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Research / Araştırma Makalesi

Complication Rates and Patient Satisfaction Evaluation of Implant-Supported Prostheses

İmplant Destekli Protezlerde Komplikasyonların ve Hasta Memnuniyetinin Değerlendirmesi

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ABSTRACT

Background: The aim of the study was to assess implant and prosthetic failure rates and patients' satisfaction following 2-year observation.

Methods: The study was conducted among 110 patients (60 male, 50 female) and 581 implants placed in the maxilla and mandibles. Researchers conducted the clinical examination during recall visits within the first and second year of prosthesis insertion. A questionnaire was used to evaluate the patient's satisfaction with the prostheses. The obtained data were analyzed by descriptive statistics, Chi-Square, Mann-Witney, and Kruskal-Wallis analysis ($\alpha<0.05$).

Results: In the maxilla and the mandible, the most commonly used prosthesis was cement-retained fixed partial dentures (31.4% and 29.6%, respectively), while the least common procedures were full arch screw-retained prostheses (2.9% and 3.5%, respectively). The most commonly used material was metal-ceramic (64.2%). Survival rates of implants were similar in the maxilla (94.7%) and the mandible (95.2%) (P=0.544). Prosthesis survival rates were also similar (P=0.094): 76.2% were in the maxilla, and 78.3% were in the mandible. The highest technical and mechanical complication rates were observed in fixed partial denture prostheses applied to the maxilla and the mandible (26.8% and 25.6%, respectively). In the maxilla and mandible, the most frequent complication was ceramic chipping (16.2% and 15.6%, respectively), followed by occlusal screw loosening (3.8% and 2.6%, respectively). Patients' satisfaction rates ranged between 91%-95% in terms of function, aesthetics, and convenience.

Conclusion: After a use time of 2 years, high survival rates and patient satisfaction ratings were obtained. There was no significant difference in implant failures, while prosthetic failures were higher in fixed partial dentures.

Keywords: Dental implants, Patient satisfaction, Dental prosthesis, İmplant-supported, Complications

ÖZ

Amaç: Çalışmanın amacı, 2 yıllık gözlemin ardından implant ve implant üstü protezlerdeki başarısızlık oranlarını ve hastaların memnuniyet oranlarını değerlendirmektir.

Gereç ve Yöntemler: Çalışma 110 hasta (60 erkek, 50 kadın), alt ve üst çenelere yerleştirilen 581 implant üzerinde yürütülmüştür. Protezler hasta ağzına takıldıktan bir ve iki yıl sonra yapılan kontrol ziyaretleri sırasında araştırmacılar klinik muayeneleri gerçekleştirmiştir. Hastaların protez memnuniyetlerini değerlendirmek için de bir anket kullanılmıştır. Elde edilen veriler tanımlayıcı istatistikler, Ki-Kare, Mann-Whitney U ve Kruskal-Wallis analizleri ile analiz edilmiştir ($\alpha<0.05$).

Bulgular: Maksilla ve mandibulada en sık kullanılan protez siman tutuculu sabit protezler (sırasıyla %31,4 ve %29,6) iken, en az kullanılan tip tam ark vida tutuculu protezlerdir (sırasıyla %2,9 ve %3,5). En yaygın kullanılan materyal, metal-seramiktir (%64,2). İmplantların sağkalım oranları maksilla (%94,7) ve mandibulada (%95,2) benzerdir (P=0,544). Protez sağkalım oranları da benzerdir (P=0.094). Maksilladaki protezlerin 76,2%'si ve mandibuldaki protezlerin %78,3'ü sağ kalmıştır. En yüksek teknik ve mekanik komplikasyon oranları maksilla ve mandibulaya yerleştirilen sabit protezlerde gözlenmiştir (sırasıyla %26,8 ve %25,6). Maksilla ve mandibulada en sık görülen komplikasyon seramikte çatlak oluşumu (sırasıyla %16,2 ve %15,6) ve bunu takiben oklüzal vida gevşemesi (sırasıyla %3,8 ve %2,6) olmuştur. Hastaların memnuniyet oranları fonksiyon, estetik ve kullanım kolaylığı açısından %91-%95 arasında değişmektedir.

