

Review Article

Piezosurgery in Third Molars-A Review of Literature

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Abstract

Piezosurgery is the current advanced technology used in bone cutting, which enables a selective cut of mineralized tissue while being cautious of the soft tissue. Previously used for osteotomies and for harvesting bone grafts, piezosurgery is more recently used for sinus augmentation and third molar surgeries. Removal of third molars is the most common surgery performed by a maxillofacial surgeon. Successful removal of the third molar depends on an appropriate osteotomy, for which many techniques have been advocated. These techniques include usage of rotatory, chisel and mallet, and recently introduced piezoelectric technique. The innovation of piezoelectric surgery has created an opportunity for precise and safe osteotomies. Post-operative sequelae and complications related to extraction of third molars include pain, trismus, edema, alveolitis, secondary infections, intra-operative nerve injury and bleeding. To reduce the post-operative discomfort, pre-operative antibiotics, variations in flap design and osteotomy methods have been employed. Piezosurgery and conventional techniques both have been routinely used in the surgical management of third molars. This article reviews previous literature on application of piezosurgery in third molars.

Keywords: Osteotomy; Piezosurgery; Post-operative sequelae; Third molar

1. Introduction

Piezosurgery is the current advanced technology used in bone cutting, which enables a selective cut of mineralized tissue while being cautious of the soft tissue. Piezosurgery was first proposed by Vang in 1955; however, it did not gain popularity until 1988. Since its renovation, piezosurgery has undergone vast improvements in the field of maxillofacial surgery [1]. Piezosurgery works on the principle of oscillation, produces a modulated ultrasonic frequency of 24-29 kHz, micro-vibration amplitude between 60 and 200 mm/s and transmitted to a metallic tip. The amplitude of these micro-vibrations allows a clean, precise cut. It also helps in preserving the integrity of soft tissues as its surgical action ceases on contact with the non-mineralized tissues [2-3]. The focal advantages of piezosurgery

include high precision, multidirectional cutting, minimal trauma to adjacent soft tissue thus preserving the neurological and vascular structures, reduced hemorrhage, minimal thermal damage to the bone, as well as improved healing thereby improving overall safety. The main use of piezosurgery is mineralized tissue cutting, which can be either for access to the surgical site or as part of an oncological resection. Previously used for osteotomies, osteoplasties and for harvesting bone grafts, piezosurgery is more recently used for sinus augmentation and third molar surgeries [1]. Removal of third molars is the most common surgery performed by a maxillofacial surgeon. Difficulty in its removal may vary according to the position, angulation, depth and density of the bone. Regardless of the difficulty; successful removal of the third molar depends on complete pre-operative planning and careful execution. During the surgical removal of lower third molars, the most essential phase is the osteotomy, for which many techniques have been advocated. These techniques include usage of rotatory, chisel and mallet, and recently introduced piezoelectric technique. The innovation of piezoelectric surgery has created an opportunity for precise and safe osteotomies. Post-operative sequelae and complications related to extraction of third molars include pain, trismus, edema, alveolitis, secondary infections, intra-operative nerve injury and bleeding [4]. Numerous therapeutic procedures have been assessed to reduce the post-operative discomfort.

These include using pre-operative antibiotics, pre-emptive analgesia by administration of corticosteroids, variations in flap design and osteotomy methods [5-7]. Piezosurgery and conventional techniques both have been routinely used in the surgical management of third molars. While piezosurgery has a significant advantage of causing less soft tissue damage as compared to the other techniques, the conventional rotatory method along with adequate post-operative care, contributes to healing at a comparable level to piezosurgery.

Bone cutting can be performed by various instruments, which include chisel and mallet, rotatory osteotomy, oscillating saws. Chisel-mallet bone cutting does not generate heat but causes injury to the bone and adjacent structures due to application of excessive forces. Use of rotatory osteotomy and oscillating saws result in heat production during bone cutting, leading to thermal injury to the bone. Additionally, these may injure surrounding soft tissues, particularly at limited or difficult access sites. In 1975, Horton et al. conducted an experimental study to rule out the effects on healing of the alveolar bone when the bone osteotomy was performed by three different methods i.e. with the help of chisel, rotatory bur and ultrasonic instrument [8].

