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Assessment of the Quality of Newly-Formed Bone for Implant Insertion after Augmentation of the Maxillary Sinus Floor

SUMMARY

Background: Presence of the maxillary sinus and low bone density in this area often could create a problem for prosthetic rehabilitation with dental implants. Sinus floor augmentation technique can successfully increase dimensions of the posterior maxilla for implant placement.

Objective: To assess quality of newly formed bone for implant insertion after augmentation of the floor of the maxillary sinus using Digora for Windows computer programme.

Materials and Methods: 30 patients with indications for sinus lift procedure were involved in this clinical study. Bone density was analysed by Digora for Windows computer programme.

Results: 16 patients completed this clinical study with preoperative and postoperative orthopantomographs.

Conclusion: Cases with sufficient density and bone volume in the posterior maxilla require sinus lift technique with adequate bone graft for implant insertion. This is confirmed by pre- and post-operative analysis of radiographic images in Digora for Windows programme.

Key words: Posterior Maxilla; Sinus Lift; Computer Analysis

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Introduction

Contemporary prosthetic rehabilitation of the posterior maxilla, instead classic dental prostheses, comprises implant insertion and subsequent rehabilitation. However, implant placement in the posterior maxilla usually presents a challenging clinical situation. When planning implant restoration in this region, several parameters need to be considered: height and width of the alveolar ridge in the posterior maxilla, and bone density. Due to the presence of maxillary sinus and low bone density in this area, it is usually required to use shorter implants, which can result in the increased risk of failure[5]. Sufficient density and appropriate volume of bone are therefore crucial factors for successful implant treatment[7,8].

The maxillary sinus floor augmentation technique has been extensively used in the last 20 years to successfully increase the dimensions of the posterior maxilla for implant placement[3]. This technique is based on elevation of the Schneiderian membrane from the floor of maxillary sinus and introduction of a bone graft or a bone substitute. In these cases, the residual height of the alveolar ridge was less than 8 mm[14] . Sinus lift was introduced by Boyne in the 1960s and it was soon more popularized[9]. This procedure is technically demanding and involves many factors that might affect implant survival, such as the type of graft used for augmentation, surgical technique and the type of implants[4].

Since survival rates in the posterior maxilla are different from other sites/locations in the mouth, it would be interesting to analyse implant survival after sinus augmentation. The aim of this clinical study was to

assess quality of newly-formed bone for implant insertion after augmentation of the floor of maxilla sinus by using modern computer analysis programme.

Material and Methods

The study was carried out on a group of 30 patients, of different age and gender, who required bone augmentation of the posterior maxilla and subsequent implant restoration. All surgical procedures were carried out in Dental/Medical Centre for Maxillofacial Surgery "Beograd-centar" in Belgrade, Serbia, under local anaesthesia. All patients had residual sinus floor of less than 8 mm high and low bone density. They had good oral hygiene, did not suffer from diabetes mellitus or other serious general diseases.

In the period from 2006 to 2007, 30 sinus grafting operations were performed. The sinus lift was carried out using 1 of the familiar techniques depending on clinical condition. Duration of rehabilitation between the sinus lift procedure and implant placement was 6 months. The particulate bovine bone Bio-Oss® was used for the sinus floor augmentation in majority of cases, as well as an autogenous bone graft from the mandible (symphysis, retromolar region) in cases of severe pneumatization. The type of implants used in the second stage procedure were Branemark, Straumann, and Replace Select Tappered according to the thickness of the bone and patient preferences.

Quality of newly formed bone (bone density) and implant stability was evaluated on the basis of computer programme Digora for Windows (Soredex Finland). Preoperative and postoperative analysis of height of the sinus floor was also performed in Digora for Windows programme. Figure 1 shows ortthopantomography (OPG) in Digora, started for analysis. To perform more precise computer interpretation of height of maxillary sinus line, a calibrate method was used. Figures 2 and 3 show analysis of height of the posterior maxilla in Digora, pre- and postoperatively. In Digora for Windows programme, the height of the posterior maxilla can be obtained automatically choosing the part of the posterior maxilla for height analysis (vertical line) with cursor (principle is the same on pre- and postoperative X-rays).

