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Immediately Loaded Bicortical Implants Inserted in Fresh Extraction and Healed Sites in Patients with and Without a History of Periodontal Disease

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Abstract

Background: Bicortical screw implants may be used in both healed bone and fresh extraction sockets and loaded immediately. To date, there have not been too many studies reporting clinical results of such screws used in periodontally involved sites. This study aimed to assess many aspects of bicortical screw implants used to retain full-arch and segmental cemented prostheses in the rehabilitation of the mandible and maxilla in patients with or without a history of periodontal disease. **Materials and Methods:** This retrospective review involved 87 patients, of whom 77 had a history of periodontitis diagnosed before implant placement and 10 did not. They were treated following the same surgical procedure and received a total of 1019 implants which were immediately loaded with fixed prosthetic works. **Results:** A total of 1019 polished surface, one-piece, bicortical screw implants were used in 87 patients who underwent the same surgical treatment, i.e., tooth extraction and immediate implant placement were investigated, of which 526 were placed in the healed bone and 493 in fresh extraction sockets with the mean follow-up time of 22.2 ± 7.3 months. Results were analyzed using log-rank test, the Kaplan–Meier method, Chi-square test, and *t*-test. Cumulative survival at 12, 24, and 35 months after placement was 99.3%, 98.6%, and 97.0%, respectively. **Conclusion:** Bicortical smooth surface implant concept with immediate loading protocol provided predictable outcomes and survival rate of 99% in patients with and without a history of periodontitis. More studies are needed to further support the clinical advantages of bicortical anchoraged smooth surface implants.

Keywords: Bicortical anchorage, dental implants, immediate rehabilitation, periodontitis, smooth surface implant

Introduction

Dental implants are used to restore missing tooth or periodontally compromised teeth. At the same time, one of the main reasons of tooth loss is periodontal disease.[1-3] For dental specialists, it is crucial to know what is the correlation between long-term implant survival rate and history of periodontitis and if there are safe, reliable implant designs which can be used in these particular clinical cases.[4]

In the literature, there are many studies and systematic reviews with meta-analyses showing strong evidence that history of periodontitis is a risk factor for such complications as implant loss, peri-implantitis, and implant bone-loss.[5-9] Despite that, some researchers took the risk and conducted studies in periodontally compromised patients and provided encouraging results.[10-13] Meyle *et al*. reported survival rates of 100% and 92.3% for the implants in the mandible and in the maxilla respectively,[10] Graetz *et al.* in their retrospective cohort study reported a 5-year success rate of 97% of implant treatment for patients with and without chronic periodontitis and what is more, after a 10-year follow-up, the success rate in periodontally compromised patients was 93%, which was higher than in the control group where it was 91%.[11] According to Li *et al*. the cumulative survival rate of the implants was 98.75% after an average of 5 years[12] and Correia *et al*. reported that survival rates in patients without periodontitis and those suffering from that condition were 95.8% and 93.1%, respectively.[13] However, it is important to bear in mind the fact all these findings may be based on different definitions for the presence or severity of the periodontal disease, as well

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as for periimplantitis or socket depth after bone loss around the implant. The longer the follow-up period, the higher the possibility of failure, especially if it is extended beyond functional loading, since other factors like general health changes may influence success rate as well.[14-16]

Fresh extraction sockets are among risk factors for immediate implant placement protocols as the bone volume in such cases is significantly reduced, and as a result, primary implant stability may not be achieved. According to Balshi and Wolfinger survival rates for immediately loaded implants in fresh extraction sites and healed bone amounted to 80% and 82.4%, respectively,[17] whereas Glauser *et al*. reported success rates of 88% and 78%.[18] However, some authors have come up with more encouraging results proving that it is possible to achieve survival rates ranging from 97.3% to 100%.[19-22] Cooper *et al*., and Vanden Bogaerde *et al*. reported 100% survival rate for implants placed in fresh extraction sockets.[19,20] Furthermore, Villa and Rangert achieved 100% survival rate for implants placed in fresh extraction sockets in the mandible in patients presenting endodontic and periodontal lesions in the interforaminal area.[21] A slightly lower overall survival rate of 87.50%–97.26% for the maxilla and the mandible, respectively, was reported by Grunder.[22]

There are very few scientific articles describing polished surface one-piece screw implants in periodontally involved cases with successful results and those available are mainly case reports.[23-27] One of the reasons for this may be the fact that the Italian school of screw implants with the longest long-term observations and richest experience in this field rarely published in English.[28-31]

Therefore, the aim of this study was to perform a clinical follow-up to evaluate immediately loaded bicortical screw implants placed in fresh extraction sockets and healed bone, used to retain full-arch and segment cemented prostheses in the rehabilitation of mandible and maxilla in patients with and without a history of periodontal disease.

