Use of the Piezon Master Surgery EMS in membrane elevation of the maxillary sinus and bone graft. Report of a clinical case.

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Resumen

Con el sentido de mejorar y mantenernos actualizados en las últimas técnicas quirúrgicas en Implantología oral, presentamos una técnica innovadora en la que se realiza la osteotomía para accesar el seno maxilar y realizar la elevación de la membrana del mismo, utilizando un instrumento ultrasónico, conocido como Piezosurgery. Esta es una técnica reciente, que ha adaptado conceptos de física y mecánica, y los ha incorporado a la odontología para realizar tratamientos mas especializados. En este articulo se describen los fundamentos y las características, que hacen que este instrumento sea de elección a la hora de realizar nuestras osteotomías en zonas en donde podamos causar daño a los tejidos blandos. Asimismo se desarrolla un caso clínico en el cual se realiza la elevación de la membrana del seno maxilar e injerto óseo Alogénico, utilizando este innovador sistema.

Abstract

With the goal of improve and update our knowledge of the most recent surgical techniques in oral implantology, we present an innovative technique in which we can do our osteotomy to access the maxillary sinus and achieve the elevation of the sinus membrane, using an ultrasonic device called Piezosurgery. This is a new technique that *brought* together Physics and mechanics concepts and incorporates it to dentistry, for more specific treatments. In this article we described the rationale and characteristics that make Piezosurgery a very important tool to do osteotomies in zones where we want to avoid contact with soft vital tissues. As well we include the description of a clinic case using the Piezosurgery device to elevate the schneiderian membrane

Introduction

Conventional rehabilitation using implants for edentulous jaws is a treatment that has shown great predictability when the remaining bone volume is sufficient, obtaining success rates between 84 and 92%, according to a bibliographic review conducted by Sorní et al.

However, according to these authors, the situation becomes more complicated in jaws that show severe atrophy. In the case of the upper maxilla, the centripetal reabsorption of the alveolar process, the pneumatization of the maxillary sinuses, the presence of the nostrils and of the nasopalatine conduct with a bone quality of class 3 or 4, as classified by Lekholm and Zar, are factors which difficult or preclude the placement of the implants. Among the proposed techniques for these anatomical limitations we can highlight the floor elevation of the maxillary sinus and the surgical reconstruction by autogeous or alogeneic grafting.

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Elevation of the membrane of the maxillary sinus.

This technique is one of the most commonly used in order to rehabilitate the posterior sector of the atrophic maxilla due to its great predictability. This technique was introduced to the surgical-dental field by Boyne in 1980, since then numerous modifications have been developed to correct bone deficiency product of the maxillary sinus pneumatization.

One of the most commonly used techniques today is the lateral window osteotomy or modified Caldwell-Luc, which is performed on the lateral wall of the maxillary sinus.

Most oral surgeons who have performed this procedure know that one of the most common complications is the perforation of the sinus membrane during the separation of it, or when performing the osteotomy to reach the sinus membrane using the surgical round bit of the piece of low speed.

These perforations are classified by Vlassis and Fugazzotto according to their location in five types: type I is located in the upper third of the mesial or distal of the window, type II in the upper middle third, the type III in the lower third of the mesial or distal, and type IV in two lower middle thirds. The type V occurs in a membrane that is already exposed due to the fenestration of the sinus wall because of the severe bone reabsorption or an excessive pneumatization of the sinus cavity. In cases I and II we often obliterated raising completely the sinus mucosa, or we can place a reabsorbable membrane. In the perforations of type III to V we should attempted to suture the mucosa or to place a sheet of bone between it and the filling material.

However, at present day, according to Wallace and In Hong et al, this complication can be avoided or greatly reduced with the use of Piezosurgery.

Piezosurgery Basics

Piezosurgery technology was introduced to dentistry by Vercellotti in 2000, and was then sold by other commercial houses. But it all started in 1881 when Pierre Curie discovered piezoelectricity, a phenomenon that is found in some crystals that, when subjected to mechanical charges, acquire electric polarization. There is also an inverse piezoelectricity, where crystals are subjected to an electric charge and they acquire a mechanical charge; in case of the electric charge being alternative, the crystals expand and contract alternately, and if on top of that we add an intermediate frequency, the crystals produce mid-frequency mechanical oscillations, producing ultrasonic waves.

Ultrasonic waves are mechanical waves which, because of the phenomenon of agitation, can induce the disorganization and fragmentation of different bodies. The ultrasonic vibrations can easily

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allow the segmentation of interfaces from solid to solid by means of distinct vibration, and solid-liquid by means of cavitation. These two concepts are the basis of Piezosurgery technology used these days in the dental field.

Ultrasonic devices, such as the Cavitron, have been used in dentistry since the 80's, but they differ from those used today for more specialized procedures. The best example of this is the frequency regulator that the Piezosurgery devices possess. You can also add the possibility that the Piezosurgery equipments offer to choose inserts of different shapes and textures, depending on the treatment to be performed.

