Clinical results of short implants replacement

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Abstract

Aim: Use of short implants offers many advantages for specific indications. This cohort study controls the survival rate of these short implants in different clinical cases, after loading.
Methods: The cohort study was based on a sample of 33 Albanian patients, 14 males and 19 females. They were applied at least one hydroxyapatite-coated Bicon implant. The study was conducted during the period 2010-2015. The main outcome variable consisted of the percentage of success/failure of these implants. The length of implants used to replace the missing teeth was 5, 6 and 8 mm.
Results: The number of locking-taper implants applied in 33 patients was 66. These subjects were followed-up for 24 months (two years). The 66 implants were restored with single crowns and integrated abutment crowns (IAC). There were two cases of failed implants, resulting in a success rate of 96.97%.
Conclusion: Based on the results of this study, we can suggest that the survival rate of short implants is comparable with those of long implants reported in the literature.

Keywords: cohort study, short implant, survival rate.

Introduction

In our daily practices as dental professionals, we are often confronted with patients who meet the ideal criteria for implant treatment, but have resorbed bones. A patient may have missing teeth, knowledge about dental implants, desire for a permanent solution, but the key factor that he/she often lacks is sufficient bone height for longer implants. Bone grafting is a solution, but bone grafting is always uncomfortable for the patient, it can be expensive, it is time-consuming, and involves complications. Dental implants are subject to occlusal loads when put into function (1) and they transfer those loads to the surrounding biological tissues (2). The biomechanical rationale behind the use of SHIs is that the crestal portion of the implant body is the most involved in load-bearing, whereas very little stress is transferred to the apical portion (3) and the increase of implant length from 7 mm to 10 mm does not significantly improve its anchorage (4).

Short implants provide an excellent alternative to bone grafting, sinus lifting or other surgical procedures and can allow patients to more easily enjoy the benefits of implant treatment. In placing longer implants, there are two major areas for anatomical concern when faced with shallow bone height. Short implants, on the other hand, can provide similar results without the need of advanced surgical techniques (5-8). Reduced bone height in posterior areas, especially in the mandible limits the use of short implants, creating a need for even shorter implants to restore such cases. The performance of these implants <6 mm has been evaluated in different studies (9-13). Maxillary sinus is considered as a hazard anatomical part when placing longer implants. In the mandible the inferior alveolar nerve poses a much more serious risk. Paresthesia is a real danger to the patient if the alveolar nerve is damaged when placing a longer implant.

Recent prospective studies (5,11,14,15) have reported similar survival rates for short and long implants. This was confirmed by several reviews (16-21).

Use of short implants offers plenty of advantages for specific indications. Single-tooth replacement with endosseous implants has shown satisfactory clinical performance in different jaw locations (22-25).

The aim of this cohort study was to control the survival rate of these short implants in different clinical cases, after loading. The length of implants used for the single tooth replacement was 5, 6 and 8 mm.

Methods

Study design and sampling

The present study was designed as a cohort study. The study included a total of 33 subjects, 14 males and 19 females, who had at least one hydroxyapatite-coated Bicon implant, placed between 2010 and 2015 at the "iDent" dental office, Tirana.

The following inclusion criteria had to be satisfied by the patients to be included in the study: i) Hydroxyapatite (HA)-coated implants (Integra-CP, Bicon) had been placed in a two-stage surgical protocol; ii) At least one locking-taper plateau design implant (5, 6, or 8 mm long, Bicon) had been placed. Eight mm long implants were defined as short implants, whereas 5-mm and 6-mm long implants were defined as ultra-short implants, according to Deporter et al (26).

Data collection

Several variables were taken in consideration grouped into the following categories using previously published criteria (13,27).

- Demographics: The patient gender and age were recorded.
- General health status: It was classified according to the American Society of Anesthesiology (ASA) system (28). Patients were categorized as ASA I (healthy) and ASA II (mild systemic disease).
- Current tobacco use.
- Anatomic considerations: In this category we

included tooth type (incisor, canine, premolar, molar) and the implant position (maxilla, mandible, anterior, posterior).

- Type of bone according to Misch (D1, D2, D3, D4).
- The proximity of the implant relative to teeth or other implants: The following categories were used: no teeth, one natural tooth, two natural teeth, one implant, two implants and one natural tooth/one implant (29).
- Complications: Implant failure and radiographic peri-implant marginal bone-loss were evaluated. Failure was defined as removal of the implant (27). The records taken for each implant were: the date it was placed, the date of the definitive restoration and the date of the last patient visit. Meanwhile, the period between the date of implant placement and the date of patient most recent visit was defined as survival of implant.
- Bone loss and bone gain: The crestal bone changes were obtained from the intraoral radiographs (periapicals) on the day of the insertion of the definitive restoration, 1 year and 2 years after loading. The radiographs were taken with a parallel technique to optimize projection geometry. Crestal bone levels (CBL) were measured mesially and distally. The linear measurements were obtained from the implant-abutment interface (IAI). A positive number suggested an increase in crestal bone level. A negative number suggested bone loss overtime.

Results

Between 2010 and 2015, 33 subjects had at least one hydroxyapatite-coated Bicon implant placed using a two-stage surgical protocol and were suitable for inclusion in the study. A total of 66 Bicon implants were placed: 60 implants (90.91%) in posterior areas. The most common location for all implants was the posterior mandible (48.5%), posterior maxilla (40.91%), followed by anterior maxilla (9.1%). No implants were placed at the anterior mandible area. The sample consists of 14 males (42.42%) and 19 females (57.58%) (Table 1) and the mean age of the patients was 47.87±14.97.