Materials and Methods

All patients were treated in one specialized dental center between 2014 and 2017, but the procedures were performed by different qualified surgeons. Various prosthodontists performed the prosthetic procedures and one dental laboratory technician delivered all restorations.

The examination was directed by the standards exemplified in the Helsinki Declaration of 1964 for biomedical research including human subjects, following amendments introduced in 2008. Patients were educated of the idea of the examination, benefits, risks, and possible alternative treatments. Moreover, participants who met criteria for survival analysis were required to deliver signed informed consent for the treatment and agree for regular control visits in the dental office. The following exclusion criteria were applied: general health conditions that could lead to bone healing problems (bisphosphonate therapy or metabolic bone disease), radiotherapy or chemotherapy in the head-and-neck area, pregnancy or breastfeeding, psychiatric problems, uncontrolled diabetes, and inability to commit to a follow-up. Eighty-seven patients (42 males and 45 females) aged 22–72, (average 52, standard deviation 14) were enrolled in the study. A total of 1019 polished surface, one-piece, bicortical screw implants (IhdeDental AG, Switzerland) were inserted, of which 493 in fresh extraction sockets and 526 in the healed bone, always reaching second cortical anchorage. The main patient's characteristics are presented in Table 1. All the patients who qualified for this study were in good general health (controlled diabetes and smokers were also included), demonstrated completely or partially edentulous condition, with remaining teeth to be extracted, included periodontitis Stage III and IV,[32] endodontic failure or cases where no other restorative treatment was possible. Diagnosis and treatment planning included: study models articulated in articulator, panoramic radiographs, and computerized tomography to identify the anatomical structures and visualize the presence of well mineralized second cortical bone [Figure 1].

Surgical protocol

A total of 2 g dose of antibiotic (Augmentin, GlaxoSmithKline, Italy) (amoxicillin and clavulanic acid) was provided to each patient at least 1 h before surgery. Afterward, the oral cavity was rinsed with 10% povidonum iodinatum solution (Betadine, Egis, Hungary) for 5 min. A 4% articaine chlorhydrate with adrenaline 1:100,000 solution (Ubistesin forte, 3M, Neuss, Germany) was used to locally anesthetize the patient. No soft-tissue incision was performed. Teeth showing a poor prognosis for further use as prosthetic abutment were extracted with most caution to preserve as much vestibular bone as possible and the socket was carefully debrided with curette. Each patient received from 3 to 10 implants bicortically anchoraged and placed in the most strategic positions according to the supporting polygon concept.[33] Placing implants in strategic position creating a polygon can reduce extra-axial load: Canines and tubero-pterygoid regions in maxilla and zone of mylohyoid ridge in mandible, thus "supporting polygon" concept has been proposed as an alternative to bone grafting to rehabilitate edentulous jaws with fixed prosthesis.[33-35] A maximum polygon is formed in sagittal and transversal directions and reduces leverage and flexural moments to a minimum.[33-35]

In the maxilla, the implants positioned most distally were inserted throughout the posterior sinus wall and pterygoid

