EVALUATION OF RESULTS OF MAXILLARY SINUS LIFTING SURGERIES USING RESORBABLE SYNTHETIC HYDROXYAPATITE

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ABSTRACT

AIM: This study aims to evaluate the results of 10 cases of maxillary sinus lifting using synthetic resorbable hydroxyapatite (osteogen ®) as a filling material. **MATERIAL AND METHODS:** The surgeries were performed in patients who presented bone resorption in this region. The results were compared radiographically six months after the surgery through initial and final radiographs analysis. **RESULTS:** The vertical bone height gain was on average 1200.4%, when compared to the initial bone edge. **CONCLUSION:** The formation of bone tissue in that region had made possible future prosthetic rehabilitation.

KEYWORDS

Maxillary sinus lifting. Graft. Resorbable synthetic hydroxyapatite.

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INTRODUCTION

Dentistry has been marked by the advance of new techniques and has a great evolution with the introduction of osseointegrated implants for edentulism rehabilitation. Edentulous posterior maxillary region presents single conditions in surgery with poor bone quantity, what become one of the higher challenges when compared with other maxillary regions[1]. Maxillary sinus, in most cases pneumatized and associated to low bone density in this region, result from loss of teeth, makes disappear the stimulus which maintain the alveolar bone, occurring the bone tissue degeneration, what provides an inappropriate field to install osseointegrated implants with appropriate lengths to obtain stability under masticatory loads[2].

In order to superinduce the anatomic limitation of this area, maxillary sinus lifting with sinus graft is the treatment more used and indicated for the atrophic posterior maxillary region, creating better conditions and obtaining enough bone structure to install osseointegrate implants aiming their stability when kept in function. The lifting technique presents a success around 95 until 97%[3].

Maxillary sinus is bigger than the other four paranasal sinuses and the first one to be developed in the human fetus. In adults, it is similar to a pyramid in four thin bony walls, whose base is localized on the lateral nasal wall and the Apex is extended towards the zygomatic bone[4].

Several filler material present good results regard the bone formation, allowing the osseointegration of implants, despite usually form a bone type IV[4,5]. Selected material for sinus grafting is in paramount importance for the success of prognosis of graft used. The ideal material should be osteogenic to stimulate alive osteoblasts to form a new bone, osteoconductive, be used as an outline for vases invasions from the neighbor bone, besides osteoinductive to stimulate pluripotent mesenchymal cells to differentiate themselves from osteoblasts[6]. The autogenous bone is the only one that possesses the three proprieties. Alloplastic materials like resorbable synthetic hydroxyapatite (osteogen®) possesses only osteocondutivity, whose propriety is conduct the development of new tissue through its support matrix (outline), it is slowly absorbed by the body, allowing that acts as a mineral reservoir and hatch for the bone substitution[7].

When consider the high demand for oral rehabilitation in posterior maxillary region with maxillary sinus lifting procedures and posterior installation of osseointegrable implants, this study had as aim verify the vertical bone formation induced by osteogen® as sinus filler material of maxillary sinus lifting technique compared with preoperative bone edge.

MATERIAL AND METHODS

To perform this research, 35 patients were screened, and as inclusion criterion were selected to participate in this study those patients who presented posterior maxillary bone tissue that made impossible the prosthesis rehabilitation (pneumatized maxillary sinus). As exclusion criteria was used smoking patients, chronic sinusitis patients, systemic diseases patients, cardiac, diabetes, osteoporosis and those who was undergone to radiotherapy on the head and neck regions[8]. The sample was formed by 10 patients (n=10). These patients were submitted to a maxillary sinus lifting surgery performed in particular offices in Tubarão town, state of Santa Catarina. The surgeries were carried out by Humberto Nesi, Surgeon-dentist, and the patients afford the costs, including the control radiographs.

Only essential radiographic evaluations were performed for the treatment. The patients were not identified to maintain total confidence and the radiographs were cataloged by letters and numbers (1A E 10A) for initial ones and (1B a 10B) for final ones. Panoramic radiographs were used after authorization by their guardian through statement. The analysis were carried out on 10 panoramic radiographs measured previously the surgery and other 10 six months after the treatment. They were imported to the IMAGE J (Research Services Branch, National Institute of Mental Health, Bethesda, Maryland, USA). For measurement, a line was traced from the initial point on the crest of the alveolar ridge, and as a final point, the maxillary sinus floor; this distance corresponded to the height of the alveolar ridge. After the measurement, the numbers were tabulated in Microsoft Office Excel™ spreadsheet, numbered according to the patients after the statistical analysis with the Student t test.

This research was carried out after consent and approval by the Ethics Committee for Research – UNISUL.

