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Research Article

Crestal Maxillary Sinus Lift with Rotating Instruments and Different Grafting Materials: Results at 4 Years Follow Up

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Abstract

Objectives: The maxillary sinus lift with lateral approach has always been one of the most complex procedures in terms of post-operative morbidity. For this reason efforts have been made to introduce less invasive methods. The use of osteotomes has been considered a good alternative. The main problem is linked to the perception of the patient, who considers this method particularly annoying to bear because of the percussion. To overcome this, methods with a crestal approach with rotating instruments are increasingly being disseminated.

Material and Methods: 150 patients (aged between 26 and 82) treated between January 2014 and January 2019 by sinus lift with a crestal approach were considered. At the same time of the elevation, the implant was inserted, for a total of 167. During the surgeries, various heterologous bone substitutes were used.

Results: After 4 years, a survival rate of 99% of the implants was recorded. No difference was observed in terms of survival in relation to the bone substitute used, with no adverse or inflammatory reaction of the sinus membrane. No patients reported any discomfort during chewing or resting conditions.

Conclusion: The most important aspect concerns the total absence of post-operative discomfort or complications, which can be completely superimposed on those present in the case of a conventional implant surgery. It can be combined with any type of implant and survival rates do not seem to be affected by the nature of the grafting material used, as long as it is a granular material with fine grain size.

Keywords: Maxillary Sinus; Grain Size; Survival Rate

Introduction

The maxillary sinus is an area that has always been considered with a certain "reverence" by the vast majority of dentists. This is probably due to the close anatomical relationships that the same has with anatomical areas of great importance, such as the orbital cavity, the tuber maxillae and the nasal cavities. For those reasons, the insertion of the implants can be complicated by the presence of the maxillary sinus. This anatomic cavity sometimes is larger than usual due to the loss of the underlying dental elements. This condition involves the rupture of the balance between the tooth, the periodontal ligament and the alveolar process. As a result of tooth extraction, the disappearance of the artero-venous ligament and plexus contained in the tooth is observed. The rupture of this balance causes a slow but progressive bone resorption resulting in horizontal and vertical bone atrophy of the alveolar process.

Sometimes this situation is aggravated by the presence of total or partial removable prostheses that compress the alveolar mucosa, reducing oxygenation and increasing the stimulation of osteoclastic cells resulting in acceleration of bone resorption of the alveolar process.

The lack of dental elements facilitates the progressive expansion of the sinus cavity also in relation to the fact that the atmospheric pressure of the air stimulates the osteoclastic activity of the membrane no longer contrasted by the chewing activity of the dental elements. For this reason, a reduction of the available bone volume is observed for the insertion of osteointegrated implants in the upper posterior jaw, as a result, surgical techniques to graft the sinus cavity had to be developed in order to position implants without encroaching on the anatomical limits of the maxillary sinus and the sinus membrane itself.

The first attempts go back to the '60s with Boyne [1], then to the first scientific publications of surgical techniques better defined with Kent and Block [2] or Boyne [3] and Tatum [4]. Since then there have been thousands of articles relating to surgical methods with greater or lesser softness and practicality.

In recent years, the increase in the average age of the population and therefore the management of patients increasingly "complex", especially from the pharmacological point of view, leads us to prefer minimal surgical invasive techniques, which provide a post-operative with minimal softness and consequent reduced discomfort for the patient himself, allowing him to return, in the shortest possible time, to his regular working and relational activity.

Aim of the Study

The aim of the following retrospective study is to present the results obtained 4 years after the operation of raising the maxillary sinus and contextual implant insertion with a minimally invasive method based on a crestal approach.

Materials and Methods

This retrospective study considers 150 patients (aged 26 - 82 years, 91 females and 69 males) treated between January 2014 and January 2019 with the SCA maxillary sinus lift (Sinus Crestal Approach, Neobiotech, Seoul, South Korea).