Table 1: Prosthetic methods applied

Prosthetic method	Percentage
Full bridge upper	59
Full bridge lower	32
Segment lower	5
Segment upper	4
Single teeth	0
Single teeth several implants	0

processes of sphenoid bone at an angle of 30°–45°. The medial and frontal implants were placed using a similar procedure penetrating the lower sinus wall and nasal floor ensuring anchorage in the second cortical bone. In the mandible, the distal implants were placed in the second and first molar region utilizing the undercut for mylohyoid muscle attachment with angulation of 30°–45°. In the frontal region, implants were placed in the position of canines and lateral incisors laterally inclined toward the mentum region of high mineralization. Postextraction implants were placed close to the palatal side, 1–2 mm below the crest. All implants were inserted according to the manufacturer's instructions to achieve as much cortical bone anchorage as possible. The diameter of the drill was 2.0 or 2.2 depending on the bone density, which was assessed during the drilling phase by an experienced operator accordingly to Lekholm *et al*. classification.[36] As a result, a minimum insertion torque of 40Ncm and maximum of 90Ncm was obtained. After implant placement, the abutments were bent to achieve parallelism with IT and TW 2 wrenches (Ihde Dental AG, Switzerland). The soft tissues where needed were closed with the use of a 5.0 resorbable suture (Vicryl Plus, Johnson and Johnson - Ethicon, Hamburg, Germany) [Figure 1]. After finishing all the procedures including implant placement, all patients were provided with oral and written instructions.

Prosthetic protocol

Impressions of the implants were taken right after the surgery with prosthetic transfers and closed-tray technique. One layer of putty impression material was used; transfers were splinted with self-curing acrylic resin or light cure composite to avoid mobility and displacement of impression transfers. All maxillary-mandibular relations were recorded twice: first bite registration on the day of surgery with the help of "tray set silicone" technique and Occlufast (Zhermapol, Germany); second bite registration during the metal try by fabrication of anterior deprogrammer, made of pattern resin. The final restorations (metal-ceramic) were fabricated postsurgically. Afterward, they were loaded within 3 days and restored with fixed prostheses metal-ceramic bridges cemented with permanent glass-ionomer cement (GC Fuji Plus, GC, Japan) in all cases.

All centric and lateral contacts were evaluated using a 40 μm articulating paper. The occlusal contacts were designed according to "supporting polygon" concept[33] and bilaterally balanced occlusion with strict anterior disocclusion, i.e., the contacts were on the premolars and mesial part of the first molar. Patients underwent clinical and radiological evaluation at each follow-up visit, as well as every 3 months from surgery as the maintenance program indicated [Figure 1].

Among the prosthetics methods applied full-bridge restorations in the maxillae (59%) and full-bridge restorations in the mandible (32%) prevailed [Table 2 and Figure 2].

Clinical results

The definition of implant survival followed criteria mentioned by Misch *et al*.[37] and included:

Table 2. Summary of patient and implants related characteristics.

Total of patients			
Patients -related characteristics (*n*=87)			
		Mean±SD	**Min-Max**
Age (years)		54.3±10.1	22-72
		n	**Percentage**
Gender	Female	45	51.7
	Male	42	48.3
Diabetes	No	82	94.3
	Yes	5	5.7
Hypertension	No	85	97.7
	Yes	2	2.3
Tobacco smoker	No	60	69.8
	Yes	26	30.2
Periodontal involvement	No	10	11.5
	Maxillae	9	10.3
	Mandible	10	11.5
	Both jaws	58	66.7
Implants -related characteristics (*n*=1019)			
Inserted implants	In the healed bone	526	51.6
	In fresh extraction sockets	493	48.4
Location	Anterior	426	41.8
	Posterior	593	58.2
Anchorage in 2nd cortical	Floor of nose	314	30.8
	Sinus floor	165	16.2
	Palatal	50	4.9
	Tuberopterygoid	117	11.5
	Interformainal	206	20.2
	Distal mandible w/o cortical	69	6.8
	Cortical distal mandible	98	9.6
Preoperative periodontal involvement	No	582	57.1
	Yes	437	42.9
Length	≤12	117	11.5
	14-17	327	32.1
	≥20	575	56.4
Diameter	3.3/3.5/3.6/3.7	704	69.1
	4.1/4.6/4.7	266	26.1
	5.5	49	4.8
Bent	No	643	63.1
	Yes	376	36.9
Mobility	No	1016	99.7
	Yes	3	0.3

n – the number of participants; min – minimum; max – maximum; SD – standard deviation

- Absence of mobility
- Absence of persistent subjective complaints (pain, foreign body sensation, and/or dysesthesia) or exudates on function
- Absence of continuous radiolucency around the implant
- Absence of severe bone loss.

