Review

Comparison between Piezoelectric Surgery and Surgery with Traditional Rotating Instruments in Extractions of the Lower Third Molars

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Abstract

Aim

The surgical removal of impacted third molars still represents a challenge for Oral and Maxillofacial Surgeons. Traditionally, impacted third molars are removed using conventional rotary technique, but this kind of surgery may lead to various postoperative side effects, such as pain, swelling, trismus, nerve injury, bleeding and dry socket.

In order to reduce these complications, recently, piezo surgery has been introduced in Oral and Maxillofacial Surgery.

The aim of this study is to compare piezo surgery and traditional rotary techniques in third molar removal, performing a literature review and presenting a case series, to record intra-operative and post-operative differences between the osteotomy techniques.

Materials and Methods

Literature was selected through a search of Pub Med, Embase and Cochrane electronic databases. The keyword used for search were “PIEZOSURGERY IMPACTED THIRD MOLAR” “OSTEOTOMY THIRD MOLAR”

The search was restricted to English language articles, published from 1991 to September 2018

Results

In literature, patients undergoing piezosurgery experience longer surgery time, but less post-operative swelling, trismus and pain. In addition, no case of paresthesia and alveolar osteitis has been reported using piezosurgery.

Conclusion

Piezosurgery, in third molar removal, shows higher operating time but reduces side effects, such as post-operative responses and surgical risks. It may, also, be important in increasing bone density in the extraction socket and decreasing the amount of bone loss of adjacent tooth in the distal aspect. Piezosurgery represent an effective alternative technique in third molar surgery.

Introduction

Literature Review

The objective of this study is to identify significant differences in the clinical management between piezoelectric surgery and surgery with traditional rotary instruments in the avulsions of the lower third molars.

According to a systematic review with meta-analysis of AL-Moraissi in 2016, the piezoelectric surgical technique applied in the extractions of third molars shows a significant reduction of post-operative sequelae (edema, pain, trismus); in agreement with numerous studies. The low

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incidence of post-operative sequelae would be due to the atraumatic and micrometric cutting action of the instrument [1-2-3].

Regarding the duration of surgery, operating times are shorter with conventional rotary instruments, in accordance with previous studies, although the time needed to decrease with the increase of the operator’s experience. In agreement with other studies, the authors show that there is no association between the duration of the operation and the operative discomfort; moreover, it has been shown that piezoelectric surgical techniques are preferred by patients because they produce less vibration and less noise, increasing patient comfort and decreasing stress and anxiety.

With regard to bleeding, it appears to be more closely correlated with the characteristics of the patient, rather than with the method used for osteotomy; in any case it has been shown that piezoelectric techniques improve visibility and describe blood loss.

The piezoelectric technique can also be used in elderly patients, who have greater portions of cortical and mineralized bone, in order to avoid bone necrosis.

In conclusion, the results of this meta-analysis have shown that piezoelectric surgery significantly reduces the incidence of postoperative sequelae and the total number of analgesics taken by the patient compared to osteotomy techniques performed with traditional rotary instruments after extraction of lower third molars.

According to Jiang’s meta-analysis, patients who received piezoelectric surgery developed less edema although the surgical times were longer, and patients who received piezoelectric surgery developed less intra and post operative pain and less trismus [4-5-6].

Bone samples obtained from the piezoelectric cut are characterized by an integrity of the bone structure, by a well-defined osteotomy, without evidence of osteonecrosis. Some studies have also reported that the piezoelectric cut induces a rapid increase in morphogenic bone proteins (bmp) bringing greater control of the inflammatory processes and a stimulated bone remodeling.

According to a study I Vercellotti postoperative pain, assessed by VAS, decreases significantly from the first, third and seventh day with piezosurgery compared to conventional rotary instruments. VAS values decrease gradually in both techniques but the values reported for traditional surgery appear significantly higher compared to piezoelectric surgery. [7-8-9]

On the seventh day the pain was completely absent in patients with piezosurgery. According to Rullo there is a reduction of pain in the piezoelectric only for the simple cases, while in the complex cases the postoperative pain is higher in the piezoelectric group; on the contrary, Mantovani concludes that, despite the longer surgical time, the VAS values appear lower in the piezoelectric group.

The number of analgesics was reduced in the piezoelectric group, probably due to minimal soft tissue damage given by the piezoelectric cut which reduces the inflammatory response.

One Srivasta study found that postoperative responses such as pain, trismus, edema, paresthesia and alveolar osteitis are significantly lower, following electrical piezo surgery; furthermore, the piezoelectric cut leads to lower thermal contraindications, a lower osteotomy area, better bone healing and a precise osteotomy design, with greater control of the cutting depth and greater safety for soft tissues.

According to Olikarinen the duration of the intervention correlates significantly with trism, pain and analgesic intake; according to Benediktsdottir postoperative behavior was independent of the duration of the intervention. A 2011 study by Goyal shows how the VAS, the trismus and the number of analgesics taken was significantly reduced in the piezoelectric group; in this study also the swelling, edema is reduced in patients undergoing piezoelectric surgery. Furthermore, in this study the quality of life was evaluated using the PoSeSe scale, specific for the extraction of third molars; a significant change has been noted in the patients’ perception of the subscale 1 (opening of the mouth, chewing movements) in the basement 4 (clinical aspect) in the basement 5 (pain) and above all in the basement 7 (interference with daily activity). [11-12].

