



Demographic Evaluation of Implant Locations Among 1000 Adult Patients in Turkey



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Abstract

Background: The present study aimed to evaluate the demographics of the patients who applied for implant treatment to Inonu University, Faculty of Dentistry, Department of Prosthodontics between 2010 and 2016.

Methods: In implant patients, implant locations, type of restoration after implant treatment, age and gender of the patients were determined using Metasoft software. FDI numbering system was used for implant locations. Descriptive statistics were analyzed using chi-square test ($P < 0.05$).

Results: It was found that a total of 1000 patients (410 males, 590 females) received 2955 implants during the specified period. 1052 implants were received by individuals between the ages of 41 and 50. There were statistical differences between age groups based on the implants in tooth numbers 14, 27, 34, 36, 37, 44, 46, and 47 ($P < 0.05$) that were frequently implemented in 41-50 year old patients. It was found that the most frequent restoration type was single crowns and the first molar tooth received the highest number of implants. It was found that the regions that received the highest number of implants were the mandible and posterior regions.

Conclusions: It was determined that the number of implants in the mandible increased with the age of the patients. It was observed that the implant-supported prosthetic treatment options varied based on the state of the jaws, the localization and width of the edentation, the income levels of the patients and their gender.

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Background

Dental implantation is the process of placement of biocompatible material in edentate regions of the jaw to function as natural dental root. Dental implants have been accepted scientifically and have become a frequently used treatment option in the treatment of complete and partial edentation, including the restoration of missing teeth since Branemark's description of osseointegration in the 1960s (1). For several decades, dental implantation has been applied as a routine clinical therapy in dental practice and became a significant prosthodontic procedure that improves patient's satisfaction and the quality of life (2,3).

There are several studies in the literature on dental implant treatments (4-8). These studies were primarily on the assessment of osseointegration (9,10), bone loss (11,12) and survival (13-15). However, despite the increasing number of implant treatments in Turkey during recent years, quantitative data on this issue are not still clear. This could be explained by the fact that the application of faculty automation systems in our country is still new and that the search capabilities to document the implantation procedures in the existing automation system is insufficient. The objective of the present study is to evaluate the implants applied at Inonu University,

Highlights

The number of implants made to the lower anterior region increased with the development of implant supported removable prostheses.

Faculty of Dentistry based on the patient demographics and application indications and implant restoration type using the data available in the Hospital Information and Management System (HIMS).

Methods

The present study is a retrospective analysis of 1000 patients who applied for implant application to Inonu University, Faculty of Dentistry, Oral and Maxillofacial Surgery. In this study, all the implant-supported prosthetic restorations were conducted in the department of prosthodontics between January 2010 and March 2016. As the restorations have been implemented in all patients, the samples did not undergo selection. Patients were evaluated for the status of the edentulousness, number of implants and implant restoration type based on their age and gender. The data were obtained by evaluating the information contained in the HIMS.

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The following data were reviewed using the patient charts: (1,2,16)

The comparison was done between genders and age groups. We had 5 age groups as follows: 20-30 years, 31-40 years, 41-50 years, 51-60 years, and 61 and older. FDI numbering system was used in the assessment of implant positions. Six groups were established based on the location of the dental implant such as anterior maxilla, posterior maxilla, anterior mandible, posterior mandible, maxilla and mandible. Six main types of prostheses for implant therapy were recorded as follows: Single tooth, three-unit fixed prosthesis for distally extended edentulous space (Kennedy Class I and II cases), multi-unit fixed prosthesis for extended edentulous space that is not contraindicated for conventional fixed partial denture, fixed prosthesis for edentulism in one jaw (maxilla or mandible), fixed prosthesis for total edentulism, and removable prosthesis for total edentulism.

The statistical analysis of the results was conducted using the Statistical Package for Social Sciences (IBM SPSS version 23.0, Chicago, IL, USA) software. Descriptive statistics were analyzed using chi-square test for the following parameters: demographic parameters, type of indication, implant position, and anatomical location. The results were assessed at a significance level of 0.05.