Table 1. Distribution of patients by gender

Gender	N	Percent
Male	14	42.42
Female	19	57.58

Thirty patients were categorized as ASA I (90.91%) and 3 patients were categorized as ASA II (9.09%) (Table 2).

Table 2. Distribution of patients according health status

A.S.A status	N	Percent
A.S.A I	30	90.91
A.S.A II	3	9.09
A.S.A III	0	0

In table 3, it is shown the distribution of sample according to tobacco use, 6 of patients were smokers (18.18%) and 27 of them were non-smokers (81.82%).

Table 3. Percentage of smokers and non-smokers

Current tobacco use	N	Percent
Yes	6	18.18
No	27	81.82

According to Table 4, 33 implants (50.0%) were placed in maxilla and 32 implants (48.5%) in mandible.

Table 4. Distribution of the implants according to jaw

Jaw	N	Percent
Maxilla	33	50
Mandible	32	48.5

According to table 5, 1 implant was placed in D2 bone (1.51%), 43 implants (65.15%) in D3 bone and 21 implants (31.82%) in D4 bone but 0 implants in D1 bone.

Table 5. Classification of bone quality according to Misch

Bone quality	N	Percent
D1	0	0
D2	1	1.51
D3	43	65.15
D4	21	31.82

According to table 6, two implants (3.0%) were adjacent by one tooth, 24 implants (36.4%) were adjacent by two teeth, 9 implants (13.6%) by one implant, 10 implants (15.2%) by two implants and 20 implants (30.3%) were adjacent by one tooth/ one implant.

Table 6. Adjacent structures of the placed implant

Adjacent structures	N	Percent
One tooth	2	3.0
Two teeth	24	36.4
One implant	9	13.6
Two implants	10	15.2
One tooth/one implant	20	30.3

The length of follow-up for all implants was 24 months (two years). During this study, two failures were documented. One implant, placed in smoker patient (cigarettes), with agenesis of two maxillary laterals, failed after loading. The implant was replaced after five months without further complications. No grafting procedure was used. The other failed implant was placed in a non-smoker patient, in the posterior mandible and no longer replaced.

Table 7. Percentage of successful and failed implants

Implants	N	Percent
Success	64	96.97
Failure	2	3.03
Total	66	100.0

The average of crestal bone level after loading was 0.5 mm (range -1.36 to 4.54 mm) and the average of crestal bone level at the last visit was -0.23 mm (range -2.04 to 3.42 mm). The mean mesio-distal change in crestal bone levels was -0.73 mm during 2 years of follow-up.

Discussion

The advanced technology and improvement of the implant surfaces have encouraged the success of short implants to a comparable level to that of standard implants (30).

Our study is based on a plateau design, HA-coated implant. The survival rates in our study are comparable to those reported in the literature by different authors as Urdaneta, Gentile and collaborators, Deporter et al, Lee and collaborators, Rossi et al.

Deporter et al. (26) reported data from a sample of a partially edentulous subjects treated with an ultrashort (5 mm long) sintered porous-surface (SPS) dental implant and had a maximal coronal diameter of 5 mm long. Twenty-six implants were placed, whereas two maxillary implants failed giving maxillary and mandibular failure rates of 14.3% and 0% respectively. Deporter et al. survival rates were as follows: 85.7% success of maxillary implants and 100% success of mandibular implants. It is well known that the mandible has better bone quality than the maxilla.

Urdaneta et al. (27) evaluated the performance of 5 and 6 mm long implants and 8 mm long implants with a survival rate of 97.6% and 95.2% respectively. They concluded that the survival rate of ultrashort (5, 6 mm) were comparable to that of short implants (8mm).

Gentile et al. (13) reported 3 failures out of 45 ultrashort locking-taper implants, 42 (93.3%) of which were restored with single crowns, that were followed for an average of 24.5 months. They concluded that the survival of short, wide-diameter locking-taper implants (6 x 5.7-mm) was comparable to the survival of longer implant (non-6 x 5.7-mm). Urdaneta et al. reported that shorter (8 mm) 5-mm-wide locking-taper implants were significantly more likely to gain bone than longer implants (11 mm) of similar width (27).

Lee et al. (31) reported high survival rates (97%) for HA-coated locking-taper implants and found that implant length ($<$10 mm vs $\geq$10 mm) did not have a significant effect on the survival. Urdaneta et al. suggest that the higher survival rates of their study may be explained by the differences in the materials and techniques used (27). The presence of an HA-coated has been shown to be predictor for crestal bone gain on single-tooth locking-taper implants (32). Rossi et al. have reported a cumulative survival rate

of 95%, of 40 short implants, 6 mm long 2 years after loading (11).

Short implants should be investigated further as a solution for the management of edentulous areas, especially in a highly resorbed bone to avoid bone grafting, sinus lifting or other surgical procedures and their complications, sparing time and money to the patients. The results documented by the present study can be generalised to a wider sample and with a longer follow-up.

Conclusion

Within the limitations of this study, we may suggest that the survival rate of short implants is comparable to the survival rate of long implants. The use of short implants should be taken into consideration as an alternative option for the restoration of edentulous areas, especially in cases of limited bone height.

Conflicts of interest: None declared.

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