Sonuç: İki yıllık kullanım süresinin ardından, yüksek sağkalım oranları ve hasta memnuniyet dereceleri elde edilmiştir. İmplant başarısızlıklarında anlamlı bir fark görülmezken, protez başarısızlıkları sabit protezlerde daha yüksek bulunmuştur.

Anahtar Kelimeler: Dental implant, Hasta memnuniyeti, Diş protezi, İmplant destekli, Komplikasyonlar

Introduction

Prosthodontic rehabilitation of edentulous patients utilizing dental implants is now a well-recognized and clinically proven approach with consistent long-term outcomes.[1-3] Many research on implant success have focused on the degree of osseointegration and the integrity of implant-bone support. These factors are often assessed using parameters including implant mobility, inflammation, infection surrounding the implant site, and peri-implant bone loss. Stable initial implant settings, controlled loading scenarios, and an osseoconductive implant surface are necessary for predictable outcomes.[4] Success will depend on more than just osseointegration as implant therapy advances and becomes routine and as people look for alternatives to fixed and complete dentures.[5]

Implant-supported or implant-retained prostheses use has been shown to improve treatment outcomes, as the rehabilitation of edentulous arches with traditional complete dentures has functional drawbacks.[6-8] Restorative therapy of fully or partially edentulous individuals using dental implants including cantilevers, resin-bonded bridges, fixed implant-supported single crowns, bridges and overdentures are a few examples.[9-11] The longevity and aesthetic results have been significantly impacted by modifications in restorative treatment protocols in addition to development of new and improved restorative materials and techniques.[12] Overdentures can require less surgery than fixed restorations since they involve fewer implants and components,[13-15] and are more cost-effective.[16] On the contrary, fixed restorations offer higher maximal occlusal forces and a decreased requirement for prosthesis maintenance.[17-19] Well-established clinical benefits of overdenture or fixed rehabilitations include an increased implant survival rate (>98%) and manageable long-term bone resorption.[18,20,21]

The number of dental implants has increased over last years, which has increased complications. Soft tissue recession, inflammation, peri-implant mucositis, soft tissue hypertrophy/hyperplasia, peri-implantitis, and implant failure were considered modest biologic problems.[22,23] Peri-implantitis was described as bone loss next to an

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implant more than 2 mm following the first year of functional loading or more than 0.2 mm for each additional year, as seen on x-rays, along with signs of an infection, such as bleeding and suppuration. The diagnosis of peri-implantitis was to be made based on radiographic bone loss, which is more than 2 mm, bleeding, and suppuration on probing, and pocket depths more than 5 mm.[24] The prosthetic material's wear, chipping, abutment/occlusal screw loosening, and loss of retention, fracture of the prosthetic framework, material, abutment, and occlusal screw were all regarded as technical and mechanical complications.[22,25]

Mainly, the effectiveness of implant-supported prosthesis has been assessed through the measurement of clinical characteristics like survival, marginal bone loss, and probing depth.[13,18,20,21] However, how patients view the treatment may differ from the clinical results. To combine clinical parameters with assessments of the patient's oral condition, those variables must be collected along with the patient's perception of the treatment using patient-reported outcome measures, such as patient satisfaction and oral health related quality of life.[26-30] In the field of dentistry research, the patient-reported outcome measure has gained popularity.[27,31,32] Although patient satisfaction about implant therapy has been previously investigated,[33] to our knowledge, there is no contemporary, comprehensive study investigating both biomechanical complications and patients' assessments of implant-supported prostheses in Turkey. The aim of the present study was to evaluate clinical and patient related outcomes of implant supported prostheses. The hypothesis of the present study was that implant survival rates, technical and mechanical complications of the prosthesis, and patient satisfaction would be different depending on the type of bone to be placed and the prosthesis type.