Results

A total of 2955 implants were placed in 1000 patients during 6 years. 410 male and 590 female patients were between 20 and 100 years old. 320 patients were in the age range of 41-50 years ($P < 0.05$). Figure 1 demonstrates the distribution of implant localizations by gender. There were statistical differences between genders and the age groups ($P < 0.05$). Table 1 presents the distribution of the number and percentage of the implants according to the age groups of the patients. The most frequent location for implant placement was the first molar region in the mandible (513 implants) followed by the first molar

region in the maxilla (262 implants). There were statistical differences between age groups based on the implants in tooth numbers 14, 27, 34, 36, 37, 44, 46, and 47 ($P < 0.05$) that were frequently implemented in 41-50 year old patients (Table 1). There were statistical differences between genders based on the implants in tooth numbers 36 and 45 ($P < 0.05$) and the number of female patients was higher compared to male patients (Figure 2).

There were statistical differences between age groups based on the restorations of single crowns, Kennedy Class, single maxillary fixed and, total edentulous with removable prosthesis ($P < 0.05$). It was found that single crowns had the maximum numbers of restorations, followed by Kennedy Class (Table 2). 48.6% of single-mandible fixed prosthesis rehabilitations were observed in patients aged 51 to 60. Fifty percent of implant-supported removable prosthesis rehabilitations of totally edentulous patients aged 41 to 50. There were statistical differences between genders based on the restorations of total edentulous with fixed prosthesis ($P < 0.05$) (Figure 3).

There were statistical differences between age groups in terms of anatomic localizations of restorations ($P < 0.05$) (Table 3). Thirty-five percent of the anterior maxillary implants, 38.3% of posterior maxillary implants and 39.3% of posterior mandibular implants were observed in patients who were 41-50 years old. Anterior mandibular implants (48%) were observed in patients who were 61-83 years old. 37% of maxillary implants and 31.2% of mandibular implants were observed in patients between the ages of 41 and 50 (Table 3). There were statistical differences between the genders in terms of anatomic localizations of restorations (Figure 4).

Discussion

Dental implants have created significant changes in the treatment planning of totally and partially edentulous patients (2). Intra-bone implant-supported prosthesis is a successful, effective, and predictable treatment that could

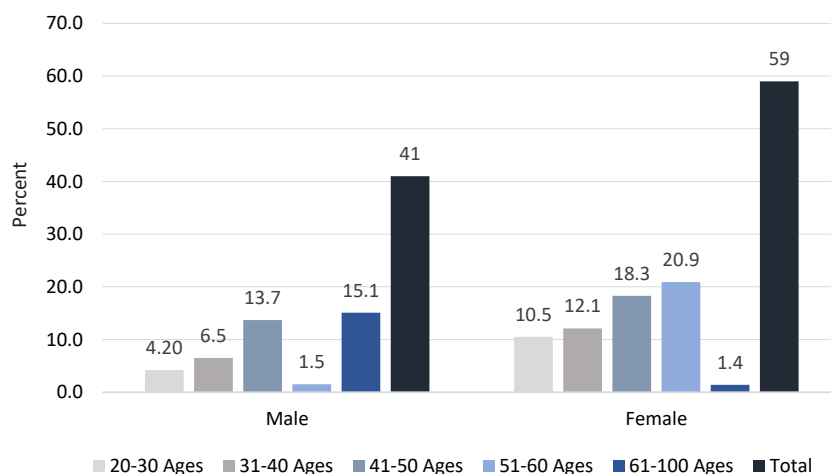


Figure 1. Age and Gender Distribution of Patients Received Dental Implants.

Table 1. Distribution of the Maxillary Implant Count and Percentage Based on Location, Age Groups of the Patients