Torrela et al say that the disadvantages that the ultrasonic instrument or Piezosurgery may have, in relation to the conventional rotary system, are completely overshadowed by its advantages.
The main advantages of Piezosurgery are:

- Reduces the risk of perforation of the sinus membrane: this mainly to the selective cutting, which is limited only to the mineralized structures (bone). This is because of the ultrasonic frequencies that are used (25-29 kHz), as the hard tissues and soft tissues are cut at a different frequency.

- Improved vision and cleaning of the operative field: This is due to the cavitation. This phenomenon is produced by ultrasonic waves at the interface between solid (inset) and liquid (solution of irrigation). What happens is a rupture in the molecular cohesion of the liquid creating steam and creating a type of bubble waves or cavities that completely clean the area where we are working.
Furthermore, the risk of subcutaneous emphysema is reduced due to the aerosol effect that the Piezosurgery produces unlike the effect of air-water spray generated by the osteotomy with rotary instruments.

Image of the Piezon Master Surgery (EMS).

Another advantage of this system is that by producing minimal noise and micro-vibrations, the fear and psychological stress of the patient is reduced when the osteotomy is performed using only local anesthesia. (Sonho et al).

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It is noteworthy that although the clinically proven Piezosurgery technology does not damage soft tissues, such as nerve membranes or sinus membranes, we must take precautions as the ultrasonic waves have mechanical energy, and this energy can be converted into heat and pass into the adjacent tissues or the same. For this reason the use of irrigation is essential, not only for the effect of cavitation, but aslo to avoid overheating.

One of the most common ways in which excessive heat is generated is when an excess pressure of the insert over the bone limits its movement, which generates an overheating, however several equipments have alarms that tell the operator if he is making this mistake. We can also mention that soft tissue can also be injured if too much pressure is applied on them, causing mechanical damage.

Description of the Piezon Master Surgery EMS

The Piezon master surgery consists of a central unit with a control panel and a control pedal. It also has a piezo-electric handpiece with a functional vibration frequency that ranges between 25-30 kHz, because of this characteristic is that it only has selective cutting of bone tissue, as if we want to generate a cut of soft tissue we require a frequency of approximately 50 kHz.
On the other hand, it has a cooling system that allows an irrigation during the osteotomy of up to 60 ml/min of sterile solution.

To the handpiece we add a variety of surgical tips with different shapes and surface features, which are used depending on the type of surgical field on which we will use them.
The power with which you get a precise and controlled cut is 5 W, and the amplitude of the vibration of the surgical tip is between 60 and 200 um.

Image 2. Piezon Master Surgery drill kit for the elevation of the maxillary sinus.

Clinical Case

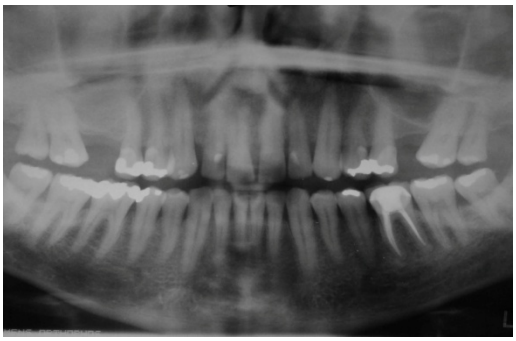

Fig.1. Initial Rx of the patient, in which we can observe the pneumatization of the right maxillary sinus.

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We present a case of a 48 year old male, known healthy, with a history of a dental extraction of the upper right first molar, more than 15 years ago, the radiographic examination shows right maxillary sinus pneumatization. It was decided to make the elevation of the maxillary sinus membrane and allogeneic bone graft, taking all the advantages that the **Piezon Master Surgey EMS** Ultrasonic system offers.

Fig. 2. Clinical view of the area where the osteotomy and elevation of the maxillary sinus membrane will take place.

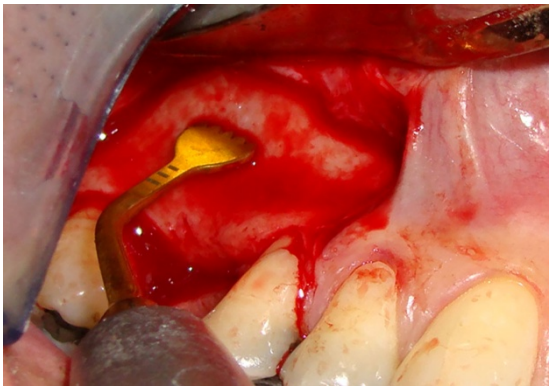

Fig. 3. Once the incision and the flap is done, we proceed to perform the initial osteotomy with the saw bit (SL1) of the Piezon Master.

Fig. 4. We proceed to increase the width of our osteotomy using the round bit (SL2) of the Piezon.

