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Evaluation of role of piezo-surgical in mandibular impacted third molar removal: An original research

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Abstract---Aim: The purpose of the present research was to assess the role of piezo-surgical and its effectiveness against conventional techniques for removal of impacted mandibular third molar. Methodology: Study included 16 patients (8 male and 8 female) age 17 to 32 years treated in the period from 2019 to 2021. All patients had both mandibular molars impacted. One third molar was extracted using classical technique while the other one using a piezo device.

Preoperative preparation was the same for all patients and included radiological analysis and verification of teeth by orthopantomography (OPG) and CT. Patients were assessed one, seven and 14 days after the procedure. Results: After the extraction, all patients were followed for postoperative symptoms: pain, swelling and paraesthesia of the inferior alveolar nerve. The results confirmed advantages of piezosurgery in the removal of impacted mandibular third molars. Average duration of the intervention was 18 minutes with standard technique while the duration with piezo technique was 23 minutes. According to the visual-analogue scale (VAS) the average pain in the standard group was 9 whereas in the piezo group it was 6. Postoperative swelling was 10 mm (pronounced) the first day after the procedure in the standard group while in the piezo group it was 6 mm (moderate). Conclusion: The use of piezo technology for the extraction of impacted wisdom teeth is a reliable method which reduces the risk of the most common postoperative complications following mandibular wisdom teeth removal.

Keywords---postoperative complications, piezosurgery, wisdom teeth extraction.

Introduction

Extraction of impacted wisdom teeth is one of the most common oral surgical procedures usually accompanied by several intraoperative and postoperative complications.¹ These complications include damage of soft and hard tissues around the tooth, they occur during and immediately after the surgery and significantly depend on the tooth position in bone. Postoperative complications include prolonged numbness in the region of the inferior alveolar nerve, swelling, pain and limited mouth opening that can last in some patients for several weeks.² After impacted wisdom teeth are indicated for removal, a surgeon must employ the best strategy to minimize complications and accelerate postoperative recovery. Some studies have suggested that frequency of complications is directly related to difficulties in the procedure of extraction and injury of soft and hard tissue during the procedure.^{3,4} In order to reduce these complications, various methods have been suggested, such as the use of ice packs⁵, antibiotics and corticosteroids⁶, the use of slow speed burs⁷ and others. After obtaining data from several histological and histomorphometric studies on animals, some authors have begun the application of ultrasonic devices for surgical removal of bone as an alternative to the classical approach of bone removal during the procedure of removing impacted wisdom teeth.⁸⁻¹⁰ It has been shown that piezosurgery is an effective method to preserve soft tissue (mucous membranes, nerves, blood vessels) during the extraction of third molars¹¹, in contrast to standard burs and jigsaws. An additional advantage of this technique is that the piezo instrument provides a clearer surgical field.¹²⁻¹⁵ Various methods over recent years have been suggested and utilized to minimize post-operative sequelae, such as platelet rich fibrin administration, laser application, cryotherapy, drug injections, and various flap designs for impacted molar extraction. However, one of the most important methods has involved the use of osteotomy techniques to minimize trauma and

the generation of heat associated with cutting the bone or osteotomy during surgical extraction of the lower third molars. Hence, it is beneficial to choose the most optimal technique for removal of the lower third molars in order to avoid jeopardizing the adjacent bone, teeth and the surrounding soft tissues. The most commonly used instrument for impacted tooth removal is the rotary hand piece. However, clinicians may find that this method leaves irregular surfaces in the bone and marginal osteonecrosis. It also impairs healing due to overheating of bone and damage to adjacent tissues. Piezoelectric surgery is a novel osteotomy technique that utilizes micro-vibrations of scalpels at ultrasonic frequency. Piezoelectric surgery has been proposed as an alternative for removing third molar surgery with the conventional rotating bone cutting instruments. Piezoelectric surgery is a pioneering technique that has an added advantage over burs and micro saws. The ultrasonic vibrations break down irrigation liquid into very small particles that are washed out from the operating field therefore, allowing for clear, unobstructed vision. Its mechanism of action is based on the ability of certain ceramics and crystals to deform when an electric current is passed across them, resulting in a microvibration amplitude between 60 and 200 mm/s at a modulated ultrasonic frequency of 24–29 kHz resulting in a clean, precise osteotomy.¹⁶

Aim of the present study

The purpose of the present research was to assess the role of piezo-surgical and its effectiveness against conventional techniques for removal of impacted mandibular third molar.