Implant	Ages Count (%)					Total Count (%)	P
	20-30	31-40	41-50	51-60	61-100		
11	11 (19.3)	9 (15.8)	21 (36.8)	10 (17.5)	6 (10.5)	57 (1.93)	0.131*
12	4 (10.8)	9 (24)	14 (37.8)	7 (18.9)	3 (8.1)	37 (1.25)	0.568
13	2 (3.3)	6 (9.8)	25 (41)	18 (29.5)	10 (16.4)	61 (2.06)	0.061*
14	16 (12.3)	29 (15.4)	57 (43.8)	22 (16.9)	15 (11.5)	130 (4.4)	0.017*
15	7 (7.6)	23 (25)	34 (37)	14 (15.2)	14 (15.2)	92 (3.11)	0.181
16	12 (6.6)	34 (18.8)	67 (37)	43 (23.8)	25 (13.8)	181 (6.13)	0.196
17	3 (5.2)	13 (22.4)	21 (36.2)	13 (22.4)	8 (13.8)	58 (1.96)	0.599
21	5 (10.9)	5 (10.9)	18 (39.1)	12 (26.1)	6 (13.3)	46 (1.56)	0.564
22	6 (14.6)	9 (22)	18 (43.9)	5 (12.2)	3 (7.3)	41 (1.39)	0.135
23	4 (6.1)	12 (18.2)	26 (39.4)	16 (24.2)	8 (12.1)	66 (2.23)	0.483
24	11 (9.4)	18 (25.4)	43 (36.8)	28 (23.9)	17 (14.5)	117 (3.96)	0.685
25	4 (5)	20 (25)	32 (40)	15 (18.8)	9 (11.2)	80 (2.71)	0.087
26	16 (8.8)	39 (21.5)	62 (34.3)	42 (23.2)	22 (12.2)	181 (6.13)	0.336
27	0 (0)	15 (21.7)	26 (37.7)	13 (18.8)	15 (21.7)	69 (2.34)	0.032*
31	0 (0)	3 (23.1)	6 (46.2)	3 (23.1)	1 (7.7)	13 (0.44)	0.597
32	2 (3.5)	6 (10.5)	15 (26.3)	18 (31.6)	16 (28.1)	57 (1.93)	0.013*
33	3 (1.3)	10 (4.5)	40 (17.9)	85 (38.1)	85 (38.1)	223(7.55)	0.001*
34	1 (1.3)	13 (16.7)	32 (41)	21 (26.9)	11 (14.1)	78 (2.64)	0.037*
35	10 (10.4)	16 (16.7)	35 (36.5)	23 (24)	12 (12.5)	96 (3.25)	0.732
36	21 (8.3)	57 (22.4)	109 (42.9)	49 (19.3)	18 (7.1)	254(8.60)	0.001*
37	8 (5.6)	29 (20.1)	65 (45.1)	26 (18.1)	16 (11.1)	144(4.87)	0.001*
41	0 (0)	5 (38.5)	4 (30.8)	3 (23.1)	1 (7.7)	13 (0.44)	0.305
42	1 (1.9)	6 (11.3)	13 (24.5)	15 (28.3)	18 (34)	53 (1.79)	0.001*
43	2 (0.9)	11 (4.8)	41 (18)	88 (38.6)	86 (37.7)	228(7.72)	0.001*
44	4 (4.8)	13 (15.5)	30 (35.7)	28 (33.3)	9 (10.7)	84 (2.84)	0.033*
45	5 (4.8)	13 (16)	36 (44.4)	19 (23.5)	19 (23.5)	81 (2.74)	0.074
46	31 (12)	51 (19.7)	100 (38.6)	59 (22.8)	18 (6.9)	259(8.76)	0.001*
47	8 (5.1)	32 (20.5)	62 (39.7)	36 (23.1)	18 (11.5)	156(5.28)	0.020*

*FDI notation used.

be used to replace missing teeth. Retrospective evaluation of the properties of clinical applications of dental implants that has been used for a long time is of great value in guiding the dentists (17). The aim of the present study was to assess the demographic and clinical data of the implant

patients whose restorations were conducted by our team at Inonu University, Faculty of Dentistry, Department of Prosthodontics between 2010 and 2016.

Vehemente et al (18) reported that the mean age at implantation was 53.5, Eltas et al (19) found that the mean

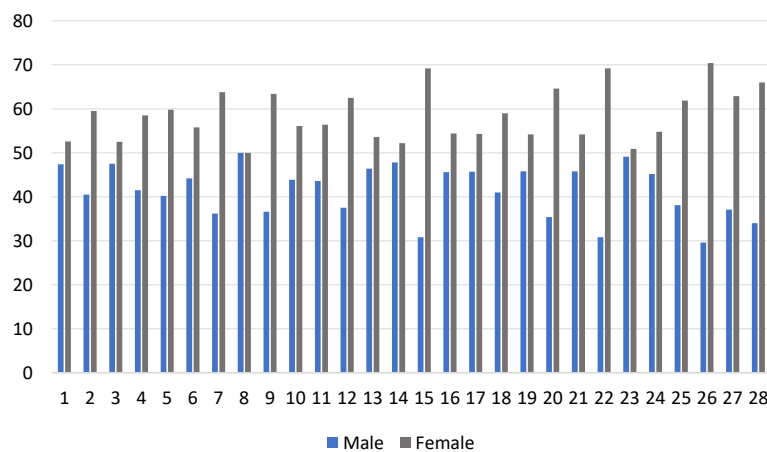


Figure 2. Distribution of the Implants in Terms of Gender.