All the patients underwent clinical and radiological inspection during which such factors as marginal bone level, probing pocket depth, peri-implant mucositis, and peri-implantitis, technical failures like fracture of the framework, and/or veneering ceramic, loss of retention, and esthetic parameters were evaluated [Figures 3 and 4]. Most patients underwent clinical follow-up at 12 and 24 months after implant placement (22.2 ± 7.3 months). One patient was lost to follow-up at 3 months. Afterward, the survival rate of implants and prosthetics were calculated.

Statistical analysis

Statistical analysis was performed using the Statistica version 13 software (data analysis software system, USA). For the quantitative variables, mean, minimum and maximum values, the standard deviation was calculated. The qualitative variables were analyzed according to descriptive statistics, using absolute and percentage frequency distribution. In the survival analysis, the Kaplan–Meier method was used to calculate implant survival rate, whereas overall survival of implants according to the implant inserted (in the healed bone vs. in fresh extraction sockets) was conducted using log-rank test. Survival time of implants was calculated from the time of placement to the time of failure, lost to follow-up, or the end time of the study. Comparison of variables of patients and implants related characteristics depending on the implant inserted (in the healed bone vs. in fresh extraction sockets) were analyzed using the Chi-square test (for qualitative variables) or *t*-test for quantitative variables. Results were considered statistically significant at $P < 0.05$.

Results

Table 1 presents the characteristics of patients and implants. A total of 87 patients (42 males and 45 females) were included in the analysis. The mean age of the participants was 54.3 ± 10.1 years. Of the participants, five (5.7%) had diabetes, two (2.3%) hypertension, and 26 (30.2%) were tobacco smokers. Most patients presented (advanced) periodontal involvement (n = 77, 88.5%), mainly in both jaws (n = 58; 66.7%).

A total of 1019 polished surface, one-piece, bicortical screw implants were inserted, of which 493 were in fresh extraction sockets and 526 in healed bone, always reaching second cortical anchorage. Detailed characteristics regarding location, anchorage, length, and diameter of implants and preoperative periodontal involvement are presented in Table 1. Analysis of the survival of the implants is shown in the Kaplan–Meier survival curves [Figure 4]. The mean follow-up time of total implants was 22.2 ± 7.3 months. Twelve out of 1019 implants failed. Three of these implants were placed in fresh extraction sockets and nine in healed bone. Six failed in one patient-two in fresh extraction sockets with periodontal involvement, position anchoraged in distal mandible and four in healed bone without periodontal involvement, anchoraged in the interforaminal area, and distal mandible. Two other implants failed in healed bone without periodontal involvement, anchoraged in the sinus floor position; three in the healed bone without periodontal involvement, anchoraged in the distal mandible position and one in a fresh extraction socket with periodontal involvement anchoraged in the sinus floor. Cumulative survival at 12, 24, and 35 months after placement was 99.3%, 98.6%, and 97.0%, respectively. The comparison of general survival considering the implants inserted (in healed bone versus in fresh extraction sockets) is presented in Figure 3. Based on these data, it can be observed that the rate of OS of implants inserted in the healed bone is nonstatistically significant (P = 0.11). Cumulative survival at 12, 24, and 35 months for implants inserted in the healed bone equaled 98.6%, 97.9%, and 97.9%, respectively. For implants inserted in the fresh extraction sockets was 99.6%, 99.0%, and 99.0%, respectively [Figure 5]. A-preoperative view of periodontal involvement; B-postoperative view-implants placed directly after removal of the teeth and the periodontally involved tissues into the sockets; C-12 month postoperative view, bone has grown vertically on all implants. Full integration of the implant in area 45 (to the crestal bone line) is not yet achieved after 1 year.

Comparison of variables of patients and implant-related characteristics depending on the implant inserted (in the in healed bone vs. in fresh extraction sockets) is presented in Tables 3 and 4. There were no statistically significant differences in the occurrence of diabetes mellitus, hypertension, number of smokers, and periodontal involvement [Table 1]. However, significant statistical differences have been observed regarding the location, anchorage in the second cortical, preoperative periodontal involvement, and length or diameter of implants [Table 3].