The results of this study concluded that the best healing of the alveolar bone was obtained when the osteotomy was performed by chisel followed by ultrasonic instrument and lastly by the rotatory instrument. Piezosurgery is very easy to handle when compared to rotatory osteotomy or an oscillating saw, as there is no need for supplemental force to oppose the rotation or oscillation of the instrument. Also, piezosurgery has an added advantage over rotatory instruments in that it provides clearer operating field and better hemostasis due to cavitation phenomenon. Piezosurgical unit cuts more like a chisel than a rotatory instrument without burnishing it, thereby leading to better healing [3]. Histologically, irregular lacunar osteocytes were found at the cut bone edges and there was no evidence in the edges of the bone cut perpendicular to the surface were irregular with lacunar osteocytes immediately adjacent to the cut surface and there was no evidence of damage to surrounding vascular structures. Use of piezosurgery in

third molar surgery has been widely debated, comparing its efficacy versus the other forms of bone cutting such as rotatory and chisel-mallet techniques. Many authors have carried out comparative studies, which include parameters like post-operative pain, trismus, edema, paresthesia and dry socket. In a study conducted by Goyal et al. patients who underwent conventional or rotatory technique complained of more edema pain and consumed more analgesics. The author concluded that piezosurgery except a few inherent limitations served as a commendable alternative for surgical disimpaction of third molars [9]. Troedhan et al. stated 50% reduction in pain when piezosurgery was used for third molar extractions [10]. Barone et al. indicated a higher pain score with the rotatory group but the results weren't statistically significant [11]. Rullo et al. stated that pain reduction was observed only in simple cases of impactions while significantly higher pain values were observed in complex extractions [12]. Complex cases take longer time with more release of inflammatory mediators of pain like prostaglandin E2, bradykinin and other mediators [13]. Mantovani et al. stated that piezosurgery took more time yet had lower pain scores, which could be attributed to the minimal damage to the surrounding structures caused by piezosurgery [14]. Improvement in trismus values were significantly higher in the piezosurgery group on post-operative days 3, 5 and 7 in the comparative study done by Goyal et al. [9]. Results of Sortino et al. and Piersanti et al. showed that 1-day and 2-day post extraction values were significantly better in the piezosurgery group than the rotatory group [15-16]. Trismus values in the study done by Sivovella et al. showed no difference as it was measured on day 7 and day 30 [17]. Barone et al. stated swelling measurement an observational bias and their study showed decreased swelling in the piezosurgical group [11]. Swelling measured significantly lower in piezosurgery group, contained in the buccal region in most cases in a study conducted by Goyal et al. [9]. Sortino et al. showed almost half of the patients had less swelling in 24hrs after the surgical extraction [15]. Troedhan et al. observed swelling reduction in the piezosurgery group by half when third molars were removed using piezosurgery [10]. Sivovella et al. found no significant change in the swelling on day 7 and 30 [17]. Kyösti Oikarinen observed a direct co-relation of duration of the surgery and the post-operative sequelae [13]. However, Benediktsdttir et al. reported that post-operative outcomes were independent of the time taken for the surgical procedure [18]. Goyal et al. Sivovella et al. Mantovani et al. showed that despite of more time taken by piezosurgery unit as compared to the rotatory osteotomy there was statistically significant reduction in the post-operative pain, trismus and swelling, which again can be attributed to the less injury to the soft tissue by piezosurgery as its surgical action ceases on contact with the non-mineralized tissue [9] [16-17]. Troedhan et al. concluded that once the technique of using piezosurgical unit is mastered it does not consume more time than the conventional surgical techniques [10]. Rullo et al. concluded that for "simple extraction" there was no statistical difference in time taken for performing the surgery in both the groups with significant less pain in the piezosurgical group, but for "complex extraction" there was a statistical difference in the time taken to perform the surgical procedure with more time needed by the piezosurgical group, also there was significantly more pain in the piezosurgical group [12].

2. Conclusion

Piezosurgical unit is more efficient in controlling the post-operative pain but it is more time consuming and an expensive tool for the surgical removal of third molar. There are numerous research papers published in the literature, which suggest that Piezosurgery may be an alternative to the conventional rotatory instruments. However,

it may not prove too beneficial as the sole replacement for conventional rotatory as the literature suggests similar post-operative healing result with the other osteotomy techniques. Also the initial cost of the equipment is of economic concern to the surgeon, thus limiting its usage. The development of pre-emptive analgesia and improved post-operative care renders use of Piezoelectric surgery in third molars impractical, conversely it can be beneficial in bone sectioning in difficult third molar extractions near inferior alveolar canal. As rightly quoted by Troedhan, once mastered, the disadvantage of operating time gradually reduces, thus extracting the finest possible advantages offered by piezosurgery.

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