Original Article

Dicle Dent J. 2024;25(4):96-101.

Retrospective assessment of dental implant applications: cross-sectional study

Hazem Alhelou, Nuran Yanıkoğlu, Zeynep Çintosun

Department of Prosthetic Dentistry, Faculty of Dentistry, Atatürk University, Erzurum, Turkiye

Cite this article as: Alhelou H, Yanıkoğlu N, Çintosun Z. Retrospective assessment of dental implant applications: cross-sectional study. *Dicle Dent J.* 2024;25(4):96-101.

Received: 23/09/2024 ◆ **Accepted**: 13/11/2024 ◆ **Published**: 30/12/2024

ABSTRACT

Aims: The aim of this study was to retrospectively examine the demographic and clinical conditions of the patients operated between 2020 and 2023 and the characteristics of the implants placed and to evaluate them using descriptive statistics.

Methods: In this study, 6990 implants were evaluated in a total of 1586 patients aged 17-80 years, whose implant treatments were performed between 2020 and 2023 in Atatürk University Faculty of Dentistry, Department of Periondotology and Department of Oral, Dental and Maxillofacial Surgery. The demographic data obtained were analyzed by descriptive statistical techniques to examine a series of characteristics such as age, gender, edentulous status, implanted sites, type of post-treatment restoration and implant locations, type of post-treatment restoration and the brand and model of implants used.

Results: 52.1% (n=827) of the patients were female and 47.9% (n=759) were male. The highest number of patients (n=480) was in the 40-49 age group. The most commonly implanted tooth was the mandibular 1st molar, and the most commonly implanted area was the mandibular molar region. It was determined that 70.8% of the implants were performed in the periodontology clinic. When evaluated according to the type of prosthetic restoration, the highest proportion of patients was 49.4% (n=1366) with fixed partial edentulism terminated with teeth. The lowest number of patients was complete edentulism and overdenture restoration with 5.9% (n=162).

Conclusion: In this study; demographic and clinical characteristics of dental implant applications and the results were explained with descriptive statistical analysis methods. Retrospective evaluation of the features of clinical applications and prosthetic rehabilitation of implants is very valuable in terms of guiding treatment planning processes.

Keywords: Eduntulism, dental implant, implant supported prosthesis, retrospective study

INTRODUCTION

Dental implant therapy now has a routine clinical application in dental practice.[1-3] It is also an important component of prosthetic procedures that improves patient satisfaction and quality of life.[4-7] Tooth loss is the most common reason for the increasing demand for dental implant treatment, followed by retention and stability problems of conventional prostheses, patient expectations, clinician preferences and the known success of implant prostheses.[8]

Treatment with dental implants has been followed in many long-term clinical trials, primarily focusing on implant survival.[9] This method is considered superior to conventional treatment methods. Despite high success and survival rates with dental implants, failures do occur. The requirement of this study was to evaluate the effectiveness of current treatment approaches using data obtained from the large and diverse patient population of Atatürk University. Patient health, age, gender, condition, smoking, bone quality, oral hygiene and implant care habits, unresolved infection, implant-related factors such as implant size, implant characteristics, implant location, and other factors such as clinicians' experience have previously been recognized as determining factors for implant success, survival and failure.[9-12] However, with the rapid increase in scientific developments and the increase in the clinical experience of the physician, the patient portfolio suitable for implant treatment has expanded.[13] The study adds to this portfolio by developing a better and more reliable treatment method, easier identification of the prosthetic options in relation to the preferences of different patient groups and assistance in future treatment planning.

The main aim of this study is to make a detailed retrospective analysis of dental implant surgery and prosthetic applications performed in our clinic in a specific time period. In this context, the age and gender distribution of the patients, the reasons for implant placement, the types of implant restorations and the brands of implants placed were all analyzed.

Corresponding Author: Hazem Alhelou, hazem.alhelu@gmail.com

This work is licensed under a Creative Commons Attribution 4.0 International License.