The implants placed in the healed bone were more likely to be in the posterior area (n = 387, 73.6%), the percentage of implants placed posteriorly in fresh extraction sockets was 41.8% (n = 206). When it comes to implants placed in the healed bone, anchorage in the 2nd cortical most often concerned the area of the floor of the nose (n = 110, 20.9%), sinus floor (n = 108, 20.5%), and tuberopterygoid region (n = 93, 17.7%), while the implants placed in fresh extraction sockets were mainly related to the area of floor of nose/anterior maxillae (n = 204, 41.4%) and interformainal region (n = 132, 26.8%). Slightly shorter implants were placed in the healed bone (n = 77, 14.6%) than in fresh extraction sockets (n = 40, 8.1%), whereas fewer with a smaller diameter were placed in the healed bone (n = 369, 74.9% vs. n = 335, 63.7%). More implants placed in fresh extraction sockets (n = 214, 43.4%), than in the healed bone (n = 162, 30.1%) were bent after insertion.

Discussion

In this study, cumulative survival at 12, 24, and 35 months for implants inserted in the healed bone equaled 98.6%, 97.9%, and 97.9%, respectively, and for implants inserted

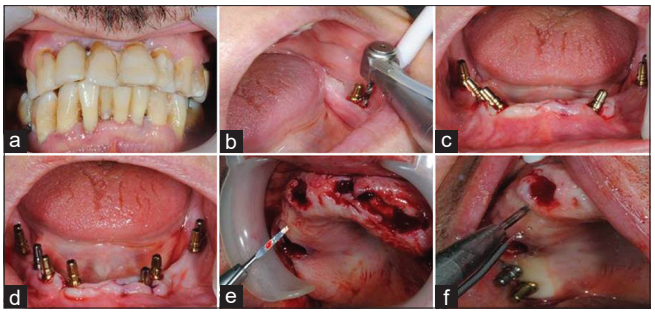

Figure 1: Surgical procedures. (a) Preoperative view of a patient with periodontal disease. (b) Mid-operative view after first implant placement and hole drilling with 2.0 mm drill for the second implant. (c) Frontal view of the mandible before abutment bending. (d) Final view of the mandible after all implant placement and abutment bending. (e) View of the maxilla after extractions. (f) Hole drilling with a straigthpiece; in the posterior maxillae double tuberopterygoid implants are visible

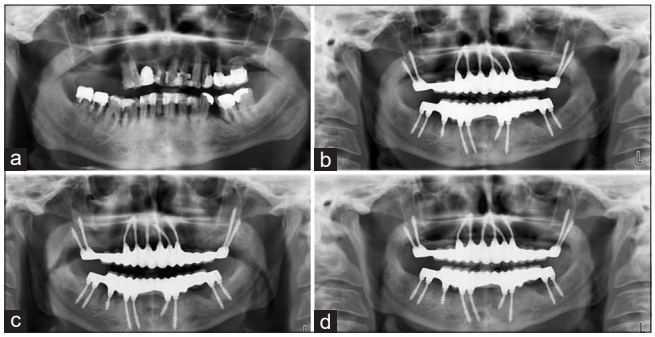

Figure 3: Panoramic orthopantomographs. (a) Before treatment (general periodontitis visible in the maxillae and mandible). (b) A few weeks after surgery. (c) Six months after surgery. (d) After 24 months

Figure 5: (a) Preoperative view of periodontal involvement; (b) postoperative view - implants placed directly after removal of the teeth and the periodontally involved tissues into the sockets; (c) 12-month postoperative view, bone has grown vertically on all implants. Full integration of the implant in area 45 (to the crestal bone line) is not yet achieved after one year

in the fresh extraction sockets was 99.6%, 99.0%, and 99.0%, respectively, which was similar to survival rates for immediately loaded implants reported by other authors.[17-22] Baelum and Ellegaard reported 5-year survival rates of 97% for the two-stage implants and 94% for the one-stage implants inserted in periodontally compromised areas.[38] In their systematic review, Chen *et al*. reported similar survival rates for implants placed in healthy sites and infected regions in the esthetic zone amounting to 97.6%–98.4%, respectively, providing that surgical procedures and treatment plan are carefully designed and executed.[39] As it has already been mentioned, most researchers consider periodontitis a risk

