



ORIGINAL RESEARCH PAPER

Oral and Maxillofacial Surgery

"MAXILLARY SINUS FLOOR ELEVATION USING A PRESS-FIT BONE BLOCK IN A CRESTAL APPROACH FOR DENTAL IMPLANTS-A PROSPECTIVE STUDY."

KEY WORDS: Maxillary Sinus Lift, Autogenous Bone Grafting, Crestal Approach

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ABSTRACT

Background :Autogenous bone grafts have been proven to be the gold standard for bone grafting. Although several techniques for sub-antral bone augmentation have been proposed in the literature, the current trend is towards a less invasive procedure in sinus lifting and reducing the complications like membrane perforation and sinusitis. Crestal approach for sinus floor elevation along with an autogenous bone grafting is one such procedure which would give the desired results with minimum complications. **Materials and methods :** This study was performed on a total of 10 patients (7 females and 3 males) with the age ranging from 26 to 58 years. The clinical efficacy of maxillary sinus floor elevation with a crestal approach using a press-fit bone block for dental implants was evaluated in terms of Pre and Post-operative Residual Bone Height, Bone density in Hounsfield Units, Intra-operative and Post-operative Complications. **Results :** Study revealed bone augmentation varied from 9 to 13 mm, with a mean of 10.60 mm. The length of the implants placed ranged from 8 to 11 mm and the diameter 4.5 mm. Intra-operatively 2 patients had sinus perforation. 1 case had graft resorption and 1 case showed non-union of the graft. None of the cases had any signs of wound dehiscence or donor site morbidity. **Conclusion :** In our experience, we believe that there are negligible disadvantages to the crestal approach for sinus lifting, if performed meticulously with sound knowledge of anatomy of maxillary sinus.

INTRODUCTION :

The rehabilitation of the posterior maxilla with the placement of dental implants is often difficult due to reduced bone volume¹. Sometimes a different solution might be feasible: if vertical bone heights are insufficient, short implants and tilted implants can be correctly fitted to avoid entering the sinus^{2,3}. In order to position implants on atrophic maxilla posterior to the first premolar, sinus lift and bone graft are required. If a window is placed at the buccal side of the sinus⁴ to increase bone volume, the Schneiderian membrane shall be elevated prior to placement of the bones. There are several complications such as membrane perforation and graft loss associated with this sinus enlargement procedure. Tatum⁵ was one of the first to implement the technique of lifting the maxillary sinus using autogenous particulate bone for implant prosthesis rehabilitation. To counter this potential problem, particularly for severely atrophic bone in the posterior maxillary region that requires a greater volume of filling material, there was a need for a procedure that would aid in providing the optimal amount of sinus floor elevation and sub-antral bone augmentation through an indirect approach while eliminating the risks of sinus membrane perforation and also maintaining the stability of graft post-operatively. Summers⁶ presented a more conservative and less invasive approach than the conventional lateral approach of sinus floor elevation known as the transalveolar or crestal technique. This procedure was originally applied when the residual vertical bone height was 6-7 mm, but still not enough to place a traditional implant^{7,8,9,10}. Draenert and Eisenmenger¹¹ have described: a trans-crestal elevation of the sinus floor and alveolar ridge augmentation with a cylindrical bone transplant with the press-fit technique. This method also reduces the lateral fenestration of the maxillary sinus and the perforation of the sinus mucosa.

autogenous bone graft block through crestal approach for maxillary sinus floor elevation and also to assess the stability of the implant placed in the same block after 4 months.

MATERIALS AND METHODS :

This study included 10 subjects with posterior partial or total edentulous maxilla associated with various degrees of alveolar ridge resorption and sinus pneumatization that did not allow the placement of adequately sized implants.

All the patients underwent two stage surgery for implant placement. First stage surgery included sinus lift using transcrestal approach and placement of graft, second stage included placement of endosseous implant after 3 months.

All the patients were clinically and radiographically evaluated to check for graft uptake, bone density preoperatively and in the 3rd month post operatively.

RESULTS :

The sample size consists of 10 patients requiring replacement of missing maxillary posterior teeth. The study group included 7 females and 3 males with the age group ranging from 26 to 58 years. Pre-operatively CBCT evaluation was done in all patients to evaluate Residual bone height at the implant site. The initial residual bone height preoperatively at the recipient site ranged from 2.5 to 3.6 mm, with a mean of 3.1mm which was inadequate for placement of an adequate sized implant. In all the 10 patients autogenous bone grafts were harvested from the mandibular symphysis region. The dimensions of the cylindrical bone blocks harvested depended on the residual crest and planned implant diameter and length. 11 cylindrical bone blocks were used for bone grafting for the placement of 10 implants. In one patient two blocks were placed one over the other, as the graft length obtained was insufficient. Cone beam computed

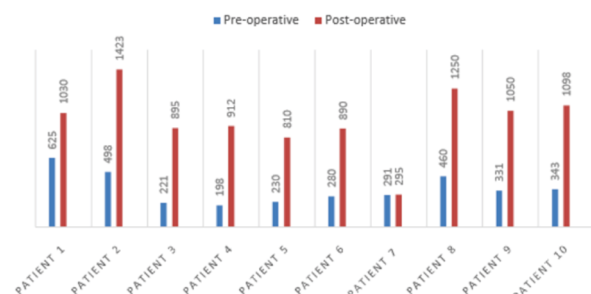
The present study aimed to evaluate the success of

tomography (CBCT) radiographic examination was done pre-operatively and 3 months post-operatively after sinus lifting and grafting to assess the residual bone height and bone density at the implant site.

