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Case Series

Modern Approaches to External Sinus Lift: The Impact of Piezoelectric Surgery in Severely Atrophic Maxillary Ridges

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Abstract

Insufficient bone volume is considered a serious problem occurring during oral rehabilitation of the upper posterior maxilla. Piezo surgery was introduced years ago and showed lots of advantages in respect to the maxillary sinus reconstruction fundamentals.The comparison between piezoelectric devices and conventional rotary instruments used in external sinus lift surgery has become an important topic because of many technical complications related to the technique. The aim of the following article is to evaluate how far did we get in the lateral sinus lift technique using piezoelectric device, regarding success criteria and long-term results, while presenting two challenging clinical cases with advanced ridge resorption, reduced vertical bone height and pneumatization of the maxillary sinus.

Keywords: *Piezoelectric Devices, Conventional Rotary, Sinus Lift, Pneumatization Maxillary Sinus.*

Introduction

Following tooth extraction, bone resorption associated to sinus pneumatization will alternate the bone height making it hard to place implant. External sinus lift is considered a satisfactory solution in advanced severed atrophic ridges. The reasons for reduced bone height can differ from chronic or acute periodontal disease to atrophy of the residual alveolar ridge after extraction[1]. The challenges that we are facing in this technique is the risk of perforation of the Schneiderian membrane with bone heating, a non-accurate bone osteotomy, bleeding, swelling which is usually happening when using rotating instruments[17].

Maxillary sinus augmentation through the lateral window access is a well-established surgical procedure used to increase vertical bone height in the posterior maxilla.

Piezoelectric device was introduced in recent years helping surgeons overcome these per and post-operative complications[14], the way to be used evolved in a way to cover even the most atrophic ridges. Sinus lift can be conducted with or without simultaneous implant placement by using crestal or lateral approaches [2,3].

The comparison between piezoelectric devices and conventional rotary instruments has become an important topic in implant dentistry due to membrane perforation, surgical precision, operative time and implant survival [5,6,12,21].

Many publications showed that the membrane perforation is reduced when using the piezoelectrical device[4].

The aim of the present article is to shed light on the importance of the piezoelectric devices in preventing perforation of the Schneiderian membrane and also in limiting the extension of rupture in case it occurs while proceeding with the Schneiderian membrane elevation.

Case Presentation

Clinical Case 1:

A female patient, aged 41 years old reported to our clinic with chief complaint of edentulous upper left tooth#14 with difficulty in food consumption. Patient reported no health problems. Intraoral examinations showed good vertical bone inter-arches distance. Panoramic X-ray and CBCT findings showed insufficient bone height making it impossible for implant placement without lateral approach sinus elevation (Figure 1&2).

Sinus lift procedure was scheduled using lateral approach to establish an adequate bone level in order to support an implant rehabilitation using piezoelectric device. Following anesthesia of the maxillary posterior segment and crestal incision, a full thickness flap was elevated, a bony window was traced using bone erosion technique by piezo surgical diamond insert, followed by sinus membrane elevation. Mixture of Xenograft-Autologous bone was used to fill the sinus cavity underneath the Schneiderian membrane, the bony window was covered by cross-linked collagen membrane.

Eight months post-operative CBCT shows sufficient bone high with satisfactory healing (Figure 2&3&4). Implant Straumann BLT (4.1*10mm) was placed in site#14. A 4 months post operative X-Ray shows stable marginal bone and successful implant placement (Figure 5).

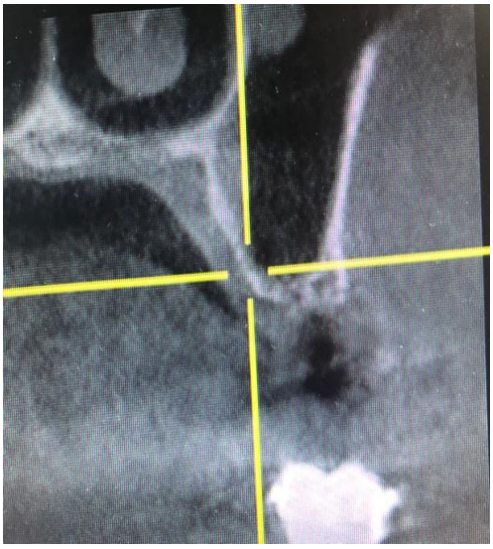

Figure 1. Cone beam computed tomography showing advance bone loss with limited remaining bone height making it an indication for external sinus lift.