**Surgical Technique**

**Standard Protocol**

Patients are prescribed antibiotic prophylaxis with 2gr of amoxicillin 1h before surgery, and then a truncular anesthesia is performed with lidocaine without vasoconstrictor, then infiltration with adrenaline at the buccinators nerve. A full-thickness triangular flap is then sculpted with a horizontal incision at the base of the papillae between the sixth and seventh and a distal discharge incision with a vestibular pattern. Fig. (1-2-3-4) Then we proceed with the osteotomy that can be performed with rotating instruments mounted on a straight handpiece or with a piezoelectric terminal with the dedicated inserts. If necessary, dentotomies and root separation are performed with tungsten carbide burs mounted on a turbine, then the dental element is luxated and avulsed. Fig (The alveolar cavity is revised with abundant washing with saline solution, collagen filling and suture stitches separated in 4/0 vicry l. Fig(5-6-7-8-9-10) the patient is discharged with analgesic and supportive antibiotic therapy.

Figure 1. RX OPT Pre OP

Figure 2. CBCT Pre OP

Figure 3. Initial clinical Situation

Figure 4. Full-Thickness Flap

Figure 5. Ostectomy

Figure 6. Crown Separation
Figure 7. Remove Cyst

Figure 8. Residual alveolar Cavity

Figure 9. Collagen Sponge

Figure 10. Suture Reabsorbible
Materials and Methods

Use of piezoelectric instruments the avulsion of the included or semi-included dental elements is one of the most frequently performed clinical procedures by the odontostomatological surgeon. This practice can be relatively simple or extremely difficult in relation to many variables related to the element to be extracted such as localization, anatomy of the dental crown and root, depth and type of inclusion, etc. If on the one hand dental avulsion can be considered a routine dental procedure, the extraction of included dental elements requires a considerable technical preparation, an accurate knowledge of all the noble anatomical structures and a matured surgical experience. It is essential to perform a proper treatment planning that, on the one hand, allows minimizing the risk of post-surgical complications (pain, edema, trismus, alveolitis ...) and, on the other, to be able to manage the latter in correct way, always with the lowest biological cost for the patient. In recent years, odontostomatological surgery has been strongly affected by the technological innovations introduced in this field. In particular, the use of ultrasound applied to surgery has changed some of the most frequent clinical procedures, such as the extraction of third molars included, thus spreading an innovative concept throughout dentistry: piezoelectric surgery or piezosurgery. The first clinical trials using piezoelectric bone surgery date back to the late 1980s. This is an innovative surgical method based on the use of instruments consisting of various types of ultrasonic inserts which, replacing the traditional rotating one, is able to achieve the same objectives for which the latter is used.

One of the most important operational advantages of ultrasonic instrumentation is that of allowing a selective cut, exploiting microvibrations, for the bone tissue without damaging the soft tissue, thus safeguarding the anatomical vascular - nervous structures that could accidentally come into contact with the terminal during osteotomy. This property, in addition to decreasing intra and post operative complications in maxillary sinus augmentation operations and in those in close relationships with neuro vascular bundles, allows improving a surgical technique, to perform osteotomies in previously inaccessible areas and to carry out a surgical protocol. Minimally invasive, all to the benefit of a postoperative easier for the patient.

Ultrasounds allow a micrometric and very precise osteotomy in all directions, recording a minimal loss of bone tissue. This characteristic of cutting with ultrasonic instruments is very advantageous when micro-osteotomies are performed to allow the bone wall to be expanded to be mobilized. The hand piece of the current ultrasonic instrumentation is very manageable and the inserts allow access to the operating field much easier than traditional instruments. During the cutting action a sound is produced that can be used as acoustic feedback to adjust the force to be used. The remarkable cutting precision and the good control of the ultrasonic instrumentation are obtained both due to the reduction of pressure necessary to perform the osteotomy, and thanks to the absence of the displacing moment (typical of traditional rotary instruments). Thanks to the use of ultrasonic instruments, it is possible to greatly reduce the detachment of the access flap and, consequently, to reduce the edema following a lower bleeding, so we will have a postoperative course that is clearly more comfortable for the patient.

The frequencies of the ultrasounds used (25-29 khz) do not allow damage to underlying or adjacent soft structures and tissues. The cutting action is less invasive, producing less damage to the surrounding tissues thus allowing a better healing process. Thanks to the cavitations effect on the physiological solution used (for example, blood), piezosurgery creates a clean and contamination-free surgical site.

Finally, it seems that the cavitations effect of the ultrasound on the bone is able to decrease the bleeding of the operated site. The maximum efficiency of this instrument is obtained by using it at maximum power and with the minimum pressure of the operator, reducing the risk of overheating and damage to the soft structures. One of the limitations of the piezoelectric is instead the slowness with which the instrument works.

What are the ADVANTAGES of ultrasonic instrumentation? Selective cut for hard tissues

- Micrometric and precise cutting
- Handy handpiece
- Improved accessibility of inserts
- Availability of inserts with a complex shape
- Micro vibration action
- Cavitation action (energy release phenomenon) which in turn: Facilitates the separation between soft and hard tissue
- Promotes hemostasis
- Removes debris from the surgical field

Conclusions

We can therefore conclude that the piezo is an instrument that allows you to safely perform very delicate surgical procedures, thanks to...
the precision of cut and to the ineffectiveness on soft tissues. Many advantages are also offered by the ability to maintain an operating field with hemostasis control, a clinical aspect of considerable importance especially when operating in deep bone portions with small root residues. The problem, however, has always been related to the slowness of cutting, even if the inserts are currently more and more efficient on different types of fabric. Many authors describe the many advantages and qualities of this instrument, especially when used in conjunction with traditional rotating instruments.

References