Methodology

The study included 16 patients (8 males and 8 females) 17 to 32 years old and treated in the period from 2019 to 2021. All patients had both mandibular molars impacted. Patients who had acute infection, poor hygiene and were not interested in monitoring for the planned period of time were excluded from the study. Difficult extraction was assumed according to the classification of mandibular wisdom teeth as per Pell and Gregory¹⁷ Interventions were done at the same time, where the extraction of a third molar on one side was performed using burs while on the other side a piezo device was used). Impacted teeth were accessed after raising a mucous periosteal flap in the area of the tooth to be extracted. Patients were followed up postoperatively after 1, 7 and 14 days. Pain, swelling and paraesthesia in the region of the inferior alveolar nerve were checked on the follow up check-ups. Pain was analysed on a visual analogue scale (VAS) from 0-10 where 0 represented the absence of pain, 1-10 presence of pain where the score 10 was maximal pain. It was monitored daily until the seventh postoperative day. The time required to perform the procedure was measured for each patient from the incision to the last suture placement. The swelling was measured using a flexible meter and points of reference used were: tragus (Tr), lateral canthus of eye (Ca), nose tip (No) and lip commissure (Bk). Obtained values were compared with the findings in the preoperative period (T0). That way, swelling was characterized as mild (0-5 mm), moderate (6-9 mm) and severe (10-13 mm). The degree of paraesthesia was determined using mechanoreceptive test, static detection of light touch while the patient was in sitting position with closed eyes.¹⁸

Results

The most important postoperative complications were evaluated: pain, paraesthesia of the inferior alveolar nerve and swelling. Average duration of the intervention was 18 minutes for standard technique while the duration of the procedure was 23 minutes for piezo technique. Pain was the most intense on the day of surgery where in the group of standard method it reached the value of 9 and in the piezo group it was 6. On the seventh day these values decreased to 7 for standard method and to 3 for piezo. Postoperative swelling one day after the surgical procedure was 10 mm (pronounced) while in the piezo group it was 6 mm (moderate). Numbness in the area of inferior alveolar nerve was much more pronounced on the side where standard surgical techniques was used and it lasted for about a month while in the group of patients where the extraction was performed using piezo technique it lasted no longer than two weeks. All patients liked more piezo method because it was comfortable ("there was no vibration") and they would rather choose this treatment over the standard one. (Table 1 & 2)

Discussion

Surgical extraction of lower third molars can be challenging. As clinicians it is our priority to aid optimal therapeutic outcomes while preserving the integrity and viability of the surrounding anatomical structures. It is this balance of trauma and healing that initiated ongoing efforts to utilize piezoelectric surgery, which is now considered a novel technique with promising results. Previous studies have shown that the surgical outcome (pain, swelling and trismus) following lower third molar removal are influenced by various factors, such as angulations of impaction, especially distoangular impaction, bone removal combined with tooth sectioning, difficulty of the surgical procedure, and operation duration. Surgical procedures using piezoelectric surgery had significantly faster postoperative recovery compared to the traditional rotary systems, which can be attributed to many factors. Piezoelectric surgery has a cavitation phenomenon: an implosion of gas bullae into blood vessels during osteotomy, producing bone cutting which produces a haemostatic effect and reducing blood loss. Piezoelectric surgery plays an important role in increasing bone density within the extraction socket and in decreasing the amount of bone loss along the distal aspect of the mandibular second molar. Keki et al. and Bonetti et al.^{19,20} demonstrated the use of orthodontic appliances to move wisdom teeth away from mandibular canal that are then extracted without danger of nerve injury. Renton et al.²¹ reported another strategy such as partial removal of the crown to enable spontaneous eruption. All these methods significantly prolong the treatment and patients are subjected to larger number of interventions. Our study was aimed to compare traditional approach in the removal of impacted wisdom teeth using steel burs and piezo technology for work in bone. It is known that different surgeons employ different surgical techniques, therefore all patients were treated by the same surgeon and the same personnel.²² There was a significant difference between standard and piezo techniques in the postoperative period for the following complications: paraesthesia, pain and swelling. All complications were significantly worse in areas where traditional technique was used. Duration of intervention was longer with piezo method but postoperative complications were

less pronounced. This is a very important fact due to the belief that prolonged intervention is directly related to the degree of postoperative pain.²³

Conclusion

Use of piezo technology for the extraction of impacted wisdom teeth is reliable method that reduces the risk of injury to the inferior alveolar nerve. Although duration was slightly longer compared to standard method, the period of numbness of lower lip and postoperative swelling was significantly reduced and total recovery time significantly shortened.

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Tables

Table 1- Changes in variables during the study period on 1st day

Variables	Standard technique	Piezo- surgical technique
Duration of treatment	18 mins	23 mins
Pain experienced	VAS= 9	VAS=6
Numbness	Till 1 month	Till 2 weeks

Comfortability	More vibration	Less vibration, more comfortable
Swelling	10mm	6mm

Table 2- Postoperative changes in variables on 7th, 14th day

Variables	Standard technique		Piezo- surgical technique	
	7 th day	14 th day	7 th day	14 th day
Pain experienced	VAS=7	VAS=2	VAS=3	VAS=0
Swelling	7mm	2mm	3mm	nil