Materials and Methods

This study, conducted in accordance with the declaration of Helsinki, involved 110 subjects (60 male and 50 female) who underwent rehabilitation with maxillary and/or mandibular implant-supported dentures. Power analysis was performed using the G*Power (V3.1.9.7) program. Based on the results of the reference study,[34] a minimum of 249 implants should be included in the study according to the chi-square test power analysis result with 95% confidence (1-α), 95% test power (1-ß), w=0.249 effect size. The present study was conducted among 581 implants, (267 in the maxilla, 314 in the mandible) placed. This study was approved by the Ethics Committee of Ataturk University, Erzurum, Turkey (N:22/02/2024:16). Screening was conducted through the electronic records of all edentulous patients who had rehabilitation with dental implants and implant supported fixed prosthesis (IFP) and overdentures (OD) at Ataturk University Faculty of Dentistry between August 1, 2019, and December 31, 2023.

In the present study, patients who are 18 years or older, partially and totally edentulous, had received rough surface dental implants; had been rehabilitated with IFP and/or OD in at least one edentulous jaw, with under a minimum of 1-year functional loading were included. Patients who had received smooth (machined) surface implants, did not want to sign the informed consent form, were pregnant and in case less than a year since the final prosthesis was inserted were not included in the current study.[35]

The subjects who fulfilled the inclusion requirements were invited to participate in an extensive radiographic and clinical evaluation. After being fully informed of the investigation's objectives, every patient provided signed informed consent. All patients received the standard surgical and prosthetic procedures performed by dentists in Ataturk University Faculty of Dentistry, which included, in brief, the following: taking a medical history and clinical examination, getting consent, evaluating radiography and hematology, prophylactic antibiotic use, implant surgery, submerged healing for 7-8 weeks, subsequent surgery, and prosthetic rehabilitation.

All eligible patients who signed the informed consent form and consented to be included in the current study had a thorough examination done on visits. A review of the patient's medical and dental histories, intraoral photos, radiography, and clinical examination, including an assessment of the oral cavity's soft and hard tissues were all included in this examination.[24] All patients were followed up at the first and second year of prosthesis insertion. Two calibrated prosthodontists (NY, DA) completed implant supported prosthesis treatment, conducted the clinical examination, and looked for any complications or failures of the implants and prosthesis throughout the evaluation. A survey was utilized to evaluate the patient's satisfaction with the prostheses' convenience, functionality, and aesthetics.[36] The first part of the survey consisted of 4 questions about patients' personal information, including name, gender, age, and medical history. The second part of the survey consisted of 3 questions about patients' satisfaction with their prostheses in terms of function, esthetics, and convenience (**Table 1**).

Table 1. The survey questions

Q1. Name Surname.....
Q2. Age.....
Q3. Gender..... ( ) Male.....( ) Female.....
Q4. Do you have any systemic disease? ( ) Yes.....( ) No.....
Q5. Are you satisfied with your prostheses in terms of function? .....( ) Yes..... ( ) No .....
Q6. Are you satisfied with your prostheses in terms of esthetics? .....( ) Yes..... ( ) No.....
Q7. Are you satisfied with your prostheses in terms convenience? .....( ) Yes..... ( ) No.....

Statistical analysis of obtained data was performed with IBM SPSS v26.0 software (SPSS Inc., Chicago, IL, USA). After performing Kolmogorov-Smirnov normality test, it was concluded that data were not distributed normally. The data were analyzed by descriptive statistics, Chi-Square, Mann-Whitney U and Kruskal-Wallis test. Statistical significance was set at $p<0.05$ level.

Results

In the present study, 267 implants were placed in the maxilla and 314 in the mandible. When, demographic values of the participants were evaluated, it was concluded that 55% of the cases were male (n=60), while 45% were female (n=50). Most of the participants (31%, n=34) were 46-55 years old (**Fig 1**).

