PALATAL POSITIONING OF IMPLANTS IN SEVERELY RESORBED POSTERIOR MAXILLAE

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Abstract:
Objectives: To evaluate an alternative treatment for rehabilitation of the severely resorbed posterior maxilla with palatal positioning of implants using the pre-existing anatomic features. Material and Methods: A retrospective study was conducted of thirty eight patients who received palatally positioned implants in the posterior maxilla using optimally the palatal curvature to avoid sinus grafting between Sep. 2005 and Sep. 2009. Patients with class IV and V atrophied maxillae according to the Cawood and Howell classification were included in this study. All patients received implant-retained fixed metal ceramic crowns. Panoramic radiographs and computerized tomographs of the maxillae had been made prior to surgery. Patients were followed-up for forty eight months after prosthesis delivery. Mesial and distal bone loss around the implants was measured on periapical radiographs and the largest value was considered as the bone loss. Periotest values (PV) of inserted implants were analyzed. Results: Thirty eight resorbed posterior maxillae were treated with fixed prosthesis supported by a combination of 196 upright and palatally positioned implants. All implants were placed as planned, 56 implants were placed in the palatal curvature through optimal use of the anatomic features of the posterior arch, 140 implants were placed in upright position using the residual pristine bone. The success rate of palatally positioned implants during the four-years observation period was 96% (54/56). Clinical evaluation of the results showed stable implants according to PV. The mean bone loss of implants with palatal infection or inflammation. Conclusion: Palatal positioning of implants in situation where there is sufficient palatal bone medial to the maxillary sinus, may be a predictable alternative to avoid sinus grafting for rehabilitation of the atrophied posterior maxilla.

Keywords: dental implants, palatal position, posterior maxilla, sinus elevation.

INTRODUCTION
Implant insertion in the posterior maxilla can be problematic due to insufficient vertical and horizontal bone volume and the proximity to the maxillary sinus (1). The generally poor bone quality frequently encountered in this region in conjunction with inadequate bone volume related to both the pneumatization of the maxillary sinus and resorption of the alveolar ridge, thus the success rate for implants in this region is less favorable than in other region (2).

Treatment options include sinus elevation via a crestal or lateral approach, or reconstructive surgery with bone grafting are the most common procedures. The technique of the sinus floor augmentation was developed to increase the vertical bone level to accomplish primary stability of endosseous implants. The drawbacks of sinus elevation are increases in treatment duration and cost, the extra oral bone harvesting prolongs hospitalization, possible surgical complications at the donor and the host sites, with higher morbidity rates, including pain and neurosensory disorders. Furthermore the volume reduction of bone graft as a result of resorption has to be considered. Because of this invasive surgery the patient acceptance could be limited. To overcome these negative aspects, some have suggested using optimally alternative anatomic features to place the implants, such as the anterior or posterior wall and the septa of the sinus, the palatal curvature and the zygoma or the pterygoid process (3,4). A technique has been reported for implants placed tangential to the palatal curvature in the area of the first or second molar. These implants placed in the palatal sulcus direction, in the bone impression of the
great palatal bundle. Furthermore, with palatal positioning implant good primary stability could be achieved. The objective of this paper is to evaluate the use of palatally positioned implants using optimally the palatal buttress and basal bone facilitating the rehabilitation of the severe resorbed posterior maxilla as an alternative method to avoid sinus grafting.

MATERIALS AND METHODS

A retrospective study was made of thirty eight patients (20 females and 18 males) with a mean age of 49.2 (range 32-76) underwent minimally invasive surgery to place 56 implants in the palatal curvature of the molar region in the posterior maxilla, 140 additional implants were placed in upright position using the residual pristine bone between Sep. 2005 and Sep. 2009. Patients were selected after evaluation of medical anamnesis. Before treatment, all patients were clinically and radiographically examined by panoramic radiographs and computed tomographs of the posterior maxilla for available bone volume, bone quality, anatomy and existing sinus pathology. A total of 196 Alpha Bio dental implants in different diameters (3.75, 4.2, 5mm) and different length (10, 11.5, 13, 16mm) were placed. In three patients a sinus perforation was detected, bioresorbable collagen membrane were intraoperatively placed through the prepared implant site to repair the sinus perforation and the implants were simultaneously placed. In all patients a two stage approach was performed. A surgical stent was used for implant site preparation. An angulation of approximately 31° to 33° was necessary to accommodate the implant into the medial wall of the sinus. With the surgical stent in place implantation was performed according to angulation determined from the computed tomograms after the height and width were measured from the different slices of the tomograms.

SURGICAL TECHNIQUE

All surgery was performed under local anesthesia (2% scandicaine with 1:100,000 adrenalin) and carried out by the same surgeon. A crestal incision was performed slightly palatally, supplemented with two buccal releasing incisions, mesially and distally. Full mucoperiosteal flaps were raised, the palatal flap was held in a retracted position by a suture, elevated until the superior border of the impression sulcus, of the great palatal bundle was reached. The prepared stent was positioned. The places of the desired implants were marked. The implants were placed from the alveolar ridge crest close to and tangential with the palatal surface, these implants passed through the palatal cortical plate and sulcus formation, which assured that cortical anchorage was achieved.

The bone quality was classified as type III according to the classification of Lenkholm and Zarb (6). The patients were instructed for postoperatively appointments every month. After three months the implants were exposed and healing abutments were placed. Panoramic radiographs were obtained immediately after surgery and again yearly till four years follow-up. To investigate the exact location of the implant position, computed tomography were obtained after surgery (Fig. 2a,b,c).
Fig. 2 a,b,c: Postoperative cross-sectional CT scans showing supporting bone around the implants inserted in the palatal curvature.