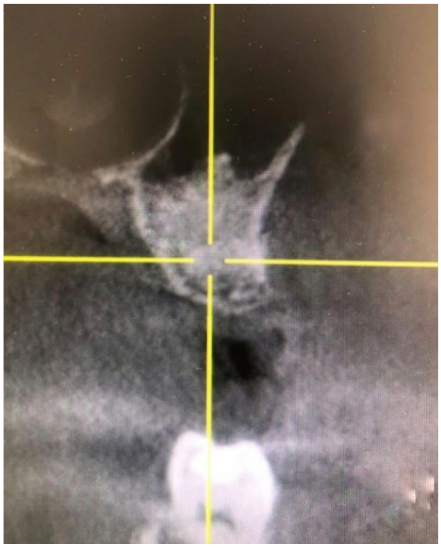

Figure 2. Cone beam computed tomography 8 months following sinus elevation using piezoelectric device.

Figure 3. Cone beam computed tomography 8 months post sinus lift showing satisfactory results.

Figure 4. Panoramic X-Ray showing the amount of bone following external sinus lift.

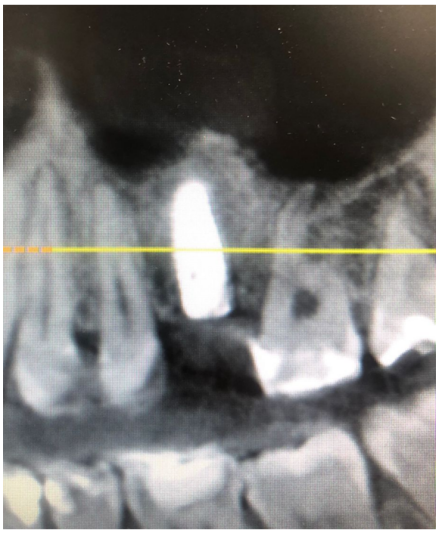

Figure 5. Four months following implant placement, note the marginal bone level showing satisfactory results.

Clinical Case 2:

A 49-year-old patient presented to our practice. His chief complaint was difficulty chewing due to missing upper left molar. On clinical examination a missing maxillary molar number 14 was spotted. Cone beam CT (CBCT) showed advanced pneumatization of maxillary sinus with intimate contact between Schneiderian membrane and the periosteum due to severe vertical bone deficiency and post-extraction bone resorption (Figure 7).

The treatment plan was discussed with patient shedding light on the high rate of perforation risk while dissecting the maxillary membrane from the periosteum, patient approved to proceed.

Following anesthesia of upper posterior sextant, a mucoperiosteal flap was elevated and a dissection using Metzenbaum scissors was conducted. A 0.8mm perforation was resulted (Figure 6), and the elevation was carried on with the piezo surgical inserts in order to complete the sinus membrane elevation that was afterwards stitched using 6(0) polyglactin 910 sutures followed by a Platelet Rich Fibrin (PRF) membrane collected prior to intervention.

Bone graft material Xenograft -autograft-Platelet Rich Fibrin sticky mixture was grafted in sinus with no additional breakage of the membrane or infusion of material inside sinus membrane (Figure 8,9,10). Eight months post-operative X-ray shows stable grafted bone in maxillary sinus.

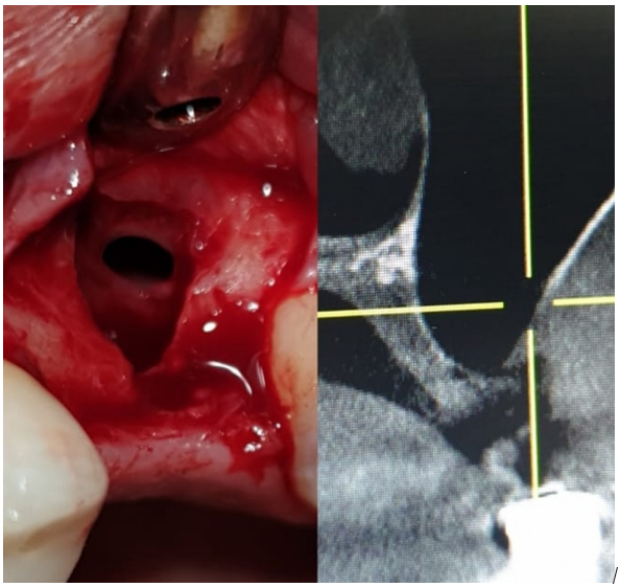

Figure 6. Clinical intra-oral view showing the predicted perforation of the Schneiderian membrane with advanced bone defect.

Figure 7. Cone beam computed tomography showing the extension of bone loss following sinus pneumatization with intimate contact of the mucosal periosteum and the Schneiderian membrane.