METHODS

In this study, patients who underwent implant treatments in Atatürk University Faculty of Dentistry, Department of Oral and Maxillofacial Surgery and Department of Periondotology and patients whose implant prostheses were completed in the Department of Prosthodontics between 2020 and 2023 were included in this study. Patients were analyzed in terms of age and gender, edentulous status, number of implants, brand and type of implants, type of restoration on implant, implant sites, and type of restoration after treatment. The data were obtained by evaluating the information in the HIS. Atatürk University Ethics Committee approval was obtained for our study (Date: 25.04.2024, Decision No: 2024/04), which was planned in accordance with the Declaration of Helsinki. Bego, Bioinfinity, Bredent, Cowelmedi, Direct, DYNA, EVOSS, Implance, ITI, Medentika, Megagen, MS implant, Nobel, Nucleoss, OSSTEM, Profil, ROOTT, SWISS, Tidal, Trias, X gate brand implant systems were evaluated. A total of 6990 dental implants in 1586 patients were analyzed using Turcasoft software (Turcasoft Yazılım Ltd.Şti. Yenimahalle Atakum/Samsun, Turkiye), TurcaSoft Medical Viewer X-ray program and data from patient files.

Age groups and gender comparisons were made for a total of six age groups: 18-29, 30-39, 40-49, 40-49, 50-59, 60-69 and 70 years and older.[14] Anterior mandible, anterior maxilla, anterior maxilla, premolar mandible, premolar maxilla, premolar maxilla, molar mandible and molar maxilla where the six groups in which implant placement locations were evaluated. According to the type of restoration, crown-bridge restoration, single crown and overdenture prosthesis were evaluated. For each missing tooth, the age and gender of the missing tooth were analyzed.

Statistical Analysis

Numbers (percentages) were used to summarize the data according to groupings. Pearson's chi-square test, Yates' adjusted chi-square test and Fisher's exact chi-square test were used in statistical studies. Statistical significance level was accepted as $p<0.05$. IBM SPSS statistics 26.0 application was used for analysis.

RESULTS

In the study, 6990 implants applied to a total of 1586 patients aged between 17 and 80 years were evaluated. Of the patients, 52.1% (n=827) were female and 47.9% (n=759) were male. The highest number of patients was in the 40-49 age group with 30.3% (n=480), followed by the 50-59 age group with 23.4% (n=371) and the 30-39 age group with 19.1% (n=302). While 11.8% (n=187) were in the 60-69 age group, 13.8% (n=220) were in the 18-29 age group. Patients aged 70 years and older constituted the group with the lowest number of patients (1.6%; n=26). The mandibular left first molar was the most frequently implanted tooth number with 543 implants, while the mandibular right first molar was the second most frequently implanted tooth number with 509 implants. A statistically significant relationship was found between tooth number and age ($p<0.0001$) (Table 1).

The rate of implant placement for tooth number 11 in the 40-49 age group was statistically significantly higher than in the 18-29 and 30-39 age groups. The number of implants placed for tooth number 32 was statistically significantly higher in the 40-49 age group. It was found to be statistically significant that more implants were placed in teeth numbered 36 and 37 among people aged between 40 and 49 years (Table 1).

The majority of the patients were female with 52.1% (n=827). When the age distribution of the patients was analyzed, the age group with the highest number of patients was 40-49 years old with 30.3% (n=480), while the age group with the lowest number of patients was 70 years and older with 1.6% (n=26) (Table 2).

According to the anatomical sites of the implants, the molar mandible accounted for 24.3% of all implants (n=1697), followed by the molar maxilla (19.5%) for the second highest number of implants. The anterior mandible had the least number of implants (11.0%) (n=768) (Table 3).

When the implants were analyzed according to tooth numbers, tooth number 36 had the highest implant rate (7.8%; n=543), followed by tooth number 46 (7.3%; n=509). The fewest implants were placed in tooth number 41 with 0.8% (n=53) (Figure 1).

When evaluated according to the type of prosthetic restoration performed, the highest proportion of patients was 49.4% (n=1366) with fixed partial edentulism with tooth termination, followed by single tooth deficiency with 33.8% (n=935) and lower fixed complete edentulism with 8.4% (n=232). In single edentulous cases, tooth 36 was restored at the highest rate, while tooth 41 was restored at the lowest rate. The lowest number of patients was complete edentulousness and overdenture restoration with 5.9% (n=162) (Figure 2).

When the distribution of patients according to the clinic where their surgical operations were performed was analyzed, it was seen that the periodontology clinic was preferred by the most patients with 70.8% (n=4952), followed by the surgery clinic with 29.2% (n=2038).