Following the indirect sinus lift procedure, the harvested bone block was prepared and inserted into the osteotomy site to attain a press-fit. During the healing period of 3 months, the grafted site was assessed for any signs of infections, wound dehiscence, non-union of graft, etc. CBCT assessment was done 3 months postoperatively to assess residual bone height, bone density and graft resorption if any, at the recipient site.

The quality of bone achieved after graft placement was assessed by measuring the bone density in Hounsfield units and comparing it with that of pre-operative bone density values. In all the cases, there was significant increase in bone density values 3 months post-operatively which can be attributed to the high success rates of autogenous bone grafting from the mandibular symphysis region. (graph 1)

BONE DENSITY IN HOUNSFIELD UNITS



Graph 1: Bone Density In Hounsfield Units

The residual bone height at 3 months follow-up is assessed using CBCT radiographs and compared with the pre-operative values. In our study, majority of the cases (9 out of 10 cases) showed good graft uptake, which was evident by the marked increase in residual bone height post-operatively and increased bone density at the grafted site. The increase in residual bone height post autogenous block grafting at the recipient site ranged from 9mm to 13 mm, with a mean of 11.1 mm. 4 months post-implant placement peri-implant radiolucency was checked to evaluate bone loss around the implant by standard radiographic methods. Peri-implant bone loss between implant placement and loading at the crestal level was radiologically null in 100% of the cases after 4 months. Mild graft resorption was seen in 1 case, in this case autogenous particulate bone obtained by bone scraper was used along with PRF to fill the residual defect at the time of implant placement.

DISCUSSION :

The only options available to restore edentulism have been complete dentures, removable or fixed partial dentures. Different bone grafting strategies can be used before the implant is placed to deal with a loss of bone mass¹². Breine and Branemark first reported clinical and experimental trials with bone graft in combination with titanium osseointegrated implants for patients who have advanced resorption of bones¹³. Boyne & James (1980)⁴ was the first to introduce maxillary sinus floor augmentation with autologous bone graft. This technique has been modified and improved by Tatum (1986)⁵ who introduced the lateral approach by fenestrating the buccal wall of maxillary sinus and lifting the Schneiderian membrane. This technique was modified by Wood and More in 1988¹⁴ where autografts, allografts, xenografts or alloplasts can be used for particulate bone augmentation. We may consider reconstruction of a defect in Alveolar by the use of alternatives for bone filling, e.g. freeze dried bone, demineralised frozen bone or any osteobiomaterial with hydroxyapatite and tricalcium phosphate. Although some bone substitutes are available,

autologous grafts continue to be the most common method of maxillamandibular reconstruction^{15,16,17}.

In our clinical study, 10 maxillary sinus floor elevations with cylindrical bone blocks via the crestal approach, as described by Draenert and Eisenmenger¹¹, were done using autogenous bone cylinders obtained from mandibular symphysis region using a bone trephine. A thorough follow-up was done 3 months post-operatively after sinus lifting and graft placement. Implants were placed 3 months post-operatively after sinus floor augmentation. One of the problem encountered in this study was the perforation of the sinus membrane, which was managed using PRF membrane prepared from the patient's own blood. In our study the autogenous bone from mandibular symphysis had been taken as a single block, and it could be placed easily in the subantral region. In contrast to other techniques such as the modified Summers technique or other innovative methods which simultaneously fill a subantral area with particulate biomaterials for bone regeneration, in this procedure no graft may be pulled out of an open sinus cavity. The ability to carefully check the integrity of membranes which is seen as a clinically relevant advantage can be achieved by using pressfit bone blocks. Nevertheless, our technique enables adequate enlargement of alveolar bone to be achieved with a solid and pressfit arthrograft in order to avoid an extended approach from sinus lifts. The stiffness and press-fit fixation of the cancellous bone transplant allows a faster contact healing process, compared to amorphous augmentations (Perren and Boitz, 1978)¹⁸. Non-union of the graft was seen in 1 case, in this case direct sinus lift with onlay grafting was performed for augmentation of the crestal bone.. In our study 8 out of the 9 implants were within the above range suggesting a good primary stability. 1 implant showed a periosteal value of +10.7 for which loading was done 6 months after the implant placement during which time the periosteal value improved favourably to -2. Several authors have describe the use of periosteal in assessing the primary stability of implant for immediate loading. Periosteal reading ranging from -8 to 0 is suggestive of good osseointegration and is fit for immediate loading. This case series indicates that the use of a cylindrical bone block inserted into the antrum with a crestal approach may be an alternative to conventional sinus grafting. Further studies should confirm the exact indications for this procedure, particularly regarding the degree of atrophy. It would be useful to compare it with zygomatic implants.

CONCLUSION :

We believe, in practice of a small number of patients, that the crestal approach for sinus lifting is not considered to have any detrimental effect if performed with precision and proper knowledge of maxillary skull anatomy. In order to support the current understanding that a crestal approach with sinus pressfit bone block is more advantageous for floor enlargement, further studies will need to be carried out with greater number of cases. This approach may rule out the need for any other techniques like direct sinus lift and also need for zygomatic implants in cases with a very minimal residual bone height in the maxillary posterior edentulous area.

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