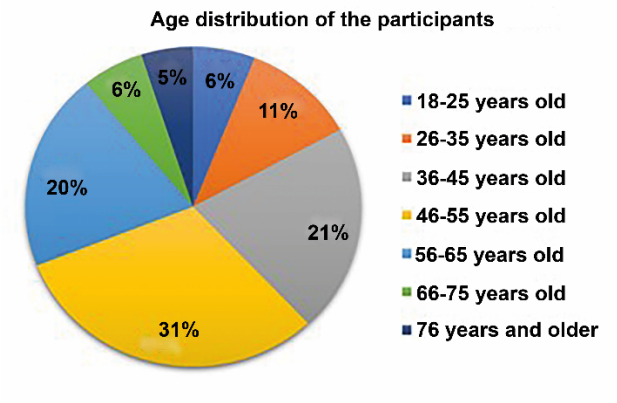

Fig 1. Age distribution of participants

In this study, totally 105 prostheses inserted in the maxilla and 115 prostheses in the mandible. Most of the cases were cement-retained fixed partial dentures (31.4%), while the least common procedures were full arch screw-retained prostheses (2.9%) in the maxilla. In the mandible, similarly, most of the cases were cement-retained fixed partial dentures (29.6%), while screw-retained full arch fixed dentures (3.5%) were the least common type of prosthesis (**Table 2**).

When material types of the prostheses were investigated, it was concluded that metal-ceramic (64.2%) used in fixed prostheses was the most commonly utilized material. Acrylic resin (26.8%) utilized in overdentures was the second most used material. The least utilized material was Zirconia (9%) used in fixed prostheses.

Implant failure rates and technical and mechanical complications of the prosthesis were also investigated in the current study. Implant failure rates ranged between 4.3% and 6.2% in the maxilla, 4.4% and 5.3% in the mandible (**Table 2**). There was no difference between implant failure rates regarding prosthesis type in the maxilla (P=0.096) and mandible (P=0.398). Also, implant failure rates did not differ between the maxilla and the mandible (P=0.544). Survival rates of implants were similar in the maxilla (94.7%) and the mandible (95.2%).

Table 2. Percentage (%) and number (n) of implant supported prosthesis types in the maxilla and mandible

Type of prosthesis	Retention type	Maxilla (%)	Mandible (%)
Single crown fixed	Cement retained	15.3% (n=16)	11.3% (n=13)
	Screw retained	5.7 % (n=6)	5.2% (n=6)
Partial Fixed	Cement retained	31.4% (n=33)	29.6% (n=34)
	Screw retained	7.6 % (n=8)	7.8% (n=9)
Full arch fixed	Cement retained	12.4 % (n=13)	13.9% (n=16)
	Screw retained	2.9 % (n=3)	3.5% (n=4)
Overdenture	Ball	9.5 % (n=10)	12.2% (n=14)
	Bar	5.7 % (n=6)	7% (n=8)
	Locator	5.7 % (n=6)	5.2 % (n=6)
Hybrid prosthesis	Cement retained	3.8 % (n=4)	4.3% (n=5)

Technical and mechanical complication rates ranged from 18.2% to 26.8% in the maxilla and 17.9% to 25.6% in the mandible (**Table 3**). Technical and mechanical complication rates differed regarding prosthesis types both in the maxilla (P=0.037) and mandible (P=0.039). The highest technical and mechanical complication rates were observed in fixed partial dentures applied to the maxilla and the mandible both. However, technical and mechanical failure rates were not different between the maxilla and the mandible (P=0.094). Survival rates of implant supported prosthesis was 76.2% in the maxilla, while 78.3% in the mandible.

Table 3. Relative (%) and absolute (/) rates of implants' failures and prosthesis' technical and mechanical complications in the maxilla and the mandible

Type of prosthesis	Maxilla		Mandible	
	Implant failure	Technical and mechanical complication	Implant failure	Technical and mechanical complication
Single crown fixed	4.5% (1/22)	22.7% (5/22)	5.3% (1/19)	21% (4/19)
Partial fixed	5.9% (5/85)	26.8% (11/41)	4.4% (4/90)	25.6% (11/43)
Full arch fixed	5.1% (5/98)	25% (4/16)	4.8% (6/126)	20% (4/20)
Overdenture	4.3% (2/46)	18.2% (4/22)	5.1% (3/59)	17.9% (5/28)
Hybrid	6.2% (1/16)	25% (1/4)	5% (1/20)	20% (1/5)

In the maxilla and mandible, the most frequent complication was ceramic chipping (16.2% and 15.6%, respectively) followed by occlusal screw loosening (3.8% and 2.6%, respectively) and loss of retention (1.9% and 1.7%, respectively). No abutment fracture, one occlusal screw fracture, and one abutment loosening were also noted (**Table 4**).

