to the other systems. Scherer et al.[28] compared the ERA, ball attachment, locator, and O-ring retention systems in their in-vitro study and found that the ball attachment system provides the highest level of retention and stability.

Besides, many studies in the literature claim that the locator systems are more successful than the ball attachment system. In an in-vitro study, El-Anwar et al.[8] reported that the use of the locator system as compared to ball attachments was more advantageous in terms of both, the retention and the stresses on the bone, and therefore the IOD supported by the locator systems could have a longer life and would require lesser maintenance. Burns et al.[29] compared two locators, two implant-supported bar and four implant-supported bar for IODs. They reported that even though retention of the prosthesis in IODs with locator was lesser than that in bar systems, according to the other measured parameters, the locator systems showed

equivalent or more favorable results to the bar holders. In addition, at the end of the study, patients preferred two locator supported IODs to other options. In their in-vitro study, Cicciu et al.[11] investigated stress formations and distributions in IOD prostheses supported by ball attachment, locator and standard abutments and concluded that the locator system is more successful than other systems in terms of stress formation. Sadig et al.[25] worked on the effects of retention type and the number of implants on the retention and stability of IODs and reported that locators gave the most successful results regarding stability and retention, and these results were followed by ball attachments and magnet holders, respectively.

The literature reports some studies claiming that the retainer type has no serious effects in terms of patient satisfaction. Mumcu et al.[18] studied the effects of IODs on patient satisfaction and quality of life in five different patient groups (two ball attachment, two locators, three ball attachment, three bar holder, and four bar holder) and reported that patient satisfaction was independent of implant number or retainer type. Cristache et al.[21] reported that all of the two-implant supported retainer systems (magnet, ball attachment, and locator) functioned well enough during the five years of follow-up of 69 patients using IODs. In accordance with these results, the present study also showed that there was no statistically significant relationship between the retainer type and patient satisfaction. The patients were generally satisfied enough from their IODs, irrespective of the retainer types used.

It is common for IODs to be applied in patients with advanced age since complete edentulousness is often seen in older patients. Many studies have shown that IODs are a successful treatment option for patients with advanced age and provide a good quality of life to these patients. Kuoppalla et al.[30] reported that older patients (65 years and older) were more satisfied with their oral health-related quality of life after 13.7 years follow-up of 58 patients using mandibular IOD with bar or ball retainer. Besides, they also reported that the number of implants or retainer types did not have a significant effect on the quality of life of patients. In a study by Muller et al.[31], IODs were identified as a successful treatment option even in individuals over 85 years of age. It has been shown that even over 85-year-old individuals who face difficulty in carrying out daily life activities without help, can benefit from IODs. High survival and success rates in these patients confirm the feasibility of the IOD treatment concept. However, in selecting the retainer type, they suggested that the hand/wrist force and abilities must be taken into account in order to enable the patient to wear and remove the prosthesis without help. When the results of the present study were examined, the average age of the participants in the study was 62.8 years, and 50 patients were older than 65 years with a mean age of 71 years. It was determined that individuals over 65 years old showed higher satisfaction for IOD prostheses in general (9.48) and also for both the retainer groups (BALL: 9,72- LOC: 9,16).

In their study on 60 patients using locator supported IOD, Fernandez-Estevan et al.[15] reported higher satisfaction of male patients, and patients over 65 years of age, than the younger patients. On the other hand, Pan et al.[32] reported that there were no gender differences in IOD prostheses in terms of patient satisfaction. Mumcu et al.[18] also reported that the number of implants and retainer type used in IOD prostheses did not differ in terms of satisfaction, between male-female and old-young patients. Similar to the results obtained in these studies, the present study observed no differences in terms of gender and age on satisfaction, in general, and for different retainer types.

When the answers given to the 10-questions were evaluated separately in the present study, it was observed that despite the high satisfaction values obtained in general, a problem, in particular, had ceased from the other questions and caused higher dissatisfaction. The answers of the participants to the sixth question in the questionnaire (Have you ever noticed that your dentures retained food?) scored nearly 3 points, i.e., "frequently", in all groups (BALL: 2,94 – LOC: 2,81). However, it was difficult to avoid since IOD prostheses are substantially a type of removable prosthesis. Even if the implant support significantly increases the retention of complete dentures, it should not be expected to provide rigid retention as that is provided by a fixed prosthesis, especially by a two-implant support over dentures evaluated in the present study. Besides, the fact that IOD prostheses can be applied using more conservative methods, employing lesser surgical procedures and even in areas with low bone volumes, at overall lower costs than those in the fixed prostheses, these should be considered as an advantage of the system over implant-supported fixed prostheses.[33-37]

Although OHIP–49 aims to provide comprehensive data on the perception of oral health impact, some researchers have not considered it necessary to use all of the 49 questions. Although statistically speaking, the reliability of the index decreases as the number of questions decreases, the questionnaire is easy to understand and its simple application is shown to be necessary for the pragmatic scale.[3,13,14,16-19,30] Moreover, some questions do not make any sense for the studies focusing on a specific problem, such as the current study. In the light of this idea, for this study, considering the advanced age of the patients (average: 62.8 years); to encourage participation in the study; and to avoid misunderstandings, distraction, and irrelevant and sloppy response to the survey, the number of questions was reduced and a short-compact question-

naire was created by selecting 10 questions from OHIP–49, which were decided to be suitable for the evaluation of IOD prostheses.

CONCLUSIONS

The results of this study clearly demonstrate that (1) IOD prostheses provide high satisfaction rates in general, regardless of gender and age of the patients; (2) Ball attachment and locator retainers do not cause a statistically significant difference in terms of patient satisfaction in general and for age-sex factors separately; (3) Among all the questions directed to the participants, the sixth question stating "Have you ever noticed that your dentures retained food?" has the highest average score; (4) Food leakage beneath the IOD prostheses can be considered to be the most significant disadvantage of these types of prostheses.

Clinical implementation of the results suggests that the application of IOD prostheses create high satisfaction rates for all age groups and both the genders. Else, clinicians can make retainer choice between the ball attachment and the locator system, by taking into account the current costs of these systems and by considering the price/performance balance in favor of both, the clinician and the patient.

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