When analyzed according to the type of implant brand, the most preferred implant brand was Nucleoss with 27.2% (n=1900), followed by OSSTEM with 26.6% (n=1861), Implance with 22.3% (n=1560), Direct with 6.8% (n=474) and Bredent with 5.7% (n=401). The least implants were X gate and ITI brand with the same rate of 0.03% (n=2) (Figure 3).

DISCUSSION

Dental implants are now widely used in the treatment of missing teeth.[15-17] The range of implant indications has expanded significantly in recent years due to evolving patient profiles and continuously improving implant technologies. Despite the increasing number of implant treatments in Turkiye in recent years, quantitative data on this subject is still unclear. This can be explained by the recent implementation of faculty automation systems in Turkiye and the inadequate ability of existing automation systems to document implantation procedures. Simultaneously, implant treatment has become widely used in patients with single

Table 1. Distribution of implants according to tooth numbers and age groups

	Age					
Tooth number	**18-29**	**30-39**	**40-49**	**50-59**	**60-69**	**70 and above**
	Number (%)	**Number (%)**	**Number (%)**	**Number (%)**	**Number (%)**	**Number (%)**
11	17_{a} (20.0)	14_{a} (16.5)	32_{a} (37.6)	17_{a} (20.0)	4_{a} (4.7)	1_{a} (1.2)
12	54_{a} (26.7)	22_{b} (10.9)	40_{b} (19.8)	71_{a} (35.1)	12_{b} (5.9)	$3_{a,b}$ (1.5)
13	55_{a} (27.9)	16_{b} (8.1)	$45_{b,c}$ (22.8)	56_{c} (28.4)	$24_{b,c}$ (12.2)	$1_{a,b,c}$ (0.5)
14	$62_{a,b}$ (18.7)	86_{b} (26.0)	82_{c} (24.8)	$76_{a,c}$ (23.0)	20_{c} (6.0)	$5_{a,b,c}$ (1.5)
15	24_{a} (7.3)	80_{b} (24.4)	$105_{b,c}$ (32.0)	$65_{a,c}$ (19.8)	$52_{b,c}$ (15.9)	$2_{a,b,c}$ (0.6)
16	32_{a} (8.2)	102_{b} (26.3)	110_{a} (28.4)	92_{a} (23.7)	$50_{a,b}$ (19.2)	$2_{a,b}$ (0.5)
17	0_{a} (0.0)	16_{b} (8.4)	79_{c} (41.8)	$54_{b,c}$ (28.6)	40_{c} (21.1)	$0_{a,b,c}$ (0.0)