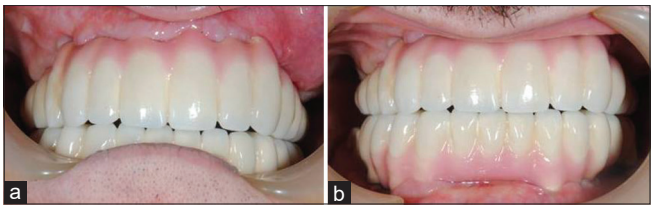

Figure 2: (a) Final restoration frontal view, 2 weeks postoperative. (b) Final restoration frontal view, 36 months postoperative

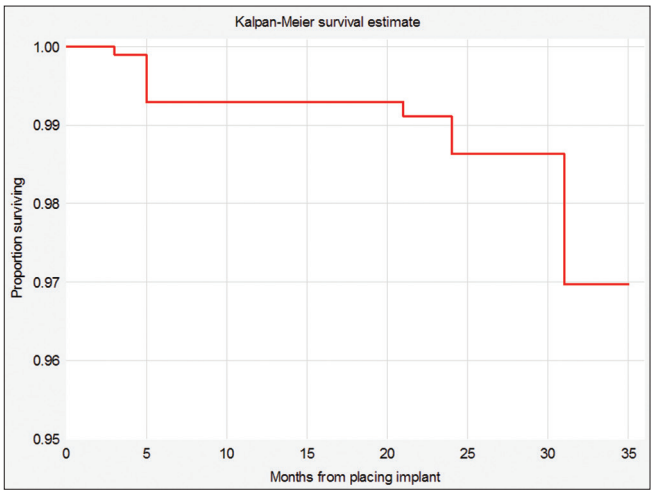

Figure 4: Kaplan–Meier survival curves for implants survival

factor for implant loss and peri-implantitis.[5-9] Moreover, patients with periodontitis have a higher implant-bone loss and biological complications.[40-42] This issue was even discussed in the House of Lords, which indicates how serious a problem it is with conclusions that the placement of implants in patients with periodontal disease is not a treatment that should be performed without full periodontal assessment and stabilization of periodontal disease first,[43] which clearly denies the possibility of immediate implant placement in such cases not to mention functional immediate loading. On the other hand, there are also studies showing no correlation between the history of periodontal disease and the implant survival rate,[11-13] but all of them concerned intra-osseous rough surface implants. Therefore, if compared to our results, it can be concluded that one of the problems may be surface design.[11-13] Bicortical screw implants provide bendability in the neck area and have polished surface and the thin neck which, according to Berglundh *et al*., might be the reason for lower progression rate of peri-implantitis.[44]

Statistical difference related to bendability of implants in case of implants placed in the fresh extraction socket results from the fact that the long implant axis is not always the same as the long axis of the extracted tooth. In some designs, additional threads or a slightly thicker metal prop in the area of the 1st cortical is provided, which means better stabilization in the 1st cortical which helps directing the bending.[34] The main anchorage for the implant (osseofixation) is arranged by the surgeon in the 2nd cortical of the jaw bone.[34] The implant then osseointegrates

Table 3: Comparison of variables of patients characteristics depending on the implant inserted (in the healed bone versus in fresh extraction sockets)

	The implant inserted		*P*
	In the healed bone	In fresh extraction sockets	
Age (years)			0.86*
Mean±SD	54.2±10.0	54.7±10.7	
Minimum-maximum	22-72	34-72	
Diabetes, *n* (%)			
No	63 (94.0)	19 (95.0)	0.87**
Yes	4 (6.0)	1 (5.0)	
Hypertension, *n* (%)			
No	66 (98.5)	19 (95.0)	0.36**
Yes	1 (1.5)	1 (5.0)	
Tobacco smoker, *n* (%)			
No	48 (72.7)	12 (60.0)	0.28**
Yes	18 (27.3)	8 (40.0)	
Periodontal involvement, *n* (%)			
No	8 (11.9)	2 (10.0)	0.79**
Maxillae	6 (9.0)	3 (15.0)	
Mandible	7 (10.4)	3 (15.0)	
Both jaws	46 (68.7)	12 (60.0)	

