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Original Article

A retrospective analysis of dental implants in patients who received a mandibular overdenture with locator attachment

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Abstract

Aim: The objective of this study is to retrospectively examine the relative superiorities of mandibular overdenture dental implants in terms of diameter, length, age and sex, and to determine the rate of implant survival.

Material and Methods: The demographic data showing the age, sex and dental implant distribution by age of 138 patients who underwent dental implant treatment at our clinic between 2011 and 2016 were retrieved from the archival records. Patients who underwent mandibular overdenture with two implant-supported locater attachments were included in the study. The anatomical locations, diameter and length characteristics and rate of loss of the implants were analyzed by way of descriptive statistical analysis.

Results: Of 138 patients, 69 were female (50%) and 69 were male (50%), and a total number of 276 dental implants were evaluated. When distribution of these implants was examined, it was found that they were mostly placed in the region of 33-43 (94.2%). The mean age of the patients was 63 with an age range of 40 to 87 years. It was found that the dental implants were applied mostly in patients ranging in age from 60 to 69 years (52.8%). The most common implant diameters were 4 mm (18%), 4.2 mm (18%) and 4.5 mm (17%), respectively. The most common implant lengths were 12 mm (32%) and 14 mm (30%). The rate of implant survival was found to be 97.8%.

Conclusion: The mandibular two-implant retained overdenture prosthesis with a locator attachment is a successful treatment method with a high survival rate when factors such as diameter and length of the implant and age and sex of the patient are taken into consideration.

Keywords: Dental implant; overdenture; mandible

INTRODUCTION

Currently, dental implantation is a frequently preferred treatment method in the rehabilitation of patients with partial or total edentation. In partial edentation, planning treatment with implant-retained fixed prostheses has certain advantages. These advantages include better retention, stabilization, chewing efficiency, patient comfort, low bone reabsorption and less mucosal irritation as a result of implant support (1).

For patients with total edentation, there are many treatment options such as fixed or removable implants. Fixed or removable prostheses can be fixed in varying designs depending on the number of implants (2). Mandibular two-implant overdenture prostheses between inter-foramina have been recommended as the best treatment option for edentulous patients since the McGill consensus (3). It has been reported in the literature that implant-supported overdentures have a much better retention rate compared to conventional prostheses (4). Implant-retained overdentures have proven to offer a particularly high level of patient satisfaction, comfort, prosthetic stability, and also offer considerable benefits for masticatory function in the elderly population (5).

Overdenture prostheses consist of bar attachment systems as well as solitary attachment systems. Bar attachment systems offer a good alternative for patients as they provide strong retention in the mandible (6). However, the high production costs can be a disadvantage for the bar attachment systems (7). Solitary attachment systems are less costly than bar attachment systems (8). According to the literature, patients can attend to oral

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hygiene more easily with solitary attachment systems than with bar attachment systems, and therefore peri-implant soft tissues and bone health can be better preserved (9).

Solitary attachments consist of various matrix systems (7). The design and material structure of retentive parts may be affected by friction and consequently, it may give rise to the need for replacement of the parts due to abrasion (10). Frequent replacement of the parts compared to bar attachment systems can be a disadvantage. However, the advantage of solitary attachment systems over bar attachment systems is that the matrix parts to be replaced can be replaced chairside in a much faster manner (11).

In regard to solitary attachment systems, more prosthodontic complications were observed in ball attachments than in locator attachments (12). However, no difference was observed between ball and locator attachments in terms of patient satisfaction and peri-implant tissue destruction in consequence of use after one year. In their study, Kronstrom and Carlsson have reported that the LOCATOR® system is the most frequently used stud type attachment system for implant-retained overdentures (13). The reasons why the locator system is preferred more often for the mandible are the lower cost, better option for oral hygiene and ease of use (7). This system has been evidenced by its good clinical performance (12).

Dental implant design is crucial to provide primary stabilization and stress distribution (14). Many dental implants are available in different properties according to diameters and lengths, connections, surfaces, platforms, exterior designs (15). The length and diameter influence the stress transferred from the dental implant to the bone. The prognosis and long-term success of dental implant treatment is influenced to a high degree by the physical and geometric properties of the individual implant components and the biomechanical environment to which they are exposed (16). It is known that the transfer process of stress to the surrounding bone and its consequences depend on the type of stress applied (amplitude, direction and frequency), the implant design, the biological and biomechanical properties of the bone-implant interface, and the response of the bone tissue to the mechanical environment resulting from the stress (17).