21	43_{a} (43.4)	$3_{b,c}$ (3.0)	$25_{c,d}$ (25.3)	26_{d} (26.3)	1_{b} (1.0)	$1_{a,b,c,d}$ (1.0)
22	$43_{a,b}$ (22.1)	23_{c} (11.8)	53_{c} (27.2)	34_{c} (17.4)	$30_{b,c}$ (15.4)	12_{a} (6.2)
23	43_{a} (20.2)	$39_{a,b}$ (18.3)	54_{b} (25.4)	$59_{a,b}$ (27.7)	18_{b} (8.5)	$0_{a,b}$ (0.0)
24	58_{a} (15.8)	$57_{a,b}$ (15.6)	122_{a} (33.3)	64_{b} (17.5)	61_{a} (16.7)	$4_{a,b}$ (1.1)
25	21_{a} (6.3)	90_{b} (26.9)	83_{a} (24.8)	111_{b} (33.1)	25_{a} (7.1)	$5_{a,b}$ (1.5)
26	35_{a} (9.2)	89_{b} (23.3)	139_{b} (36.4)	$107_{a,b}$ (28.0)	10_{c} (2.6)	$2_{a,b,c}$ (0.5)
27	0_{a} (0.0)	27_{b} (14.2)	58_{b} (30.5)	59_{b} (31.0)	46_{b} (24.2)	$0_{a,b}$ (0.0)
31	17_{a} (28.3)	$7_{a,b,c,d}$ (11.7)	$14_{c,d}$ (23.3)	$5_{b,d}$ (8.3)	17_{a} (28.3)	$0_{a,b,c,d}$ (0.0)
32	6_{a} (4.3)	4_{a} (2.9)	66_{b} (47.8)	24_{a} (17.4)	38_{b} (27.5)	$0_{a,b}$ (0.0)
33	0_{a} (0.0)	12_{b} (6.4)	28_{b} (15.0)	57_{c} (30.5)	47_{c} (25.1)	43_{d} (23.0)
34	4_{a} (6.1)	63_{b} (25.5)	38_{c} (15.4)	76_{b} (30.8)	63_{b} (25.5)	$3_{a,b,c}$ (1.2)
35	$22_{a,b,c}$ (8.6)	$60_{c,d}$ (23.4)	$88_{b,d}$ (34.4)	44_{a} (17.2)	$26_{a,b,c,d}$ (20.2)	16_{e} (6.3)
36	87_{a} (16.0)	136_{a} (25.0)	196_{a} (36.1)	84_{b} (15.5)	40_{b} (7.4)	0_{b} (0.0)
37	21_{a} (6.8)	48_{a} (15.5)	152_{b} (49.2)	68_{a} (22.0)	19_{a} (6.1)	$1_{a,b}$ (0.3)
41	$11_{a,b,c,d}$ (20.8)	$6_{c,d,e}$ (11.3)	2_{e} (3.8)	$13_{b,d}$ (24.5)	21_{a} (39.6)	$0_{a,b,c,d,e}$ (0.0)
42	$18_{a,b,c,d,e}$ (12.6)	$23_{d,e}$ (16.1)	$19_{c,e}$ (13.3)	71_{b} (49.7)	$12_{a,c,d,e}$ (8.4)	$0_{a,b,c,d,e}$ (0.0)
43	39_{a} (20.9)	6_{b} (3.2)	40_{c} (21.4)	$55_{a,c}$ (29.4)	44_{a} (23.5)	$3_{a,b,c}$ (1.6)
44	7_{a} (2.8)	17_{a} (6.7)	87_{b} (34.4)	94_{b} (37.2)	46_{b} (18.2)	$2_{a,b}$ (0.8)
45	55_{a} (20.6)	39_{b} (14.6)	71_{b} (26.6)	$65_{a,b}$ (14.6)	$37_{a,b}$ (13.9)	$0_{a,b}$ (0.0)
46	117_{a} (23.0)	118_{a} (23.2)	116_{b} (22.8)	114_{b} (22.4)	44_{b} (8.6)	0_{b} (0.0)
47	18_{a} (5.4)	34_{a} (10.1)	123_{b} (36.6)	96_{b} (28.6)	65_{b} (19.3)	$0_{a,b}$ (0.0)