The patients were operated and rehabilitated with fixed zirconium-ceramic or monolithic zirconium implants by 5 different operators who were particularly experienced in surgery and implant insertion.

The criteria for inclusion were: patients 21 years of age, with need for implant therapy in the posterior jaw of residual bone height 6 mm, absence of active periodontal disease. The exclusion criteria were: use of drugs that could interfere with bone metabolism (e.g. corticosteroids, bisphosphonates), heavy smokers (> 10 cigarettes/day), history of maxillary sinusitis or previous sinus surgery. Pre-surgical evaluation included clinical examination and radiographic analysis of the posterior jaw. Intraoral and panoramic X-rays were taken to assess the need for surgery and measurements of the operation were taken by CBTC. The examinations showed health conditions of the maxillary sinuses in all subjects prior to implant treatment, with patency of the osteo-meatal complex.

The amount of residual bone below the maxillary sinus was at least 2 mm. The study was designed and conducted in full accordance with the ethical principles for medical research involving human subjects published in the year 2000 5th revision of World Medical Association Declaration of Helsinki.

All patients signed a specific written informed consent form and the study design was approved by the Ethics Committee.

Surgical procedures

Surgery was performed under local anesthesia (2% xylocaine dental with epinephrine 1:50000, DENTSPLY Pharmaceutical, York, PA, USA) after pre-operative oral sedation with diazepam (Valium 2, Glaxo SmithKline, Verona, Italy) when necessary.

An incision of the crest was followed by a lifting of the full thickness flap to expose the posterior-lateral jaw area, with or without release incisions depending on the habits of the operators or the difficulty of the case. Starting from the reference measurement, the initial bur was used with a stop of 1 mm shorter than the residual height as per the protocol. The second step involves the use of S-reamer cutters with the stop of the same measure of the residual height to approach the sinus floor and cause the detachment of a small bone disk from which to begin the elevation of the sinus membrane (Photo 1 and 2).

The S-reamer cutters have different diameters, and the last cutter used must have a diameter slightly smaller than the diameter of the implant that will be inserted. To ensure the perforation of the

cortical floor of the sinus, the kit has a special button probe that allows the control, minimizing the risk of damage of the Schneider membrane. If the correct perforation of the cortical base of the sinus has not occurred, the working depth of the S-reamer bur shall be increased by 1 mm until the perforation is observed.

Photo 1: S-reamer drill.

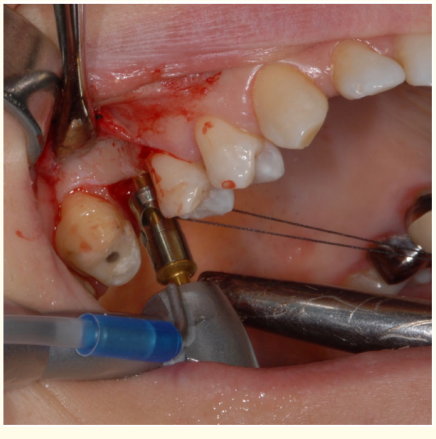

Photo 2: Initial X-ray before sinus elevation.

Certified to have obtained the detachment of the bone disc, we begin to insert the grafting material, previously hydrated with physiological solution for at least 10 minutes, with the Bone Carrier. Every time the biomaterial is inserted, it should be compacted using the appropriate instrument and when there is too strong resistance to the insertion of the biomaterial itself, you should use a rotating instrument the Bone Inserter that allows the insertion with a controlled pressure. To be sure to expand the material to 360° in the sinus cavity, it is useful to use every two or three biomaterial increments a rotating tool similar to a pallet, able to dislocate the biomaterial evenly and not all in one direction (Bone spreader).

It is important to perform a number of adequate bone increments to create an elevation of about a couple of mm higher than the implant you intend to insert.