All patients had been followed for at least four years. Furthermore, throughout the period for prosthetic loading, the level of bone resorption, and the periodontal conditions were evaluated annually, vertical bone resorption was assessed based on standardized periapical radiographs. The length of the implants was used as a reference for the measurement of bone resorption, which was expressed as a percentage of the implant length. The stability of the implants was evaluated objectively by periotest measurements (Gulden, Laurertal, Germany).

RESULTS
The study involved thirty-eight patients with severely resorbed posterior maxilla (20 females and 18 males with a mean age of 49.2 years). Who received 196 implants. 56 implants were placed palatally anchored in the palatal bone curvature and 140 were placed in upright position in premolar and molar areas (Fig. 3a,b).

Fig. 3 a: Panoramic radiograph of bilaterally edentulous patient prior to implant placement.

Fig. 3 b: Panoramic radiograph obtained after implant placement, implants 15,16 in palatal position.

Every implant was placed with a primary stability of 35 N/cm. The results of the periotest examination ranged between -4 to -6 of palatally positioned implants and implants in upright position. Two implants of the fifty-six palatal positioned implants were removed in the healing period. The rest of the implants were stable. New tomographs were obtained to confirm the implant position in the palatal wall of the maxilla, before starting the restoration phase of treatment (Fig. 4a,b,c).
The tomographs examination showed the presence of dense bone around and above the implants. The implants appeared to be well integrated with no peri-implants bone loss. The implants were positioned at the palatal axial inclination. Three Schneiderian membranes of the sinuses were slightly detected, all sinus membrane perforations were repaired with collagen membrane and fibrin glue through the osteotomy sites. In two cases of sinus membrane perforation with simultaneous implant insertion a minor penetration of the implant into the sinus were noted, but no mucosal reaction at the implant site was noted. Two implants were lost and removed in the perforated sinus during the osseointegration phase between 4 to 6 weeks after implant placement. By evaluation of patients those with sinus perforation and those without sinus perforation significant difference were noted. The survival rate in patient with sinus perforation was much lower than the group without sinus perforation. The success rate of the 56 implants placed in palatal position after 4 years of follow-up was 96% according to Albrektsson success criteria (7). At the 12-month evaluation after loading, peri-implant crestal bone loss averaged $0.95 \pm 0.44 \text{mm}$ for upright maxillary implants ($n=140$ implants) and $0.88 \pm 0.59 \text{mm}$ for palatally positioned implants ($n=56$ implants). No significant difference in crestal bone loss between palatally positioned implants and upright implants was detected at the 12-month follow-up evaluation in the posterior maxilla.

### DISCUSSIONS

Implant placement in the posterior maxilla is often complicated due to insufficient bone volume caused by atrophy of the maxilla and pneumatization of the maxillary sinus (8). Following removal of teeth, the buccal alveolar bone plate resorbs much faster than the palatal plate (9). Pietrokovski and Massler (9) examined bone resorption after 149 extractions and concluded that resorption was greater along the buccal surface than the palatal surface. In patients with severe maxillary atrophy (classes IV and V) the palatal bone remains longer, allowing the placement of standard implants without the need for difficult grafting procedures which usually requires hospitalization of the patients and may be associated with serious complications. For such patients the placement of implants in pre-existing bone, which can be used to place implants in a very limited amount of bone may be a viable alternative for rehabilitation of the posterior maxilla.

The advantages of the surgical methods as a therapeutic option are: it reduces surgical and treatment duration by avoiding grafting procedures and long healing period, thereby reducing the cost of treatment; it reduces the risk of morbidity and reduces patient and...
practitioner discomfort and increases patient acceptance, particularly for those patients if the only other option is to harvest bone from the iliac crest. Mattsson et al (10) presented an alternative method, in which the maximum amount of the severely resorbed alveolar crest was used for implant placement without grafting procedure. A success rate of 97.8% was achieved in Rosen and Gynther study (11) when implants were placed in a palatal position without postoperative complications.

Ivanoff recently showed that the stability of bicortically anchored implants is superior to the stability of an implant that is supported by only one cortex. Thus, the implant that is placed tangential to the palatal in the maxilla can be expected to provide acceptable support for fixed prosthesis. Penarrocha et al (12) suggested that implants placed in a palatal position may be a viable alternative for rehabilitation of the atrophied maxilla and in another study Penarrocha et al (13) concluded that placement of implants slightly to the palatal and tilted in the anterior maxillary buttress to support an overdenture with bars may be a viable treatment alternative for the rehabilitation of the severely atrophic maxilla.

A mean crestal bone loss of 0.88mm was measured on periapical radiographs of the 38 patients after 12 months of follow-up, Levy et al (14) observed a mean bone loss of 0.43mm on 144 implants, and Boronat et al (15) recorded a mean bone loss of 0.58mm in 106 dental implants after 12 months of loading.

CONCLUSIONS

More attention should be given to the possibilities of implant placement using the anatomic features of the arches, without the use of bone grafting procedures. Using palatally positioned implants in the atrophied posterior maxilla offers excellent support for prostheses and thus enhanced the possibility for simpler rehabilitation of patients.

For patients resistant to implant placement in the posterior maxilla because they are not willing to undergo extensive sinus floor elevation using a lateral window approach, intentional angulation of implants in the palatal direction may represent a less invasive treatment option. If the treating clinician or referring dentist is aware of the indications for this procedure, many patients may be more accepting of implant rehabilitation in the posterior maxilla.

The Author's use of palatal positioned implants simplified an alternative method to sinus floor elevation or any extensive reconstructive surgery and Increased case acceptance.

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