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Augmentation of atrophic posterior maxilla by short implants and osteotome technique

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SUMMARY

Introduction. Edentulous ridge in the posterior maxilla is often compromised by reduced bone volume. This anatomical condition limits the implant placement of 10 mm in length without sinus augmentation. The use of shorter implants with osteotome technique minimizes the need of more extensive sinus floor elevation, thus reducing the duration and morbidity of the treatment.

Materials and Methods. A prospective study was conducted of all patients treated between Nov 2007 and Nov 2008 who received endosseous implants that were less than 10 mm in length. Patient age, gender, height bone residual of posterior maxilla, location of implants, number and type of implants and Albrektsson criteria for success were assessed.

Results A total of 25 implants of 8 mm in length were placed with primary stability in 11 patients. Cumulative survival rates for implants were 100%.

Conclusion. This simplified treatment modality can make implant rehabilitation of the atrophic posterior maxilla more accessible.

Key words: short implant, osteotome technique, sinus floor elevation.

INTRODUCTION

An assumption was made at the time of introduction of dental implants that longer fixtures would be proved to be more advantageous in clinical use than their shorter counterparts, due to an improved crown-to implant ratio and the greater implant surface area available for osseointegration (1). This concept appeared to be supported by the data from early publications documenting the use of machined, hex headed, screw-type implants (2-4).

The attitude to place shorter implants and have the same level of clinical success as observed with longer counterparts would achieve a number of potential advantages to the clinician and the patient (5-7). The sinus floor elevation could be avoided if using shorter implants. The purpose of this paper is to examine the outcomes in terms of predictability and safety using the osteotome technique with an immediate placement of short implants in atrophic posterior maxilla.

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MATERIALS AND METHODS

A prospective analysis was carried out of all patients treated between Nov 2007 and Nov 2008 who received implants of 8 mm in length (Tapered Screw-Vent, Zimmer Dental, Carlsbad, CA). Abutment connection surgery was performed after a healing of 5 months. The study group included 11 patients, 4 male and 7 Female, with a mean age of 46.2 years. Because of advanced horizontal and vertical bone loss of the alveolar processes and/or extensive pneumatization of the maxillary sinus the patients were considered to have insufficient bone volume for routine implant treatment in the posterior maxilla.

Previous to initiation of implant placement medical histories were obtained for all patients. The inclusion criteria for our study were the following: good general state of health; a non-smoker or light smoker (less than 10 cigarettes per day); absence of pathology affecting maxillary sinus; residual bone height between crest and maxillary sinus floor between 4 and 6 mm and bone thickness over 5 mm;

correct inter-arch relationship and patient consent to treatment. Criteria of exclusion were: a history of intravenous biphosphonate therapy, uncontrolled diabetes, chemotherapy and/or head and neck radiation therapy within the 2 years previous to consultation.

The choice of treatment was based on the amount of available bone for implant placement, which was evaluated by clinical and radiographic (Rx OPT and TC dental scan) presurgical examination.

In all patients the bone of the posterior maxilla was considered Class V or VI to Cawood and Howell (8). An osteotome technique was used to improve the bone quality and sinus floor elevation. To avoid maxillary bone grafting, we prefer to use an osteotome technique with an immediate placement of short implants. When considering the use of short implants in the compromised posterior maxilla, the insertion protocol should improve localized bone quality, maximize implant stability and perform minor sinus floor elevation as necessary by osteotome technique. The clinical application of shorter (8 mm) implants in the posterior maxilla serves to minimize the extent of the sinus floor elevation required, which could be performed in most instances by a less invasive, bone-condensing osteotome technique (9, 10).

All patients underwent clinical and radiographic examination according to the prospective follow-up protocol. The follow-up period ranged from 6 to 12 months from the day of implant treatment. From obtained patient records, the following parameters were recorded: age, gender, jaw bone volume according to Cawood and Howell (8), type and number of implants placed and lost, implant position and Albrektsson (2) criteria for success (Table).