Figures 4 and 5 show analysis of bone density pre- and postoperatively in Digora. Principle of bone density assessing in Digora for Windows programme can be obtained automatically as well by using cursor. Length for assessing bone density preoperatively was preformed in side of rectangle in bone zone planned for augmentation and subsequent implant insertion. The same principle was used on postoperative X-rays in the zone where bone augmentation was performed.

Figure 1. OPG X ray in Digora started for analysis

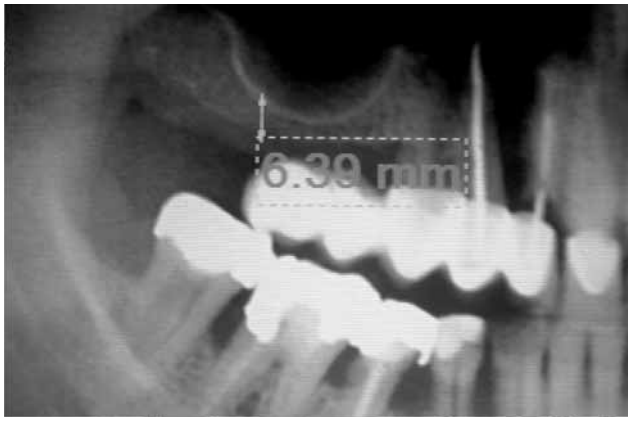

Figure 2. Analysis in Digora preoperatively postoperatively

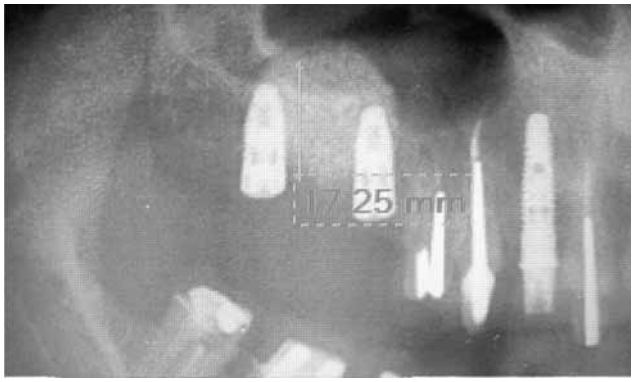

Figure 3. Analysis in Digora after augmentation

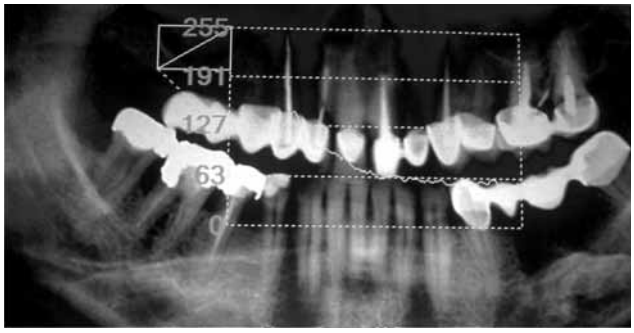

Figure 4. Analysis in Digora of bone density bone preoperatively

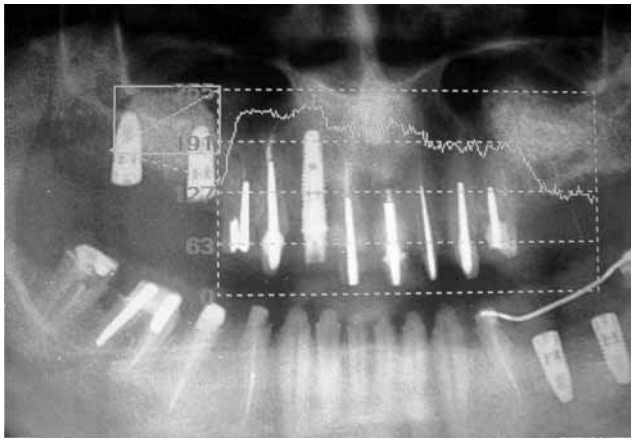

Figure 5. Analysis in Digora of density postoperatively

Results

16 patients completed the study with preoperative and postoperative OPGs, what was the requirement for analysis of bone height (the distance between the sinus floor and the top of the alveolar ridge) and bone density. Preoperative mean-value of bone height was 7.03 mm and 15.82 mm after augmentation. Preoperative and postoperative values of the bone density in the posterior maxilla in the region of the maxillary sinus floor were of 50.80 and 114 respectively. These findings significantly improved bone conditions for implant placement.