Table 2. Distribution of Implants in Terms of Restoration Type

Restoration	Ages Count (%)					Total Count	P
	20-30	31-40	41-50	51-60	61-100		
Single crown	128 (21.3)	156 (25.9)	204 (33.9)	89 (14.8)	25 (4.3)	602	0.001*
Kennedy 1-2	24 (4.3)	110 (19.6)	233 (41.6)	124 (22.1)	69 (12.3)	560	0.001*
Extended edentation	1 (1.3)	13 (17.1)	24 (31.6)	22 (28.9)	16 (21.1)	76	0.184
Single maxillary fixed	0 (0)	1 (2.9)	12 (34.3)	17 (48.6)	5 (14.3)	35	0.001*
Total edentulous fixed	1 (4.5)	3 (13.6)	11 (50)	4 (18.2)	3 (13.6)	22	0.465
Total edentulous removable	0 (0)	6 (2.9)	29 (13.9)	82 (39.2)	92 (44)	209	0.001*

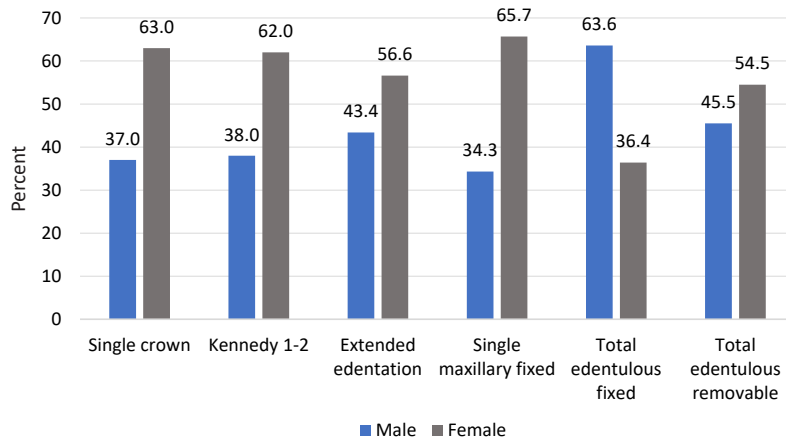


Figure 3. Distribution of Restoration Types in Terms of Gender.

age was 45.2 in their study and Urvasizoglu et al (17) reported that the most common age range for implants was the 46-55 age range. In the present study, when the age ranges of the patients were examined, it was found that the implants were most frequently applied between the ages of 41 and 50. This discrepancy was considered to be due to the differences in the sample sizes. In the present study, 1000 patients were evaluated, while in other studies, these values were determined with a smaller number of patients.

In comparison with other gender-based studies, it was observed that implant treatment was more common among female patients than in male patients in the present study (16,17,19). When the tooth numbers and implant localization were evaluated, it was found that the number of implants in the first molar tooth was higher than that of

the other teeth. In a study by Bural et al (2) and Bornstein et al (16), it was determined that the highest number of implants was placed in the central tooth position and in the youngest age group. However, in the present study, it was found that the higher number of central teeth and single-crown implant were conducted in 41-50 year old patients. This could be attributed to the fact that it is the first permanent tooth in the mouth and its early loss is due to this fact. The findings of this study demonstrated that the comparison of the right and left arcs revealed that the number of implants conducted in symmetrical teeth was very similar. Moreover, both right and left first molars were found to be identical. It should be mentioned that no other study has been found to elucidate the location of implants in the age groups as thoroughly as this study.

Implants in tooth numbers 32, 33 and 42, 43 were more

Table 3. Distribution of the Dental Implants in Different Regions of Each Jaw in Terms of Age Groups

Anatomic Localization	Ages Count (%)					Total Count	P
	20-30	31-40	41-50	51-60	61-100		
Anterior maxilla	27 (17.2)	26 (16.6)	55 (35)	31 (19.7)	18 (11.5)	157	0.015*
Posterior maxilla	42 (9.7)	94 (21.7)	166 (38.3)	80 (18.5)	51 (11.8)	433	0.001*
Anterior mandible	5 (1.7)	19 (6.5)	58 (19.8)	106 (47.3)	105 (63.6)	293	0.001*
Posterior mandible	51 (10.4)	104 (21.4)	192 (39.3)	99 (20.2)	43 (8.8)	489	0.001*
Maxilla	66 (13.6)	106 (21.8)	180 (37)	84 (17.2)	51 (10.5)	487	0.001*
Mandible	55 (7.6)	116 (16.1)	225 (31.2)	184 (25.5)	141 (16.5)	721	0.001*