a, b, c: Different characters in each row indicate a statistically significant difference ($p<0.05$)

Table 2. Distribution of implants by age

Patient age	**18-29**	**30-39**	**40-49**	**50-59**	**60-69**	**70 and above**	**Total**
n	220	302	480	371	187	26	1586
%	13.8	19.1	30.3	23.4	11.8	1.6	100.0

Table 3. Distribution of implants by region

Implanted region	**(n)**	**%**
Anterior maxilla	991	14.2
Anterior mandible	768	11.0
Premolar maxilla	1361	19.5
Premolar mandible	1024	14.6
Molar maxilla	1149	16.4
Molar mandible	1697	24.3
Total	6990	100.0

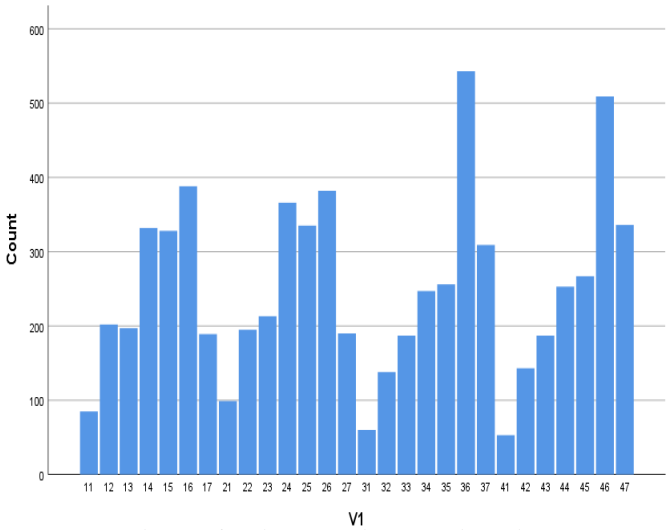

Figure 1. Distribution of implants according to tooth numbers

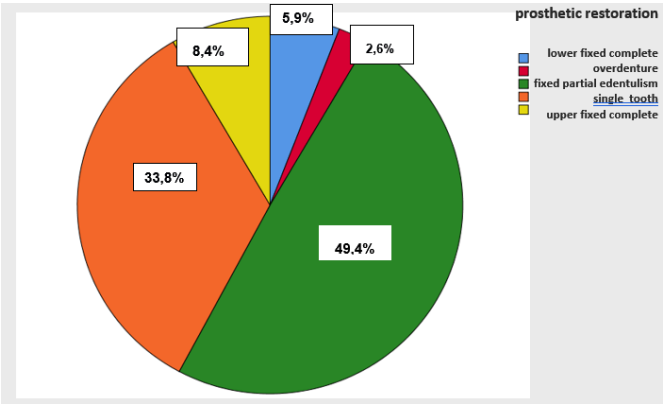

Figure 2. Distribution according to the type of prosthetic restoration

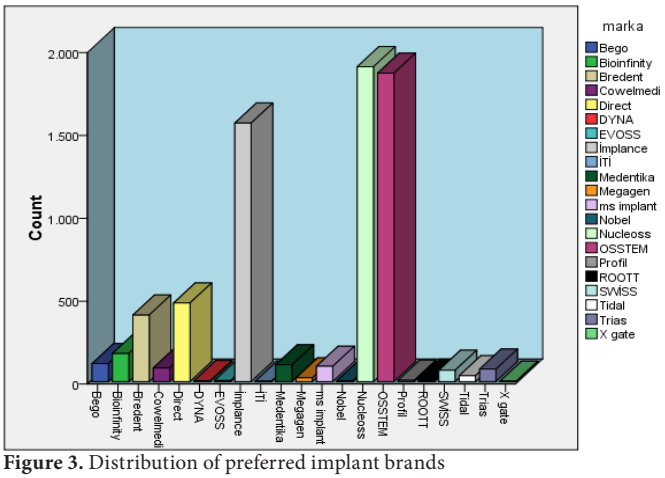

Figure 3. Distribution of preferred implant brands

missing teeth as well as in partially or completely edentulous patients.[18] Physicians benefit from retrospective evaluation of the characteristics of clinical applications of dental implants that have existed for some time.[19,20] In this study, we examined the clinical and demographic data of patients who underwent dental implant surgery between 2020 and 2023, as well as the characteristics of the preferred implants.

Dental implants are becoming increasingly necessary as people age and experience more tooth loss. In the study by Sarı et al.[21] the mean age of dental implants was 52.43 years. When the age range of the patients was evaluated; 2 patients (3.44%) between the ages of 18-25, 4 patients (6.89%) between the ages of 26-35, 12 patients (20.6%) between the ages of 36-45, 11 patients (18.9%) between the ages of 46-55, 24 patients (41.3%) between the ages of 56-65, and 5 patients (8.62%) over the age of 65. According to Bural et al.,[14] the mean age of dental implants was 52.12 years and the most common age groups were 40-49 years (20.7% of implants), 60-65 years (25.2% of implants) and 50-59 years (30.8% of implants). According to Brennan et al.,[22] the mean age was 53.4 years and the 40-60 age group was the most common age group to receive dental implants, followed by the 20-40 age group and the 60-80 age group. The mean age of 159 patients in Mundt's[23] study of 663 implants was reported to be 54 years. According to Urvasızoğlu et al.,[24] the mean age was 41.1 years, with 46-55 years being the most popular age group for dental implants, followed by 36-45 years. Polat et al.[25] found the mean age and age range for men and women to be 51.7 years and 18-70 years and 51.2 years and 22-75 years, respectively. The age range of the patients in our study was 17-80 years, with a mean age of 52.43 years. In our study, when the age range in which the most dental implants were applied was evaluated, the highest number of patients was in the 40-49 age group with 30.3% (n=480), followed by the 50-59 age group with 23.4% (n=371) and the mean age was 45.1 years. Differences in sample sizes between the studies are thought to be the reason for the difference in these results.