At the end a radiographic examination is performed to ensure the correctness of the sinus elevation and partially of the integrity of the Schneider membrane. Patients were given antibiotics (1g Augmentin cps every 12 hours for 5 days, Glaxo SmithKline, Verona, Italy), and were advised to avoid sneezing. Analgesics were prescribed with paracetamol or a non-steroidal anti-inflammatory drug for 1 week after surgery.

Patients were reviewed and sutures removed after 7 - 10 days. No infection occurred in the post-operative period.

Implants

During the period under consideration 167 implants were inserted with a crestal elevation of the maxillary sinus, subdivided as follows: 81 IS II implants (Neobiotech, Seoul, South Korea), 34 Xive implants (DentsplySirona, York, Pennsylvania, USA), 25 Prime Prodent implants (Prodent, Milan, Italy), 14 Astra-Tech implants (DentsplySirona, York, Pennsylvania, USA), 7 (Zimmer, Warsaw, Indiana, USA), 3 Win-Six implants (Biosafin, Ancona, Italy), 2 Straumann implants (Basel, Switzerland), 1 Biohorizon (Biohorizon-Camlog, Birmingham, Alabama, Usa) (Figure 1).

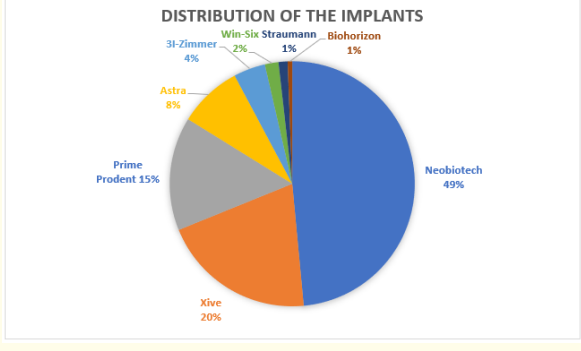

Figure 1

The implant diameters were between 3.4 and 5.5 mm (Figure 2), with lengths ranging from 7.3 to 13 mm (Figure 3).

Grafting materials

The following products have been used as grafting material inside the maxillary sinus: Bioss (Geistlich Pharma, Wolhusen, Switzerland) 0.5 - 1 mm granules in 66 cases, Flyoss (Butterfly, Cavenago, Italy) 0.5 mm granules in 46 cases (in 6 cases combined with collagen sponges), Hypro-oss (Bioimplon GmbH, Giessen, Germany) 0.5 - 1 mm granules in 20 cases, CopiOs (Zimmer, Warsaw, Indiana, USA) granules 0.25 - 1 mm in 11 cases, Endobone (Biomet, France) granules in 8 cases, Creoss (NobelBiocare YorbaLinda, Ca,

Usa) granules in 4 cases, Mineross Xp (Biohorizon-Camlog, Birmingham, Alabama, Usa) granules 0,5 - 1 mm in 4 cases, Cerabone (Basilea, Svizzera) in 3 cases, Apatos (Tecnoss, Torino, Italia) in 2 cases, Symbios (DentsplySirona, York, Pennsylvania, USA) in 1 case, Osteobiol (Tecnoss, Torino, Italia) in 1 case, Collagene in 1 case (Figure 4).