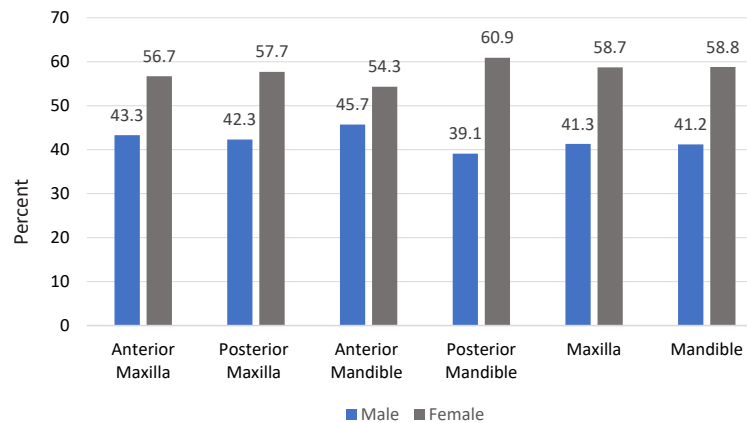


Figure 4. Distribution of Dental Implants in Different Regions of Each Jaw in Terms of Gender.

frequent in the higher age groups, and this was due to the implementation of the two-implant supported removable prostheses to support the mandibular prosthesis in totally edentulous patients.

Based on the performed restoration, unlike some other studies, single-crown restoration was found as the most prevalent type of restoration in the present study (2,17). This was followed by Kennedy Class I and II. Bornstein et al (16) found similar results in their study.

Consistent with the other studies, when the anterior and posterior implants were compared, they demonstrated that the number of implants in the anterior region was less than that in the posterior region. However, contrary to certain studies (16,18) and consistent with a study by Buser et al (1), the number of mandibular implants was higher compared to maxillary implants. This could be due to the placement of two-implant supported prosthesis in the mandible, while no implants were placed in the maxilla in totally edentulous patients since the number of implants in the anterior mandibular region was about 2 times higher than the number of implants in the anterior maxilla.

Limitations of this study include the fact that the implant diameter and size were not assessed. This is a retrospective study that covered 6 years where 1000 patients were evaluated, however higher number of patients could be evaluated in a longer period of time. Furthermore, the present study was conducted in only one province of Turkey and further studies that would cover all provinces should be conducted.

Bearing in mind the limitations of the present retrospective study, it was found that the maximum numbers of implants were implemented in the 41-50 age group and in female patients. The single crown restoration was the most prevalent type of restorations. Kennedy Class I and II were the most frequent restoration in the 41-50 age group. The highest numbers of implants were placed in the first molar. When the right and left segments were compared, it was found that implant counts were surprisingly similar. Based on the findings,

it could be argued that retrospective studies on dental implant treatment provide informative and prompting results, and the significance of much wider, multi-center and multidisciplinary studies could be recognized.

Authors' Contribution

Study concept and design: GY, CA, NTP, and EBGA; acquisition of data: CA; analysis and interpretation of data: GY; drafting of the manuscript: GY, CA, EBGA; statistical analysis: GY; administrative, technical, and material support: GY; study supervision: GY.

Ethical Statement

The experimental protocol was approved based on the ethical standards of the Declaration of Helsinki. The permissions and consents required for the study were obtained from the Clinical Research Ethics Committee of Malatya (Approval number: 2016 / 12-6, Approval date: 09/06/2016).

Conflict of Interest Disclosures

The authors declare that they have no conflict of interests.