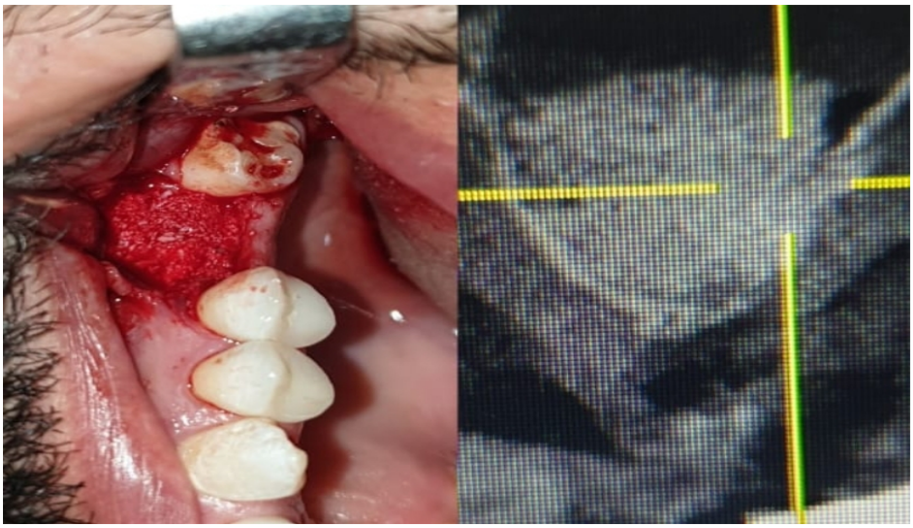

Figure 8. Clinical intra-oral view following completion of sinus elevation and bone graft.

Figure 9. Cone beam computed tomography showing the elevated sinus using mixture of xenograft -autograft and PRF used as scaffold.

Figure 10. Eight months post-operative X-ray showing the amount of bone gained during sinus elevation using piezoelectric device.

Discussion

Piezoelectric surgery has emerged as a valuable alternative for managing thin Schneiderian membranes.

Having a limited available bone for implant placement and the presence of Schneiderian membrane, the available option is always a surgical elevation of sinus membrane by lateral approach. Piezoelectric devices offer improved visibility due to cavitation effect which makes sinus elevation easier for both patient and operator[23].

Membrane thickness is considered an important factor influencing the likelihood of perforation[20,22]. When membrane thickness is less than 1 mm, even minor trauma can result in perforation[15].

The management of a thin Schneiderian membrane remains one of the most challenging aspects of the maxillary sinus augmentation. Perforation of the Schneiderian membrane is the most common intraoperative complication and may compromise graft stability and increase the risk of sinus infection[22].

The primary benefit of using the piezoelectric devices lies in their selective cutting action.

When the Schneiderian membrane is thin, the precision of osteotomy becomes of value. The controlled ultrasonic vibration effectively cut the mineralized tissues and preserves the soft tissues including the maxillary sinus membrane. Membrane perforation is the most frequent complication occurring during sinus elevation and is associated to increased risks of sinusitis and contamination of grafted material[22].

Over the years many publications and studies were lunched showing the importance of using piezoelectric elevation of sinus floor in terms of limited bone heating and accurate osteotomy with an outstanding precision of cuts[13]. Several clinical studies have demonstrated effective preservation of the membrane and surrounding soft tissues when using piezoelectric devices[19] which will reduce mechanical trauma and contribute to improving bone healing[16,18]. The increased safety profile outweighs any time consuming profile and the reduced risk of perforation[10,11] will lower the risk of repair procedure or will make it easier in case it occurs such in enclosed clinical case 2 which improves treatment predictability and technique reliability.

Conclusion

Either piezoelectric device and conventional rotary techniques are effective methods for the lateral approach. In conclusion for sinus lift procedures involving thin Schneiderian membrane, using piezoelectric devices provide superior safety, precision and membrane preservation. Piezoelectric devices offer superior precision, enhanced Schneiderian membrane protection, reduced intraoperative complications, and improved postsurgical comfort. Its principal disadvantage is extended operative time.

Although conventional rotary instruments remain efficient, cost -effective they are still associated with a greater risk of Schneiderian membrane perforation and increased surgical trauma. Nevertheless, piezoelectric devices still can achieve predictable outcomes especially in case of Schneiderian membrane with thin phenotypes and associated to high risk of perforations especially when performed by skillful clinicians which makes them a valuable tool for achieving successful sinus augmentation outcomes.

Conflict of Interest

The author declares no conflict of interest.

Acknowledgements

None

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