According to the highest level of bone density in peri-implant region of 177.50 and clinical observation, all implants were stable in the second-stage surgery.

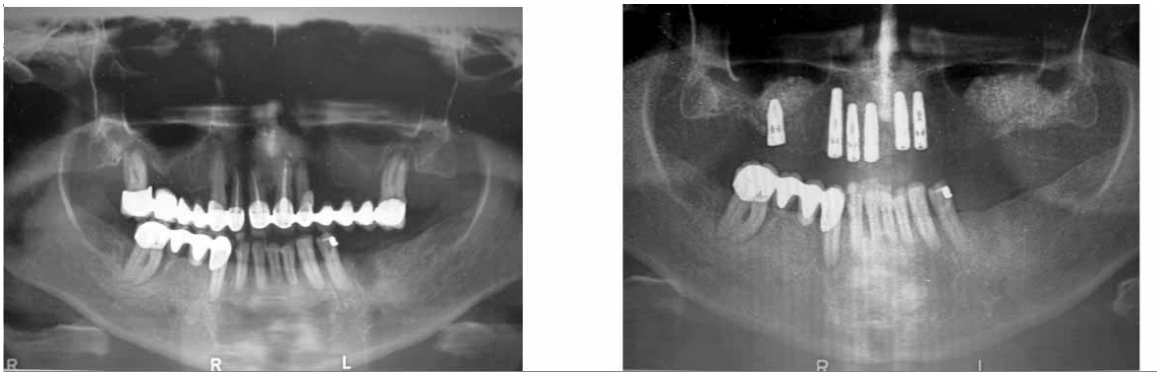

Figure 6. Posterior maxilla before and after augmentation

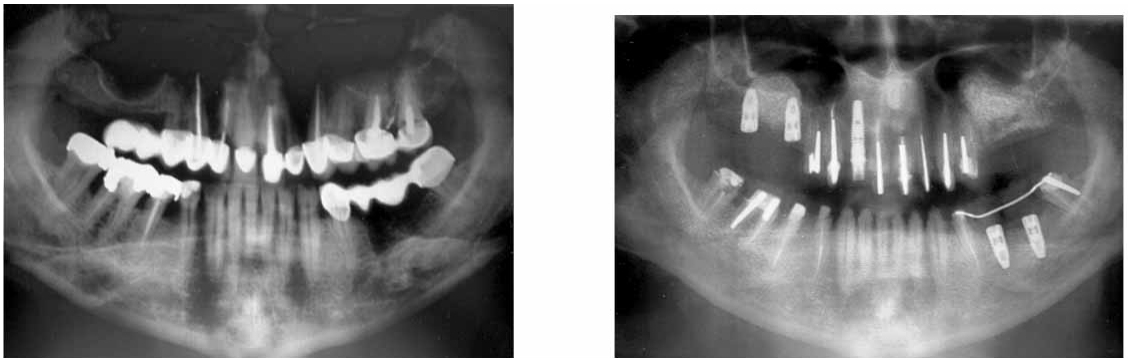

Figure 6. Posterior maxilla before and after augmentation

Analysis in Digora showed no differences between bone density of xenotransplants and autotransplants. Figures 6 and 7 show OPGs before and after augmentation of the posterior maxilla, with obvious effect.

Discussion

Dental implants have reached a high level of reliability and a considerable rate of success[1]. Best results are found in voluminous and highly mineralized bone. In the region of the posterior maxilla, bone is largely cancellous with low level of mineralization[11]. Its height is usually limited by the extended maxillary sinus. But, the amount of residual alveolar bone height is often cited as an important prognostic factor for the success of sinus augmentation procedure[9].