References

1. Buser D, Mericske-Stern R, Bernard JP, Behneke A, Behneke N, Hirt HP, et al. Long-term evaluation of non-submerged ITI implants. Part 1: 8-year life table analysis of a prospective multi-center study with 2359 implants. *Clin Oral Implants Res.* 1997;8(3):161-72.
2. Bural C, Bilhan H, Cilingir A, Geckili 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):351-8. doi: [10.4047/jap.2013.5.3.351](https://doi.org/10.4047/jap.2013.5.3.351).
3. Branemark PI, Adell R, Albrektsson T, Lekholm U, Lundkvist S, Rockler B. Osseointegrated titanium fixtures in the treatment of edentulousness. *Biomaterials.* 1983;4(1):25-8.
4. Faggion CM Jr, Apaza K, Ariza-Fritas T, Malaga L, Giannakopoulos NN, Alarcon MA. Methodological Quality of Consensus Guidelines in Implant Dentistry. *PLoS One.* 2017;12(1):e0170262. doi: [10.1371/journal.pone.0170262](https://doi.org/10.1371/journal.pone.0170262).
5. Barewal RM, Oates TW, Meredith N, Cochran DL. Resonance frequency measurement of implant stability in vivo on implants with a sandblasted and acid-etched surface. *Int J Oral Maxillofac Implants.* 2003;18(5):641-51.
6. Wolfinger GJ, Balshi TJ, Rangert B. Immediate functional loading of Branemark system implants in edentulous mandibles: clinical report of the results of developmental and simplified protocols. *Int J Oral Maxillofac Implants.*

- 2003;18(2):250-7.
7. Shalabi MM, Gortemaker A, Van't Hof MA, Jansen JA, Creugers NH. Implant surface roughness and bone healing: a systematic review. *J Dent Res*. 2006;85(6):496-500. doi: [10.1177/154405910608500603](https://doi.org/10.1177/154405910608500603).
 8. Aglietta M, Siciliano VI, Zwahlen M, Bragger U, Pjetursson BE, Lang NP, et al. A systematic review of the survival and complication rates of implant supported fixed dental prostheses with cantilever extensions after an observation period of at least 5 years. *Clin Oral Implants Res*. 2009;20(5):441-51. doi: [10.1111/j.1600-0501.2009.01706.x](https://doi.org/10.1111/j.1600-0501.2009.01706.x).
 9. Sollazzo V, Pezzetti F, Scarano A, Piattelli A, Bignozzi CA, Massari L, et al. Zirconium oxide coating improves implant osseointegration in vivo. *Dent Mater*. 2008;24(3):357-61. doi: [10.1016/j.dental.2007.06.003](https://doi.org/10.1016/j.dental.2007.06.003).
 10. Blay A, Blay CC, Tunchel S, Gehrke SA, Shibli JA, Groth EB, et al. Effects of a Low-Intensity Laser on Dental Implant Osseointegration: Removal Torque and Resonance Frequency Analysis in Rabbits. *J Oral Implantol*. 2016;42(4):316-20. doi: [10.1563/aaid-joi-D-15-00064](https://doi.org/10.1563/aaid-joi-D-15-00064).
 11. Tarnow DP, Cho SC, Wallace SS. The effect of inter-implant distance on the height of inter-implant bone crest. *J Periodontol*. 2000;71(4):546-9. doi: [10.1902/jop.2000.71.4.546](https://doi.org/10.1902/jop.2000.71.4.546).
 12. Jemt T, Book K. Prosthesis misfit and marginal bone loss in edentulous implant patients. *Int J Oral Maxillofac Implants*. 1996;11(5):620-5.
 13. Misch CE, Perel ML, Wang HL, Sammartino G, Galindo-Moreno P, Trisi P, et al. Implant success, survival, and failure: the International Congress of Oral Implantologists (ICOI) Pisa Consensus Conference. *Implant Dent*. 2008;17(1):5-15. doi: [10.1097/ID.0b013e3181676059](https://doi.org/10.1097/ID.0b013e3181676059).
 14. Lekholm U, Gunne J, Henry P, Higuchi K, Linden U, Bergstrom C, et al. Survival of the Branemark implant in partially edentulous jaws: a 10-year prospective multicenter study. *Int J Oral Maxillofac Implants*. 1999;14(5):639-45.
 15. Simonis P, Dufour T, Tenenbaum H. Long-term implant survival and success: a 10-16-year follow-up of non-submerged dental implants. *Clin Oral Implants Res*. 2010;21(7):772-7. doi: [10.1111/j.1600-0501.2010.01912.x](https://doi.org/10.1111/j.1600-0501.2010.01912.x).
 16. 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):1109-16.
 17. Urvasizoglu G, Saruhan N, Atal M. Evaluation of demographic and clinical features of dental implant applications. *J Dent Fac Ataturk Uni*. 2016;26:394-8.
 18. 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](https://doi.org/10.1563/1548-1336(2002)028<0074:rfadis>2.3.co;2).
 19. Eltas A, Dundar S, Uzun IH, Arslan Malkoc M. Assessment of Dental Implant Success and Patient Profile. *J Dent Fac Ataturk Uni*. 2013;23:1-8.

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