According to the findings of our study, 52.1% of the patients were female and 47.9% were male. Most studies conducted concurrently with our study showed that more female patients received implant treatment compared to male patients.[24,26,27]

The use of implants has increased every year due to their proven effectiveness. In the last 20 years, the patient profile has shifted from total edentulism to partial edentulism and dental implant indications have increased.[26] Sar et al.[21] 2022, it was reported that the most common edentulous condition was partial edentulism ending in edentulism 60.5%, while the least common edentulism was partial edentulism ending in edentulism 7.04%. Bural et al.[14] 2013, 48.2% of dental implants were placed to treat total edentulism, while the remaining 23.2% were placed to treat partial edentulism. Polat et al.[25] 2019, it was reported that 80% of partial edentulism was treated with dental implants. Urvasızoğlu et al.[24] 2016 reported that partial edentulism with edentulous termination was the most common edentulous condition among patients undergoing dental implant surgery. When evaluated according to the type of prosthetic restoration performed in our study, the highest proportion of patients was fixed partial edentulism with edentulous termination with 49.4%, followed by single edentulousness with 33.8% and lower fixed complete edentulism with 8.4%. The lowest number of patients was complete edentulism and overdenture restoration with 5.9%. The difference between the studies may be related to differences in the content of the selected patient cohort and the institutions consulted. It was observed that the implants evaluated in our study were also frequently applied in cases of partial edentulism with edentulous termination and single tooth deficiency clinical pictures.

In the study by Sarı et al.[21] 54.4% (n=99) of one hundred and eighty-two dental implants were placed in the upper jaw and 45.6% (n=83) in the lower jaw. Of these implants, 28.5% (n=52) were localized in the anterior region (incisor and canine teeth region) and 71.5% (n=130) were localized in the posterior region (1st premolar and later). In their study, Urvasızoğlu et al.[24] found that 53.2% of 233 dental implants were placed in the upper jaw and 46.8% in the lower jaw. Urvasızoğlu et al.[28] 2019, 52.4% of 498 dental implants were placed in the upper jaw and 47.6% in the lower jaw. Polat et al.[25] In their study, 56.2% of the 315 dental implants analyzed were placed in the upper jaw and 43.8% in the lower jaw. Adalı et al.[29] 2018, it was reported that 51.6% of the dental implants placed were localized in the upper jaw and 48.3% in the lower jaw. In our study, it was determined that 50.1% of 6990 implants placed in 1586 patients were placed in the upper jaw and 49.9% in the lower jaw. The data were found to be in parallel with previous studies. However, it was determined that the rates were very close to each other as the number of implants and patients

examined increased. The most implanted region was the molar mandible with 24.3% and the second most implanted region was the molar maxilla with 19.5%.

In our study, 25.2% of the implants were localized in the anterior region and 74.8% in the posterior region. Vehemente et al.[30] showed that dental implants were more commonly placed in the posterior region. Polat et al.[25] found that 28.2% of dental implants were placed in the anterior region and 71.7% in the posterior region. Adalı et al.[29] found that 27.8% of dental implants were placed in the anterior region and 72.1% in the posterior region. These results are consistent with our study. They found that significantly more implants were placed in the anterior maxilla and mandible for the treatment of total edentulism, whereas significantly more implants were placed in the posterior maxilla and mandible for the treatment of partial edentulism.[14] The fact that dental implants were more localized in the posterior region in our study is thought to be a parallel result of the fact that partial edentulism ending in edentulousness was the most common implant indication in our study.

In our study, after the mandibular first molar region, the maxillary first molar region was the most implanted tooth region. The region with the least implant placement was the mandibular incisor region. In the study by Sarı et al.[21] the most implanted region was the mandibular canine 15.3%. This was followed by the maxillary first molar 14.2%. The least implanted region was the maxillary lateral tooth 0.54%. In the study by Urvasızoğlu et al.,[24] the maxillary first molar region and mandibular first molar region were found to have the most and the lower anterior region the least implants, respectively. In a study by Akın et al.[31] on tooth loss, it was found that tooth number 18 was the most frequently lost tooth, followed by the first molars. We think that the high prevalence of tooth loss in the first molar regions explains the frequency of dental implant applications in these regions.

In our study, when the patients' choice of implant brand type was evaluated, the most common implant brand was Nucleoss with 27.2% (n=1900), followed by OSSTEM with 26.6% (n=1861), Implance with 22.3% (n=1560), Direct with 6.8% (n=474) and Bredent with 5.7% (n=401). When the distribution of patients according to the clinic where their surgical operations were performed was evaluated, the highest number of patients preferred periodontology clinic with 70.8% (n=4952), while 29.2% (n=2038) of the patients preferred surgery clinic. When it comes to the physician preference of the patients, implantologists and surgeons were the most preferred. We believe that the cost and the recommendation of the physicians were effective in the choice of the patients.