RESULTS

From January until July 2012, tem patients were treated through the technic proposed for sinus maxillary lifting engrafted with Osteogen®. The bone quantity formed in millimeters was evaluated six months after the surgery (Figure 1).

The height difference between the initial and final edges was statistically significant (Figure 2).

None of patients presented postoperative complications which need changes about medication and/or postoperative interventions after the grafting procedure. The medium alveolar increase obtained was 1200.48 % (according to the Table I).

The figures 3 and 4 show the six months pre and post operatory surgery.

Figure 1. Average of initial and final bone structure of alveolar edges in millimeters, and standard deviation for both of them.

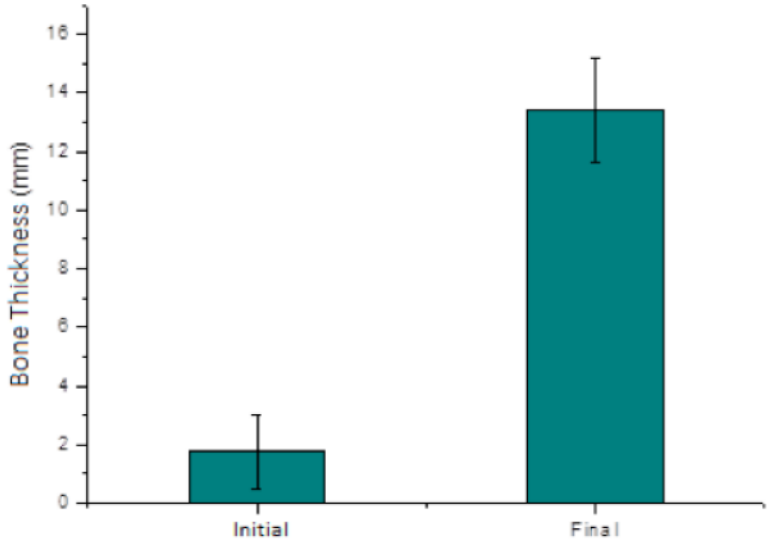
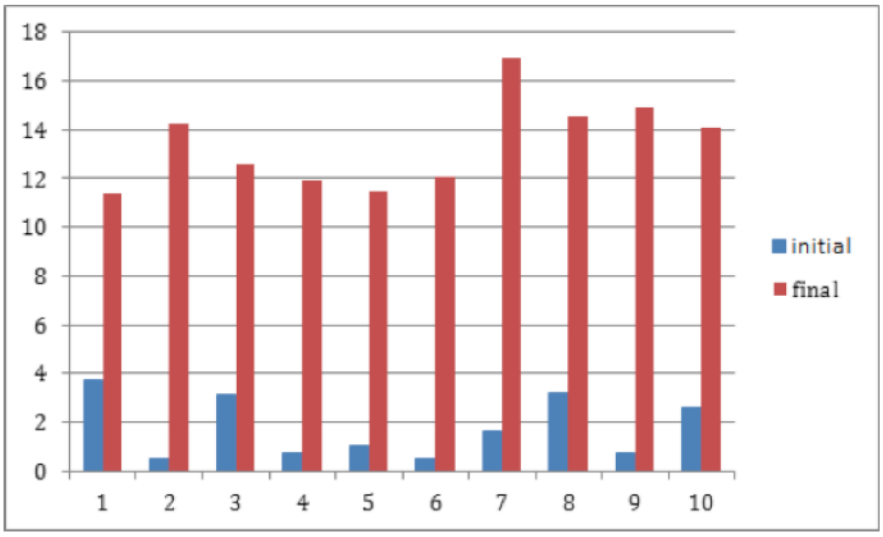


Figure 2. Comparison of initial and final edges in millimeters (after surgery).



DISCUSSION

Osseointegrate implants installation in patients with severe maxillary atrophy in posterior region and exaggerated pneumatization patients become difficult because of the inadequate height of the alveolar bone[9-12]. Sinus lifting technique is one of the most used techniques to treat the posterior atrophic maxilla. Several works present success superior of 90% with control time from one to nine years of evaluation[13,14].

The autogenous bone is described by its 'golden standard'; in other words, because it is considered as the ideal material for grafting; but despite to be considered as ideal, to obtain the autogenous bone is necessary increase the

surgical time and the operative morbidity[15,16]. Because of these reasons, surgeons search substitute materials[17,18]. Among these materials, we can cite what was used in our research, the resorbable synthetic hydroxyapatite (osteogen).

Table 1. Clinical cases with measure of initial edges before and after the grafting, in millimeters, of increased percentage.