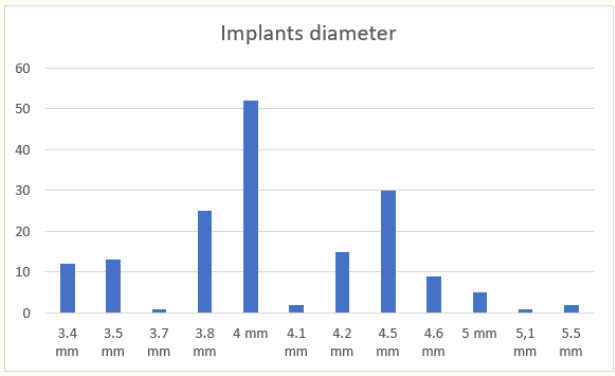

Figure 2

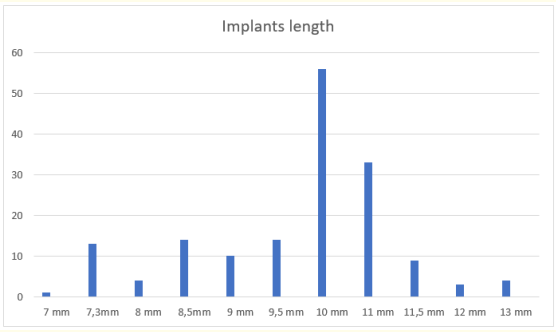

Figure 3

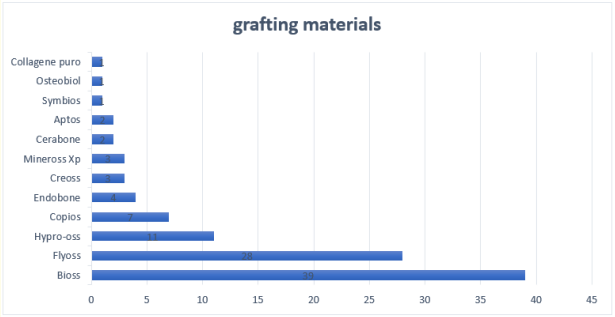

Figure 4

Prosthesis

After an healing period of 6 months reopening operations were performed with the aim of improving the amount of keratinized mucosa around every single implant (except in cases where the healing screw was inserted directly at the time of surgery). After three weeks the final impressions have been taken and whenever the implant position allowed, crowns have been screwed directly on the implants, while in all other cases crowns have been realized cemented on standard or individualized Cad-Cam abutments.

Results

The clinical follow-up examination after at least 6 months was performed evaluating the presence or absence of pain during the mastication by the patient and possible implant mobility as an unmistakable sign of loss or failure of osteointegration. The radiographic follow-up examinations were performed with intraoral radiographs, using a parallel-beam technique in which the threads of the implant were clearly visible at the abutment connection and the final observation: The aim was to assess the persistence of the grafting material inside the maxillary sinus around the implant by correlating it with the material used.

During the time period considered there was only one failure due to lack of osteointegration which was observed at reopening (range between 12 and 60 months with an average of 33.3 months of observation). In the following 4 years no implants were lost (Table 1). The total survival rate was 99%, regardless of the type of implant used in the study.

Years	Implants under observation	Failures	Survival rate
2014	27	0	100
2015	65	1	99
2016	98	0	99
2017	136	0	99
2018	167	0	99

Table 1

No difference was observed in terms of survival in relation to the bone substitute used, and no adverse or inflammatory reaction of the Schneiderian membrane could be observed.

In all cases an excellent health status of peri-implant tissues was observed, no patients reported any discomfort or during chewing or resting conditions.

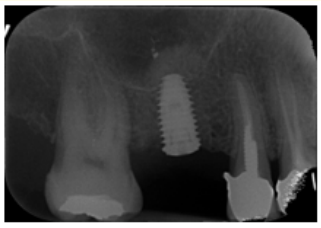

Photo 3: Implant inserted in zone 16 with elevation of the sinus via crestal technique.

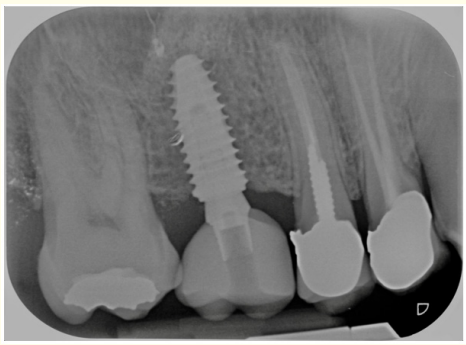

Photo 4: Final prosthesis made after 6 months.