The purpose of this study is to retrospectively examine implant survival as well as superiority of mandibular overdenture implants with locator attachments that were applied at our clinic between 2011 and 2016, in terms of their location in the jaw, diameter, length, age and sex, and to evaluate them through definitive statistical methods.

MATERIAL and METHODS

This study was conducted by way of a retrospective assessment of the demographic and clinical characteristics of 276 intra-osseous bone level dental implants in 138 patients who received mandibular two-implant retained overdenture prosthesis with locator attachments at Gaziantep University, Faculty of Dentistry, Prosthodontics Clinic between 2011 and 2016. The study was approved by the Clinical Research Ethics Committee of the Sanko University and conducted in compliance with the ethical principles according to the Declaration of Helsinki. The age and sex of the patients as well as the dental implant area, diameter and length of the implant and implant loss data were all examined.

A descriptive statistical analysis was performed in the examination of dental implant data from 9 manufacturers, i.e. Straumann (Straumann Institute, Waldenburg, Switzerland), Bredent (Bredent medical GmbH & Co.KG, Senden, Germany), Biotech (Biotech Dental, Salon de Provence, France), Zimmer Dental (Carlsbad, CA, USA), Biohorizons (Maestro Dental Implants, Birmingham, AL, USA), Mis® Seven (MIS®, Medical implants System, Israel), BIOMET 3i (Palm Beach Gardens, FL, USA), Implantium implants (Dentium Co., Seoul, Korea), and DIO Implant (Busan, Republic of Korea). Descriptive statistical analysis can be defined as classification of data, making frequency distributions, defining these distributions as percentages, means, standard deviations etc. also presenting the findings to readers with tables and graphs.

RESULTS

Of 138 patients, 69 were female (50%) and 69 were male (50%), and a total of 276 implants were inserted as mandibular overdenture prostheses. It was found that women and men preferred implant treatment equally when receiving mandibular overdenture prosthesis. According to the distribution of these implants, they were placed in region 32-42 in seven patients (5%), in region 34-44 in one patient, and in region 33-43 in the remaining 130 patients (94.2%) (Figure 1).

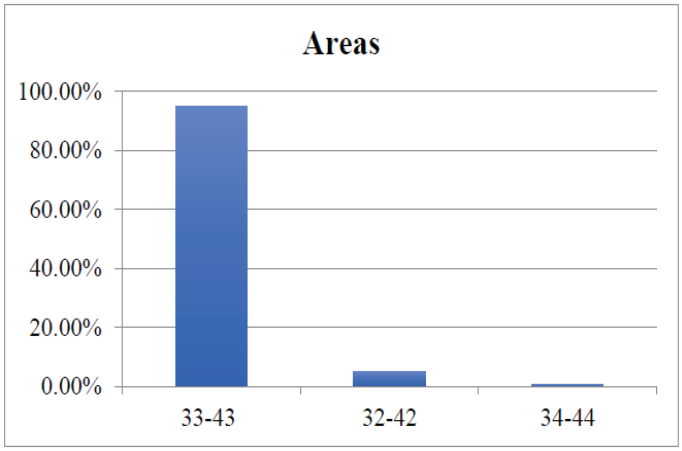

Figure 1. Dental area where implant is placed

The age range of the patients was 40 to 87 with a mean age of 63 (standard deviation was 8.56) years. The number of patients who received implants by age range was found to be 73 patients (52.8%) in the 6 th decade (60-69 years), seven patients (5%) in the 4 th decade, 28 patients (20.2%) in the 5 th decade, 23 patients (16.6%) in the 7 th decade and seven patients (5%) in the 8 th decade of life (Figure 2).