Table 4. Number (n) and percentages (%) of technical and mechanical complication types in the maxilla and the mandible

Complication type	Maxilla		Mandible	
	n	%	n	%
Ceramic chipping	17	16.2	18	15.6
Acrylic denture fracture	1	0.9	1	0.9
Loss of retention	2	1.9	2	1.7
Occlusal screw loosening	4	3.8	3	2.6
Occlusal screw fracture	0	0	1	0.9
Abutment loosening	1	0.9	0	0
Abutment fracture	0	0	0	0

Patients' self-reported satisfaction rates were also investigated in this study. In the maxilla, patient satisfaction rates ranged between 91% and 95% in terms of function, 91% to 95% regarding esthetics, 91% to 94% in relation to convenience. In the mandible, patient satisfaction rates ranged between 92% and 95% regarding function, 91% to 95% regarding esthetics, and 92% to 94% concerning convenience. The satisfaction rates did not differ regarding prosthesis type (P=0.521) and bone (maxilla and mandible) (P=0.427) (**Table 5**).

Table 5. Percentage (%) of patients who are satisfied with their prostheses in terms of function, esthetics, and convenience in the maxilla and the mandible

Type of prosthesis	Maxilla			Mandible		
	Function	Esthetics	Convenience	Function	Esthetics	Convenience
Single crown fixed	0,93	0,95	0,94	0,94	0,95	0,94
Partial fixed	0,94	0,91	0,93	0,95	0,92	0,94
Full arch fixed	0,91	0,93	0,93	0,93	0,91	0,92
Overdenture	0,94	0,95	0,91	0,92	0,94	0,93
Hybrid	0,95	0,92	0,94	0,94	0,95	0,93

There was no difference between function, esthetics, and convenience satisfaction rates regarding prosthesis type in the maxilla (P=0.325) and mandible (P=0.334). In addition, there was no difference between satisfaction rates of prostheses inserted in the maxilla or mandible (P=0.214).

Discussion

In the present study the distribution of prosthesis types, the occurrence of implant failures, technical and mechanical complications rates of implant supported prosthesis, and patients' self-reported satisfaction rates about their prosthesis were assessed. There was no difference between implant failure rates regarding prosthesis type and bone type (maxilla and mandible). The rates of technical and mechanical complications differed between the various types of prostheses, but these rates did not differ between the mandible and maxilla. In addition, the satisfaction rates of the patients did not differ regarding prosthesis and bone type. Thus, the hypothesis of the present study, stating that implant survival rates, technical and mechanical complications of the prosthesis, and patient satisfaction would be different depending on the type of bone to be placed and the prosthesis type was partially accepted.

The distributions of prosthesis types were different in studies. In a previous study conducted in 2000,[37], fixed partial dentures were the most commonly used prosthesis in the maxilla, while. Overdentures were the most common prosthesis types in the mandible. Over the past years, the increase in dental implant insertion rates[38] and the studies declaring high oral health-related quality of life ratings in implant-supported fixed complete dentures[39] may have led to clinicians applying this type of prosthesis more commonly. As a result, fixed partial dentures were the most common prosthesis type in the maxilla and mandible.

Implant survival rates vary in different studies. In a previous study, in which patients were rehabilitated with double full-arch fixed implant-supported prostheses, the implant survival rate was 99.2% after a mean 5.1 year follow-up.[35] In another study, survival rates of implant-supported overdentures with at least 3 years of observation time were investigated. It was found that 91.9% of the implants survived in the maxilla, while 98.6% survived in the mandible. In a different study, 96.1% survival rates in single-tooth implant-supported restorations within 2.4 years average time.[40] The findings of the current study show that survival rates of implants were 94.7% in the maxilla and 95.2% in the mandible following 2 years of observation. Several reasons, that were previously reported, such as ages of patients, implants' length and diameter, individuals' bone quality, and region where the implant is placed,[41] and tobacco use[42] may have affected the survival rate of implants in different studies.