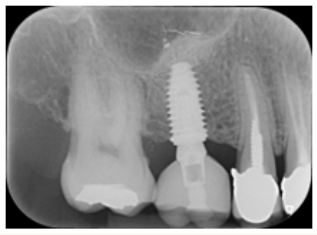

Photo 5: X-ray control 4 years after sinus lift.

Discussion

This study is in line with the opinion that elevation of the maxillary sinus floor, using the crestal technique, is a well-documented and reliable procedure that can increase the bone height available in the posterior jaw, thus allowing optimal length of dental implants [5]. The vertical distance between the floor of the maxillary sinus and the crest of the posterior alveolar process constitutes the height of the sub-antral bone. This bone height is often used to determine whether implants can be positioned simultaneously with sinus floor elevation or whether a 2 stage approach should be preferred, postponing the implant insertion at a second surgical time. Al least 6 months after the elevation of the maxillary sinus. A trans-alveolar technique to elevate the sinus floor with immediate positioning of the implant was developed by Summers in 1994 [6-8] and was modified by several authors in later times [9,10]. In few words, the floor of the maxillary sinus is fractured and the membrane of the sinus elevated by the use of osteotomes. After the elevation of the sinus membrane, the implant is inserted. In the systematic review of Tan., *et al*. [11], it was concluded that the survival rates of implants at the elevation sites of the maxillary sinus floor were comparable to those at non-augmented sites. This technique immediately appeared very safe, with low incidences of surgical complications: for this reason it was, and is considered, a valid alternative to the classic lateral approach if the residual bone height is 5 mm or more. The main problem is related to the patient's perception, which considers the sinus rise with osteotomes as a particularly annoying method to be borne by the strong percussion that he has to undergo during the surgery. Not to mention that these percussions, even if in a very small percentage of cases, can involve the onset of a paroxysmal vertigo very annoying to resolve, consequent to the displacement of the otoliths caused during the surgery [12]. The traditional side-approach technique described first by Boyne (Boyne 1968) and later modified by Kent and Block (Kent 1989) appears very safe in terms of implant survival, but certainly more invasive and not free from complications, such as the perforation of the Schneiderian membrane. The influence of sinus membrane perforation on implant survival in breast floor enhancement procedures has been discussed in many studies [13-15]. Jung., *et al*. assessed the significance of perforation of the breast membrane in the dog. The implants were placed so that part of the implant would be discovered by the bone at the bottom of the sinus. After 6 months of healing, dogs were sacrificed. No signs of sinusitis were observed in the same [16]. Other studies have shown that drilling can occur in 10 - 35% of procedures [17,18]. The perforations of the membrane were left to heal or in some cases repaired with freeze-dried sheets of human lamellar bone, or the dissected and raised membrane was sutured to the adjacent bone wall to cover the perforations. In this study no sinus membrane perforation has been observed, either directly during surgery or indirectly, reported by patients as the presence of granules of material expelled from the maxillary sinus in the days following the surgery. The prognostic criteria for implant treatment

have been discussed in numerous publications and several authors have concluded that a history of persistence, smoking and poor oral hygiene adversely affects the implant prognosis and increases the onset of peri-implantitis [19,20]. Seven patients in this study were smokers. Two of these patients showed signs of mucositis at the time of the check-up but no spontaneous peri-implant bleeding. The sinus membrane elevation technique described in this study is a monophasic approach that simplifies the sequence of implant treatment, decreases morbidity for patients and reduces the total time of therapy.

Conclusion

The surgical technique presented in this study has shown particularly favourable treatment results. It can be combined with any type of osteointegrated implant and survival rates do not seem to be affected by the nature of the grafting material used, as long as it is a granular material with fine grain size. This is a minimally invasive method, which can significantly reduce the softness of the surgery for the patient, to the point of eliminating the differences, in terms of post-surgery discomfort, between an implant inserted in native bone and an inserted one with contextual rise of the maxillary sinus.