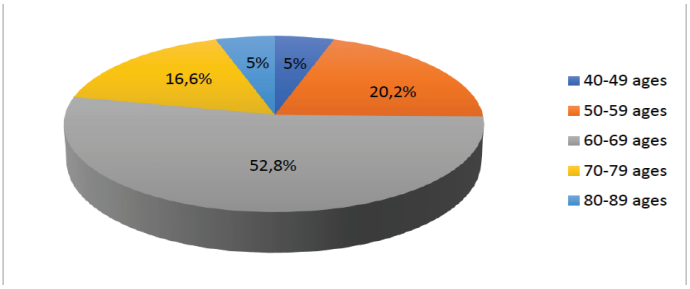

Figure 2. Distribution of dental implants according to age

When the distribution of the intra-osseous dental implants was examined by diameter and length, it was seen that 14 different diameters were used from 3.25 mm to 5 mm and implant length ranged widely from 8 mm to 16 mm in eight different lengths. It was seen that the most commonly applied diameters of implant were 4 mm (49 pieces, 18%), 4.2 mm (49 pieces, 18%) and 4.5 mm (49 pieces, 18%). Given the total number, it was seen that the most common three diameters constituted half of all implants. Other diameters were: 3.25 mm (2 pieces, 1%), 3.3 mm (13 pieces, 5%), 3.5 mm (24 pieces, 8%), 3.6 mm (14 pieces, 5%), 3.7 mm (7 pieces, 3%), 3.75 mm (17 pieces, 6%), 3.8 mm (10 pieces, 3%), 4.1 mm (17 pieces, 6%), 4.6 mm (8 pieces, 3%), 4.8 mm (14 pieces, 5%) and 5 mm (3 pieces, 1%). Patient distributions according to diameter of the implants (mm) is shown in Table 1.

It was found that the most frequently applied lengths of implant were 12 mm (89 pieces, 32%) and 14 mm (80 pieces, 29%). Other lengths were: 8 mm (9 pieces, 3%), 10 mm (41 pieces, 15%), 11.5 mm (35 pieces, 13%), 13 mm (16 pieces, 6%), 15 mm (3 pieces, 1%) and 16 mm (3 pieces, 1%). The distribution of implants by diameter and length is shown in Table 1.

Of all dental implants performed, only six implants were lost. The survival rate of the 276 dental implants was 97.8%.

Table 1. Diameter and length distribution of dental implants (mm)

Lengths Diameter	16 mm n	15 mm n	14 mm n	13 mm n	12 mm n	11.5 mm n	10 mm n	8 mm n	Total n/%
5 mm	-	-	-	3	-	-	-	-	3(1%)
4.8 mm	-	-	2	-	10	-	2	-	14(5%)
4.6 mm	-	-	-	-	8	-	-	-	8(3%)
4.5 mm	-	-	28	-	18	-	3	-	49(18%)
4.2 mm	-	-	4	4	12	19	8	2	49(18%)
4.1 mm	-	-	2	2	4	-	9	-	17(6%)
4 mm	2	2	20	-	14	1	8	2	49(18%)
3.8 mm	-	-	2	-	6	-	2	-	10(3%)
3.75 mm	-	-	-	5	-	8	4	-	17(6%)
3.7 mm	-	-	-	-	-	4	2	1	7(3%)
3.6 mm	-	-	8	-	4	-	2	-	14(5%)
3.5 mm	1	1	10	-	11	-	1	-	24(8%)
3.3 mm	-	-	4	1	2	2	-	4	13(5%)
3.25 mm	-	-	-	1	-	1	-	-	2(1%)
Total n/%	**3 (1%)**	**3 (1%)**	**80 (29%)**	**16 (6%)**	**89 (32%)**	**35 (13%)**	**41 (15%)**	**9 (3%)**	**276 (100%)**

DISCUSSION

Intra-osseous implant-supported prostheses offer a successful, effective and predictable treatment method for use when replacing missing teeth (18). The use and importance of implantations for ensuring masticatory function in patients with partial edentation has been increasing over time. Implant-supported prostheses, which offer better patient comfort than removable prostheses and total prostheses, are able to provide very satisfactory clinical results for both doctors and patients (19). Recently, mandibular two-implant retained overdenture prostheses with locator attachments have been a frequently preferred treatment method for patients with total mandibular edentation.

Many factors play a role in the success of implant treatment. Among the factors influencing the success and survival of implants, those which are related to the patients are age, sex, systemic health condition, smoking, quality and quantity of bone, and oral hygiene while the ones related to the implant are the length and diameter of the implant, the characteristics of the implant (design of surface properties), the location of the implant, the timing of placement (immediate/delayed) and loading protocol (20). While early failure results from the lack of osseo-integration before loading after the implant is placed, late failure occurs due to infection or overloading after functional loading (21). In their study in 1981, Adell et al. reported that atraumatic surgery, long recovery periods and a proper distribution of force on the implant were necessary for successful osseointegration (22).