PACIENT	SINUS LIFTING SIDE	INITIAL EDGE (mm)	FINAL EDGE (mm)	EDGE UNCREASED PORCENTAGE
01	Left	3.7	11.4	208.10
02	Left	0.5	14.2	2740
03	Right	3.1	12.6	306.45
04	Left	0.7	11.9	1600
05	Right	1.0	11.5	1050
06	Left	0.5	12.1	2320
07	Left	1.6	16.9	956.25
08	Right	3.2	14.5	353.12
09	Right	0.7	14.9	2028.57
10	Right	2.6	14.1	442.30
Average		1.76	13.41	1200.48

The use of biomaterials in grafts for maxillary sinus elevation surgeries has been used frequently, and the convincing successes were demonstrated with these materials[19]. The use of alloplastic material to increase the sinus can optimize the reduction of morbidity and the expenses with procedure.

Figure 3. Pre operative radiograph before grafting surgery. The line corresponds to the initial height of the alveolar edge.

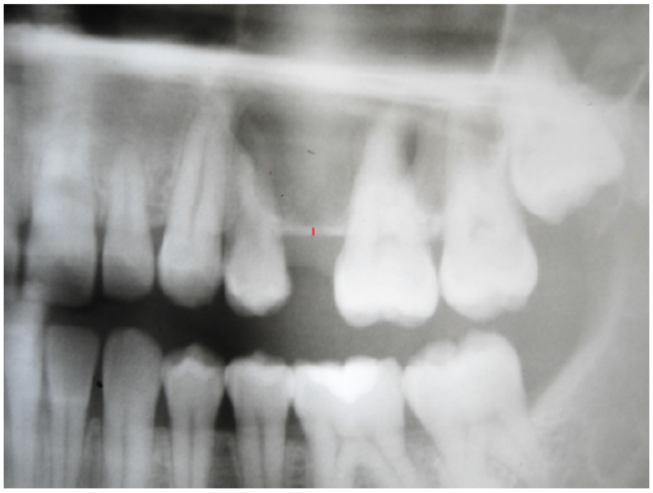
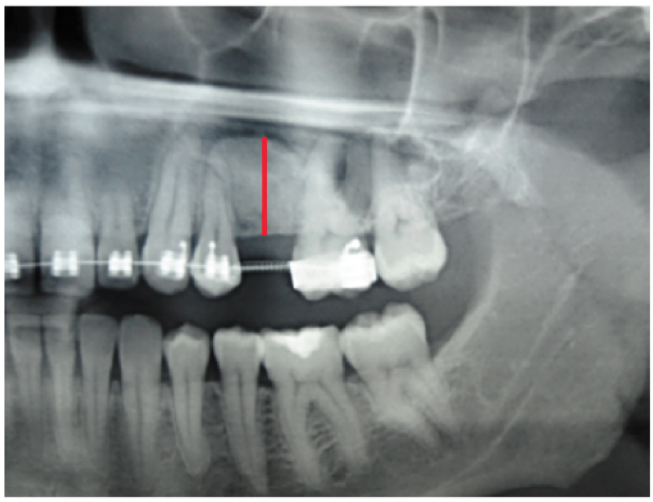


Figure 4. Postoperative radiograph after grafting surgery. The line corresponds to the final height of alveolar edge six months after grafting.



Hydroxyapatite [$Ca_{10}(PO_4)_6(OH)_2$] is the main mineral componente of the bone tissue. Synthetic hydroxyapatites are marketed in resorbable and non resorbable forms. The mix processing of basic calcium phosphate determines these properties. Non-synthesized

resorbable ahidroxiapatita (OsteoGen, Impladent, Holliswood, NY; OsteoGraf LD, CeraMed Dental LLC, Lakewood, Columbia) is processed at low temperature and has particles measuring from 300 to 400 micro meters. It is slowly absorbed by the body, allowing that acts as mineral reservoir and hatchway for bone substitution[7].

Some authors cite works in which the porous hydroxyapatite were used as graft material for maxillary sinus[16,20]. This biomaterial simplifies and allows that the procedure can be performed in the dentist office, many times only with local anesthetic, saving additional costs, surgery time and morbidity, eliminating a surgical second place.

The study performed by Rauber[21], using Osteogen as graft, possessed an initial edge of 0.75 mm, and next a height edge was achieved at 10.25 mm until 12 mm, what means an increase of until 1500%, corroborating our studies in that the case 9 – right side, presented an initial edge of 0.7 mm, and a height of 14.0 mm edge was achieved. It means there was a significant bone increase in the region with the maxillary sinus lifting through resorbable synthetic hydroxyapatite (Osteogen®), which was 2028.57% in relation to the remaining bone height.

CONCLUSION

Through our studies was possible conclude that by the technique and the method applied with use of Osteogen® as filler material in maxillary sinus lifting allowed a significant increase of vertical bone height, what allows the installation of osseointegrated implants. By the use of the method proposed we achieved a medium increase of 1200.4% height at alveolar edge. However, more studies should be carried out.

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