Bibliography

1. Boyne. US Navy Dental School lectures to postgraduates (1968).

2. Kent J and Block M. "Simultaneous 1989 Maxillary sinus floor bone grafting and placement of hydroxylapatite-coated implants". *Journal of Oral and Maxillofacial Surgery* 47 (1989): 238-242.

3. Boyne PJ and James R. "Grafting of the maxillary sinus floor with autogenous marrow and bone". *Journal of Oral Surgery* 38 (1980): 613-618.

4. Tatum H. "Maxillary and sinus implant reconstructions". *Dental Clinics of North America* 30 (1986): 207-229.

5. Pjetursson BE., *et al*. "A systematic review of the success of sinus floor elevation and survival of implants inserted in combination with sinus floor elevation". *Journal of Clinical Periodontology* 35 (2008): 216-240.

6. Summers RB. "A new concept in maxillary implant surgery: the osteotome technique". *Compendium of Continuing Education in Dentistry* 15 (1994): 152-160.

7. Summers RB. "The osteotome technique: Part 2 . The ridge expansion osteotomy (REO) procedure". *Compendium of Continuing Education in Dentistry* 15 (1994): 422-436.

8. Summers RB. "The osteotome technique: Part 3. Less invasive methods of elevating the sinus floor". *Compendium* (1994): 698-708.

9. Rosen PS., *et al*. "The bone added osteotome sinus floor elevation technique: Multicenter retrospective of consecutively treated patients". *The International Journal of Oral and Maxillofacial Implants* 14 (1999): 853-858.

10. Davarpanah M., *et al*. "The modified osteotome technique". *International Journal of Periodontics and Restorative Dentistry* 21 (2001): 599-607.

11. Tan WC., *et al*. "A systematic review of the success of sinus floor elevation and survival of implants inserted in combination with sinus floor elevation. Part II: transalveolar technique". *Journal of Clinical Periodontology* 35 (2008): 241-254.

12. Pennarocha Diego., *et al*. "Benign paroxysmal vertigo secondary to placement of maxillary implants using the alveolar expansion technique with osteotome: a study of 4 cases". *The International Journal of Oral and Maxillofacial Implants* 23 (2008): 129-132.

13. Lundgren S., *et al*. "Bone reformation with sinus membrane elevation: a new surgical technique for maxillary sinus floor augmentation". *Clinical Implant Dentistry and Related Research* 6 (2004): 165-173.

14. Shlomi B., *et al*. "The effect of sinus membrane perforation and repair with Lambone on the out-come of maxillary sinus floor augmentation: a radiographic assessment". *The International Journal of Oral and Maxillofacial Implants* 19 (2004): 559-562.

15. Cricchio G., *et al*. "Sinus bone formation and implant survival after sinus membrane elevation and implant placement: a 1- to 6-year follow-up study". *Clinical Oral Implants Research* 22 (2011): 1200-1212.

16. Jung JH., *et al*. "The effects of exposing dental implants to the maxillary sinus cavity on sinus complications". *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology* 102 (2006): 602-605.

17. Lundgren S., *et al*. "Sinus membrane elevation and simultaneous insertion of dental implants: a new surgical technique in maxillary sinus floor augmentation". *Periodontology* 47 (2008): 193-205.

18. Fischer K., *et al*. "Five-year results from a randomized, controlled trial on early and delayed loading of implants supporting full-arch prosthesis in the edentulous maxilla". *Clinical Oral Implants Research* 19 (2008): 433-441.

19. Fischer K and Stenberg T. "Prospective 10-year cohort study based on a randomized controlled trial (RCT) on implant-supported full-arch maxillary prostheses. Part 1: sandblasted and acid-etched implants and mucosal tissue". *Clinical Implant Dentistry and Related Research* 14 (2012): 808-815.

20. Chappuis V., *et al*. "Long-term outcomes of dental implants with a titanium plasma-sprayed surface: a 20-year prospective case series study in partially edentulous patients". *Clinical Implant Dentistry and Related Research* 15 (2013): 780-790.