There is various information in the literature regarding the rate of implant loss or survival depending on the type of prosthesis. Berglund et al. reported in a review that implant loss ranged between 2 to 3% for implant-supported fixed partial denture and were over 5% for implant supported removable overdentures (23). However, in their study evaluating the success rate of implants and the type of prosthesis, Jang et al. found the rate of loss was 2.32% in a single crown, 1.43% in fixed partial denture and 3.27% in overdenture prostheses (24). Visser et al. reported the rate of survival as 98% in two-implant supported overdentures (25). Wismeijer et al. reported it similarly as 97%, and Batenburg et al. reported it as 99% (26,27). In our study, the rate of implant survival was found to be 97.8% in line with the literature. According to a review in this regard, Geckili et al. asserted that there were more losses with overdenture supported implants than fixed prostheses, and that this situation could be attributed to poor access for cleaning and greater occlusal force (28).

Consistent with the results in the literature, no significant difference was found in this study between the rates of implant loss in a comparison of the sexes (29). When the age-related results of this study are examined, an increase is seen in the rate of both implant loss and the receipt of overdenture prostheses after the 6 th decade. This situation can be explained by both a decrease in the cooperation of patients in the brushing of their teeth and a more rapid onset of osteoporosis associated with aging as well as a higher frequency of total edentation at advanced ages. Similarly, Raikar et al. also established a trend toward increased failure rates with advanced age patients (30).

All implants for overdentures were placed in the anterior region and 50% of patients who had overdentures were in the age group of 60 to 69 years. This can be explained as follows: two anterior implants are usually considered the minimum number to provide support, retention and stability for mandibular overdenture treatment (31). The minimum number of implants also has economic benefits for the patient. Misch (32) had predicted a 100% success rate for implants placed in the type of bone which is present in the anterior mandible. There are controversial considerations and limited evidence which suggest that additional implants for overdentures result in better treatment outcomes (33).

The length of an implant is very important for providing good primary stabilization and wide bone-implant contact surface (34). The study reports that the length of an implant affects the duration in which the implant is retained in the mouth (35). In addition to this, the length of the implant, in contrast to the diameter of the implant, had no effect on the reducing the bone stress (36). According to Petrie and Williams (37) a decrease in implant diameter increased the load on the alveolar crest by 3.5 times, which was better for short and conical implants. In this study, it was found that implants with a length of 12 mm (32%) and 14 mm (30%) were preferred over short implants with different diameters.

However, the literature is reporting that the diameter of an implant affects the duration in which the implant is retained in the mouth (38). The correct implant diameter selection depends on the existing bone. The implant diameter can effect the performance of the treatment, if the cortical bone thickness is inadequate. The diameter of implant seems to lead the amount of stress around the bone biomechanically, as it does the implant with an expected effect on the success rate (39). As the diameter of the implant increases, the stress on the implant and peri-implant bone decreases at the same rate (40). Also the literature reported that length of implant is compensated with the increasing of diameter (41).

Kong et al. (42) reported that narrower diameters could increase implant displacement under lateral stress in cases requiring an immediate implant and cortical bone stress. In the same study, they observed that implants with a diameter of more than 4 mm and a length of more than 11 mm were the appropriate combination to achieve the best biomechanical characteristics in the case of immediate loading, based on the results of the finite element analysis (42). In our study, it was found that the most commonly used diameters were 4 mm (18%), 4.2 mm (18%) and 4.5 mm (17%), respectively, in line with the literature.

CONCLUSION

According to the results obtained within the framework of the current study; it was seen that the implants were placed in female and male patients at the same frequency and implant treatment for mandibular overdentures has proven to be a very successful and reliable treatment option with a high success rate. When evaluated by age, total mandibular edentation covered a wide age range (40-87 years), and more than half of the patients who received mandibular two-implant overdentures were in the age range of 60 to 69 years. The region of 33-43, was the area where mandibular two-implant overdentures were mostly applied. The most common implant diameters were between 4 mm and 4.5 mm and implant lengths were found to be 12 mm -14 mm, respectively.

In the light of this information, it would be advantageous to perform more detailed, multicenter, prospective, multidisciplinary, in vivo or in vitro studies on mandibular overdenture prostheses with locator attachments, to assist in guiding clinicians correctly with respect to implant treatments.

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