RESULTS

A total of 15 implants (4.7-4.1 mm ∅ × 8 mm) were placed with a good primary stability. No intraoperatory complications were recorded. At 1 year follow-up all implants (100%) met Albrektsson (2) criteria for success.

All patients received fixed prostheses, which were all stable throughout the observation period.

DISCUSSION

The patient with an edentulous posterior maxilla compromised by obviously reduced subantral height must accept the increased risk of surgical complications and extended treatment duration for dental rehabilitation. Various techniques for sinus floor elevation have been reported using different graft materials in a delayed or simultaneous approach to implant placement (11-18). The lateral window osteotomy is the most commonly used technique for sinus augmentation (12-14), but it has some disadvantages, including a higher cost, increased morbidity, risk of serious infection, and delayed healing time (19). As a less invasive alternative method, osteotome technique can obtain a localized elevation of the sinus floor through a 3 mm – to 6 mm diameter crestal osteotomy. Which minimizes the degree of a flap elevation and thus eliminates the need of a preparation of a larger bony window in the lateral aspect of the alveolus (15-19). This technique offers the advantages of a more conservative surgical entry, more localized augmentation of the sinus, a reduced degree of a postoperative morbidity, and the ability to load the implants in a shorter

Table. Patient age, gender, height bone residual of posterior maxilla, location of implants, number and type of implants and Albrektsson criteria for implant success

Patients	Age (year)	Gender	Height bone residual	Type of implant	Number of implants	Implant position	Albrektsson criteria
1	46	F	5 mm	TSV 4.7 mm	2	2.5-2.6	O.K.
2	41	M	6 mm	TSV 4.1 mm	3	2.4-2.5-2.6	O.K.
3	57	F	6 mm	TSV 4.7 mm	2	2.6-2.7	O.K.
4	51	F	5.8 mm	TSV 4.1-4.7 mm	3	1.5-1.6-1.7	O.K.
5	43	F	4.9 mm	TSV 4.7 mm	2	2.5-2.6	O.K.
6	37	M	6.1 mm	TSV 4.7 mm	3	1.5-1.6-1.7	O.K.
7	39	M	4.9 mm	TSV 4.1 mm	2	2.5-2.6	O.K.
8	48	F	5.7 mm	TSV 4.1 mm	2	1.5-1.6	O.K.
9	68	M	4.8 mm	TSV 4.1 mm	2	2.4-2.5	O.K.
10	57	F	6 mm	TSV 4.1 mm	2	1.5-16	O.K.
11	52	F	6.3 mm	TSV 4.1 mm	2	1.4-1.5	O.K.

time (20). Moreover, some authors reported that the osteotome technique could improve density of the bone and quality of the implant site, crucial factors for successful implant treatment (21).

The improved predictability of short implants placed in the posterior maxilla should reduce the necessity of more extensive sinus grafting (22-27). This improvement is intrinsically related to the implant surface area contacting with a bone and addition of a roughened surface texture to the machined threads (28, 29). Improvement of the retention between the implant and bone was obtained with modification of the implant surface which etching, blasting, porosity (29, 30).

Furthermore, the reduced bone volume required for short implants would expand the clinical applications for the less invasive osteotome technique to allow the placement of implants of 8 mm in length. Modification of this localized internal approach allows for both simultaneous and staged implant placement at sites with a residual subantral bone height of at least 2 mm (16-19, 23, 26).

Numerous finite element analyses have been performed to assess the force distribution following load application to implants of various dimensions. Pierrisnard et al. (31) reported that the magnitude and distribution of the stress to the bone was constant and independent of implant length. These findings were contradicted by Petrie and Williams, who reported a reduction in peak crestal stress following force application with implants of increased diameter and/or length (32). Buser et al. (33) reported no difference in implant survival rates between long and short implants in an 8-year life table analysis.

Based upon the retrospective report, when implants are less than 10 mm in length demonstrated cumulative survival rates in function comparable to those reported for longer implants (34).

The use of short implants in combination with osteotome technique for sinus floor elevation, where necessary, provides clinicians more conservative options of the treatment. This method can help to minimize treatment duration, cost and trauma.

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