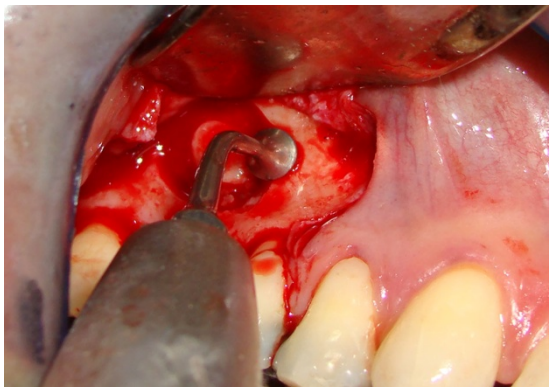

Fig. 5. Once the osteotomy is finished, we perform the lifting the sinus membrane using the plate-shaped bit (SL3) of the Piezon Master.

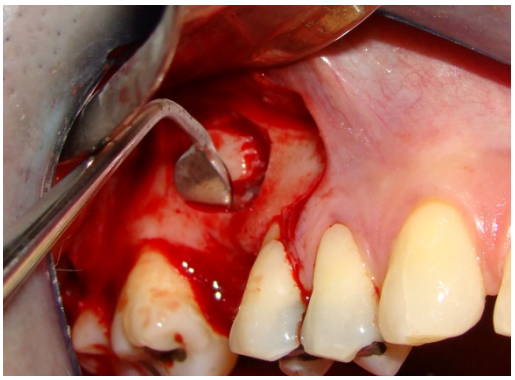

Fig. 6. Upon completion of the debridement of the sinus membrane with the ultrasonic instrument we finish with the lifting of the same with our curettes for maxillary sinus lifting.

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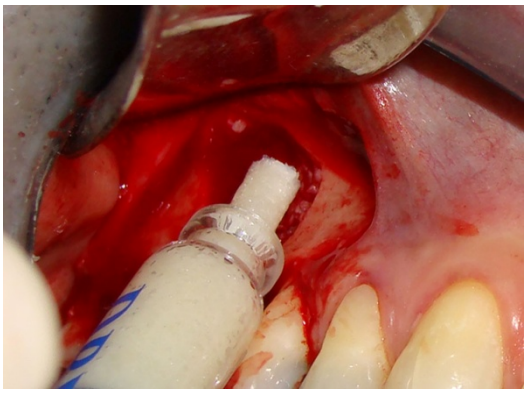

Fig. 7. Once the membrane is located at the apical position, we proceed with the placement of the allogeneic graft.

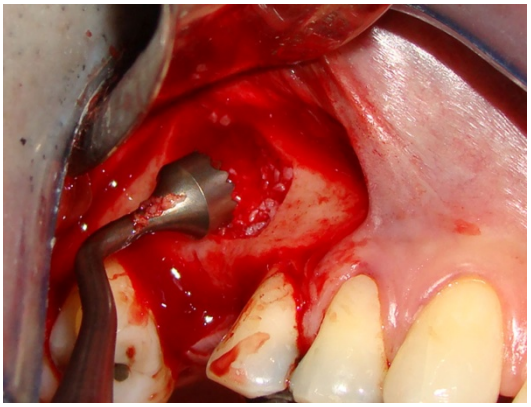

Fig. 8. After graft placement in the receiving area, we proceed to condense it to avoid the formation of any air bubbles.

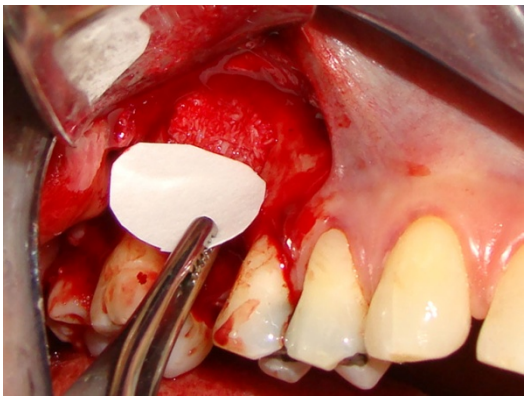

Fig. 9. We proceed with the placement of the synthetic reabsorbable membrane on our graft to prevent contamination and loss of the same.

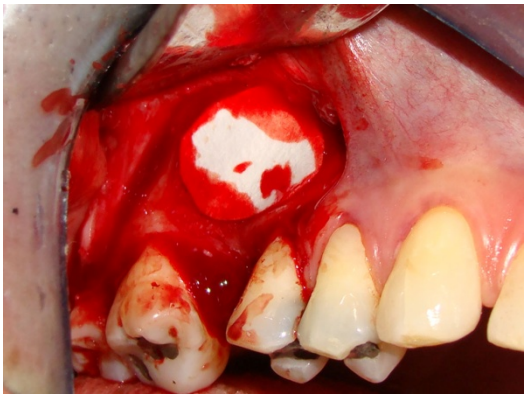

Fig. 10. Note the great adaptability of the membrane once wet with blood.

Fig. 11. Once the synthetic membrane is in place it is necessary to reposition and suture the flap.

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Conclusion

According to several authors and by personal experience, we can say that the Piezosurgery is very useful instrument when performing maxillary sinus lift. This is due to the fact that we avoid or at least are able to greatly reduce the complications that we often have when performing the same procedure using conventional rotary instruments.

In addition, with this instrument it is possible to obtain an optimal visualization of the operative field, a better cleaning of the area and we can achieve performing a completely atraumatic and safe procedure.

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