**t*-test; **Chi-square test. *n*=The number of participants; SD=Standard deviation

Table 4: Comparison of variables of implants related characteristics depending on the implant inserted (in the healed bone versus in fresh extraction sockets)

	The implant inserted, *n* (%)		*P**
	In the healed bone	In fresh extraction sockets	
Location			
Anterior	139 (26.4)	287 (58.2)	<0.001
Posterior	387 (73.6)	206 (41.8)	
Anchorage in 2nd cortical			
Floor of nose	110 (20.9)	204 (41.4)	<0.001
Sinus floor	108 (20.5)	57 (11.6)	
Palatal	34 (6.5)	16 (3.3)	
Tuberopterygoid	93 (17.7)	24 (4.9)	
Interformainal	74 (14.1)	132 (26.8)	
Distal mandible w/o cortical	43 (8.2)	26 (5.3)	
Cortical distal mandible	64 (12.2)	34 (6.9)	
Preoperative periodontal involvement			
No	521 (99.1)	61 (12.4)	<0.001
Yes	5 (0.9)	432 (87.6)	
Length			
≤12	77 (14.6)	40 (8.1)	0.004
14-17	167 (31.8)	160 (32.5)	
≥20	282 (53.6)	293 (59.4)	
Diameter			
3.3/3.5/3.6/3.7	335 (63.7)	369 (74.9)	0.001
4.1/4.6/4.7	160 (30.4)	106 (21.5)	
5.5	31 (5.9)	18 (3.7)	
Bent			
No	364 (69.2)	279 (56.6)	<0.001
Yes	162 (30.1)	214 (43.4)	
Mobility			
No	542 (99.6)	492 (99.8)	0.60
Yes	2 (0.4)	1 (0.2)	
Yes	1 (0.2)	1 (0.2)	

*Chi-square test. *n*=The number of participants

in all other endosseous regions during the following 6–12 months.[34] One of the biggest advantages of bicortical implants is that the number of failures is limited to situations of implant overloading, for example, due to unilateral chewing patterns or wrong implant placement, i.e., the anchorage in the second cortical was not reached, or iatrogenic mistakes.[14,40,45] In contrast to conventional rough endosseous implants, mobility of bicortical implants induced by overloading is in most cases reversible.[16] Along with those advantageous features, we decided to examine if there is relation between the implant survival rate and history of periodontitis.

Being able to anticipate the outcomes of treatment and estimate short- and long-term risks for both surgical and prosthetic procedures is extremely important in dental practice. Because of many implant designs, materials, surfaces or even placement methods and anchorage techniques the risk factors are not homogenous for all of them. One of the old implant concepts with completely new design is a bicortical screw implant. The main features of this implant are smooth polished surface, the long thin shaft with aggressive apical threads, designed to achieve perfect stabilization in the second and third cortical.[34] Second and third corticals are the distant cortical bones located outside of the oral cavity, bordering anatomical structures such as sinuses, nasal cavity, or symphysis of two or more bones, for example, tubero-pterygoid region.[34]

The differences of implant length between healed and fresh extraction socket stem from the fact that after tooth extraction bone of the alveolar process undergoes remodeling and physiological resorption. The increased length of implants used in maxillary tuberosity according to literature should be more than 14 mm. In order to reach the junction between pterygoid plates and maxillary bone.[46-48]

Statistical difference related to bendability of implants in case of implants placed in the fresh extraction socket results from the fact that the long implant axis is not always the same as the long axis of the extracted tooth.[49]

Based on this study, the bicortical smooth surface implant concept with immediate loading protocol provided predictable outcomes and survival rate of 98% in patients with and without history of periodontitis. Moreover, the survival rate of bicortical implants was not dependent on the presence of periodontal disease. In particular, it means that no contraindications to immediately placed bicortical smooth surface implants in the case of patients with periodontal involvement were observed.

Conclusion

Bicortical smooth surface implant concept with immediate loading protocol provided predictable outcomes and survival rate of 99% in patients with and without a history of periodontitis in 2-year follow-ups.

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Nil.

Conflicts of interest

There are no conflicts of interest

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