CONCLUSION

Within the limitations of the study, the information gathered from this study could be a significant referral source for implant manufacturers, distributors and practitioners alike. The information may be used to predict patterns in the success of dental implantology, especially for building implant reserves.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Atatürk University Ethics Committee (Date: 25.04.2024, Decision No: 2024/04).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Brånemark PI, Adell R, Breine U, Hansson BO, Lindström J, Ohlsson A. Intra-osseous anchorage of dental prostheses. I. Experimental studies. *Scand J Plast Reconstr Surg*. 1969;3(2):81-100. doi:10.3109/02844316909036699
2. Brånemark PI, Hansson BO, Adell R, et al. Osseointegrated implants in the treatment of the edentulous jaw. Experience from a 10-year period. *Scand J Plast Reconstr Surg Suppl*. 1977;16:1-132.
3. Brånemark PI, Adell R, Albrektsson T, Lekholm U, Lundkvist S, Rockler B. Osseointegrated titanium fixtures in the treatment of edentulousness. *Biomaterials*. 1983;4(1):25-28. doi:10.1016/0142-9612(83)90065-0
4. Allen PF, McMillan AS. A longitudinal study of quality of life outcomes in older adults requesting implant prostheses and complete removable dentures. *Clin Oral Implants Res*. 2003;14(2):173-179. doi:10.1034/j.1600-0501.2003.140206.x
5. Emami E, Heydecke G, Rompré PH, de Grandmont P, Feine JS. Impact of implant support for mandibular dentures on satisfaction, oral and general health-related quality of life: a meta-analysis of randomized-controlled trials. *Clin Oral Implants Res*. 2009;20(6):533-544. doi:10.1111/j.1600-0501.2008.01693.x
6. Heydecke G, Locker D, Awad MA, Lund JP, Feine JS. Oral and general health-related quality of life with conventional and implant dentures. *Comm Dent Oral Epidemiol*. 2003;31(3):161-168. doi:10.1034/j.1600-0528.2003.00029.x
7. Sonoyama W, Kuboki T, Okamoto S, et al. Quality of life assessment in patients with implant-supported and resin-bonded fixed prosthesis for bounded edentulous spaces. *Clin Oral Implants Res*. 2002;13(4):359-364. doi:10.1034/j.1600-0501.2002.130403.x
8. Müller F, Wahl G, Fuhr K. Age-related satisfaction with complete dentures, desire for improvement and attitudes to implant treatment. *Gerodontology*. 1994;11(1):7-12. doi:10.1111/j.1741-2358.1994.tb00096.x