Prosthesis type, retention mechanism, prosthesis or abutment material,[43] presence of bruxism, and absence of a nightguard[44] may affect the incidence of technical complications in implant-supported prosthesis. In a previous study, 24.8% of the patients experienced frequent technical complications with implant-supported restorations with 5.3 years of observation time.[45] In the current study, similarly to the previous study,40 technical and mechanical complication rates were 23.8% in the maxilla and 21.7% in the mandible after 2 years of observation.

There are different results in the literature regarding mechanical and technical complications types. In a study by Karlsson et al.[45] chipping (11.0%) was the most commonly seen complication and followed by

loss of retention (7.9%). According to Wittneben et al.,[25] chipping (20.3%) was followed by occlusal screw loosening (2.6%) in terms of technical and mechanical complications. In the present study, similar to the study of Wittneben et al.[25] ceramic chipping was the most common technical and mechanical problem, followed by loss of retention. However, chipping rates obtained in the present study were 16.2% in the maxilla and 15.6% in the mandible and these values were lower than values obtained from Wittneben et al.[25] When occlusal screw loosening rates were compared with Wittneben et al.[25] our results (3.8%) were higher in the maxilla and the same (2.6%) in the mandible. The difference in the observation periods might be responsible for these observed variances.[45]

In the current study, like a previous research[36] every patient responded to the survey and expressed satisfaction with the prosthesis regarding esthetics, function and convenience. And they stated that the prosthetic devices were stable and had good chewing abilities. When the implant's placement is restricted by the height and thickness of the bone or by financial limitations, implant-supported overdentures might be a viable option to traditional removable dentures and implant-supported fixed prostheses. A limited number of implants may be inserted to improve patient comfort, enhance masticatory performance, and stabilize.[36,46]

This study has some limitations. Firstly, the patient's pre-operative clinical and anatomical circumstances, implant reconstruction protocols, treatment principles used during the case planning,[25] individuals' occlusal relationships, parafunctional habits, and possible nightguard use are unknown.[35] In addition, this study was conducted within a relatively shorter follow-up time.[25,31] Future research projects should be performed gathering information about abutment and framework materials used, presence of bruxism, location of technical and mechanical complications, and their severity[25] within a longer follow-up.[25,31]

Conclusion

Most of the cases were cement-retained fixed partial dentures, and mostly commonly used prosthetic material was metal-ceramic. The survival rate of implants was relatively high in the maxilla and the mandible following 2 years of prosthesis insertion. Implant failure rates did not differ between prosthesis types and maxillary and mandibular implants. Chipping of ceramic veneers was the most frequent technical and mechanical complication. Technical and mechanical failure rates did not differ between the maxillary and the mandibular implants. The highest technical and mechanical complication rates were observed in fixed partial dentures. Most patients were satisfied with their prosthesis in terms of esthetics, function and convenience.

Değerlendirme / Peer-Review

İki Dış Hakem / Çift Taraflı Körleme

Etik Beyan / Ethical statement

Bu çalışmanın hazırlanma sürecinde bilimsel ve etik ilkelere uyulduğu ve yararlanılan tüm çalışmaların kaynakçada belirtildiği beyan olunur.

It is declared that during the preparation process of this study, scientific and ethical principles were followed and all the studies benefited are stated in the bibliography.

Benzerlik Taraması / Similarity scan

Yapıldı – ithenticate

Etik Bildirim / Ethical statement

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Çıkar Çatışması / Conflict of Interest

Yazarlar çıkar çatışması bildirmemiştir. | The authors have no conflict of interest to declare.

Yazar Katkıları / Author Contributions

Çalışmanın Tasarlanması | Design of Study: NY (%50) DA(%50)
Veri Toplanması | Data Acquisition: NY (%50) DA (%50)
Veri Analizi | Data Analysis: MK (%60) NY(%20) DA (%20)
Makalenin Yazımı | Writing up: MK (%50) NY (%20) DA (%30)
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