During the study, main parameters for analysis of the posterior maxilla were the height of the residual alveolar bone and bone density. Preoperative results during Digora analysis of height (mean-value 7.03 mm) and bone density

(50.80) have revealed poor bone quality, and doubtful osseointegration of the placed implant in the future. This anatomical handicap could be resolved with a sinus floor augmentation procedure[9].

Postoperative results of the bone height after bone graft procedure (mean-value of 15.82 mm) and bone density after 6 months (middle value 114) were confirmed by successful implant survival. Implant failure is more common with implants placed in bones of low density than in bones of high density[7,8]. Analysis of implant stability in Digora programme after few months showed satisfactory bone density (of mean-value 177.50), which is an important factor for implant osseointegration in the newly formed bone, which means close apposition of bone to the implant surface, "contact osseogenesis"[2].

In this study, a xenograft Bio-Oss® was applied for augmentation. In cases with defect of the buccal cortex of the maxilla, autogenous bone grafts from the mandible (symphysis, retromolar region) were applied to achieve highly predictable bone augmentation[6,12]. It would be interesting to predict what will happen with these implants in the future. However, that would imply a long-term follow-up findings of another clinical study.

References

1. *Adell R, EriksonB, Lekholm U, Branemark PI, Jemt T*. A long term follow-up study of osseointegrated implants in the treatment of totally edentulous jaws. *Int J Oral Maxillofac Implants*, 1990, 5:347-359.
2. *Albrektsson T, Branemark PI, Hansson HA, Lindstrom J.* Osseointegrated titanium implants. Requirements for ensuring a long-lasting, direct bone-to-implant anchorage in man. *Acta Orthopaed Scand*, 1981; 52:155-170.
3. *Boyne PJ, James RA*. Grafting of the maxillary sinus floor with autogenous marrow and bone. *J Oral Surg*, 1980; 38:613-616.
4. *Buser D, Mericske-Stern R, Bernard JP, Behneke A, Behneke N, Hirt HP, Belser UC, Lang NP.* Long term evaluation of nonsubmerged ITI implants. Part I. 8-year life table analysis of a prospective multi-center study with 2359 implants. *Clin Oral Impl Res,* 1997; 8:161-172.
5. *Chuang SK, Tian L, Wei LJ, Dodson TB*. Predicting dental implant survival by use of the marginal approach of the semi-parametric survival methods for clustered observations. *J Dent Res*, 2002; 81:851-855.
6. *Cordaro L.* Bilateral simultaneous augmentation of the maxillary sinus floor with particulated mandible. Report of a technique and preliminary results. *Clin Oral Impl Res*, 2003; 14:201-206.
7. *Friberg B, Jemt T, Lekholm U.* Early failures in 4641 consecutively placed Branemark dental implants, a study from stage I surgery to the connection of completed prostheses. *Int J Oral Maxillofac Impl,* 1991; 6:142-146.
8. *Jaffin RA, Berman CL.* The excessive loss of Branemark fixture in type IV bone: A 5-year analysis. *J Peridontol*, 1991; 62:2-4.
9. *Jensen OT, Shulman LB, Block MS, Iacono VJ.* Report of the Sinus Consensus Conference of 1996. *Int J Oral Maxillofac Impl*, 1998; 13(Suppl 1):1-45.
10. *Jensen OT.* The Sinus Bone Graft. Chicago: Quintessence, 1999.
11. *McCarthy C, Patel RR, Wragg PF, Brook IM.* Sinus augmentation bone grafts for the provision of dental implants: Report of clinical outcome. *Int J Oral Maxillofac Impl*, 2003; 18:377-382.
12. *Merkx MA, Maltha JC, Stoelinga PJ.* Assessment of the value of inorganic bone additives in sinus floor augmentation: A review of clinical reports. *Int J Oral Maxillofac Surg*, 2003; 32:1-6.
13. *Pinholt EM*. Branemark and ITI dental implants in the human bone-grafted maxilla: A comparative evaluation. *Clin Oral Impl Res*, 2003; 14:584-592.
14. *Stajcic Z., Stojcev Lj.* Atlas of Oral Implantology. Belgrade: Grafolik, 2001, p 102. (in Serb)

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