9. Levin L, Sadet P, Grossmann Y. A retrospective evaluation of 1,387 single-tooth implants: a 6-year follow-up. *J Periodontol*. 2006;77(12):2080-2083. doi:10.1902/jop.2006.060220
10. Eckert SE, Wollan PC. Retrospective review of 1170 endosseous implants placed in partially edentulous jaws. *J Prosthet Dent*. 1998;79(4):415-421. doi:10.1016/s0022-3913(98)70155-6
11. Lazzara R, Siddiqui AA, Binon P, et al. Retrospective multicenter analysis of 3i endosseous dental implants placed over a five-year period. *Clin Oral Implants Res*. 1996;7(1):73-83. doi:10.1034/j.1600-0501.1996.070109.x
12. Lekholm U, Gunne J, Henry P, et al. Survival of the Brånemark implant in partially edentulous jaws: a 10-year prospective multicenter study. *Int J Oral Maxillofac Implants*. 1999;14(5):639-645.
13. Mattheos N, Ucer C, Van de Velde T, Nattestad A. Assessment of knowledge and competencies related to implant dentistry in undergraduate and postgraduate university education. *Eur J Dent Educ Off J Assoc Dent Educ Eur*. 2009;13(Suppl 1):56-65. doi:10.1111/j.1600-0579.2008.00546.x
14. Bural C, Bilhan H, Çilingir A, Geçkili O. Assessment of demographic and clinical data related to dental implants in a group of Turkish patients treated at a university clinic. *J Adv Prosthodont*. 2013;5(3):351-358. doi:10.4047/jap.2013.5.3.351
15. Fischer K, Stenberg T. Three-year data from a randomizd, controlled study of early loading of single-stage dental implants supporting maxillary full-arch prostheses. *Int J Oral Maxillofac Implants*. 2006;21(2):245-252.
16. Juodzbalys G, Raustia AM, Kubilius R. A 5-year follow-up study on one-stage implants inserted concomitantly with localized alveolar ridge augmentation. *J Oral Rehabil*. 2007;34(10):781-789. doi:10.1111/j.1365-2842.2006.01679.x
17. Luongo G, Di Raimondo R, Filippini P, Gualini F, Paoleschi C. Early loading of sandblasted, acid-etched implants in the posterior maxilla and mandible: a 1-year follow-up report from a multicenter 3-year prospective study. *Int J Oral Maxillofac Implants*. 2005;20(1):84-91.
18. Fugazzotto PA, Gulbransen HJ, Wheeler SL, Lindsay JA. The use of IMZ osseointegrated implants in partially and completely edentulous patients: success and failure rates of 2,023 implant cylinders up to 60+ months in function. *Int J Oral Maxillofac Implants*. 1993;8(6):617-621.
19. Machtei EE, Mahler D, Oettinger-Barak O, Zuabi O, Horwitz J. Dental implants placed in previously failed sites: survival rate and factors affecting the outcome. *Clin Oral Implants Res*. 2008;19(3):259-264. doi:10.1111/j.1600-0501.2007.01466.x
20. Wittneben JG, Buser D, Salvi GE, Bürgin W, Hicklin S, Brägger U. Complication and failure rates with implant-supported fixed dental prostheses and single crowns: a 10-year retrospective study. *Clin Implant Dent Relat Res*. 2014;16(3):356-364. doi:10.1111/cid.12066
21. Sarı M, Tümer MK. Retrospective Assessment of Dental Implant Applications: Cross-Sectional Study. *Turk Klin J Dent Sci*. 2022;28(2):245-251. doi:10.5336/dentalsci.2021-83695
22. Brennan M, Houston F, O'Sullivan M, O'Connell B. Demographics of implant placement and complications of a patient subgroup in a dental hospital population. *J Ir Dent Assoc*. 2010;56(2):85-92.
23. Mundt T, Mack F, Schwahn C, Biffar R. Private practice results of screw-type tapered implants: survival and evaluation of risk factors. *Int J Oral Maxillofac Implants*. 2006;21(4):607-614.
24. Urvasizoğlu GG, Saruhan N, Ataol M. Evaluation of demographic and clinical characteristics of dental implant applications. *J Atatürk Uni Fac Dent*. 2016;26(3):394-398. doi:10.17567/ataunidfd.290237
25. Polat ME, Saruhan N, Gojayeva G. Demographic evaluation of patients with dental implants. *J Biotechnol Strateg Health Res*. 2019;3(2):85-90. doi:10.34084/bshr.580426
26. Bornstein MM, Halbritter S, Harnisch H, Weber HP, Buser D. A retrospective analysis of patients referred for implant placement to a specialty clinic: indications, surgical procedures, and early failures. *Int J Oral Maxillofac Implants*. 2008;23(6):1109-1116.
27. Eltas A, Dündar DS, Uzun İH, Malkoç MA. Evaluation of dental implant success and patient profile: a retrospective study. *J Atatürk Uni Fac Dent*. 2013;23(1):1-8.
28. Urvasizoğlu G, Türen T. Prevalence and treatment of intraoperative and early complications encountered in dental implant procedures: a retrospective clinical study. *J Atatürk Uni Fac Dent*. 2019;29(2):259-267. doi:10.17567/ataunidfd.498763
29. Adalı E, Yüce MÖ, Günbay T, Çıplak G. Retrospective evaluation of success rates of different dental implants. *J Atatürk Uni Fac Dent*. 2018;28(2):174-181. doi:10.17567/ataunidfd.418844
30. Vehemente VA, Chuang SK, Daher S, Muftu A, Dodson TB. Risk factors affecting dental implant survival. *J Oral Implantol*. 2002;28(2):74-81. doi:10.1563/1548-1336(2002)028<0074:RFADIS>2.3.CO;2
31. Akin C, Mutlu ŞN, Güntekin N. The relationship between increasing age and severity of tooth loss in adult patients. *Necmettin Erbakan Uni J Dent*. 2020;2(2):64-68.