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Evaluation of post-surgical outcome of impacted third molar removal using piezoelectric surgery In Comparison With Conventional Rotatory

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Abstract
Removal of impacted wisdom teeth is a commonly performed procedure in oral and maxillofacial surgery, but there is a considerable debate among the surgeons, regarding the technique used for osteotomy. For this generally requires certain degree of bone removal to facilitate delivery of tooth from its position. Various bone cutting tools, both rotatory and hand cutting have been used extensively to accomplish the same. The surgical removal of third molar teeth may result in a number of complications including pain, trismus, swelling, bleeding, alveolar osteitis, nerve dysfunction or even infections. Piezosurgery is a new and revolutionary osteotomy technique utilizing the micro vibration of scalpels at ultrasonic frequency. Rotary speed ranging from 15,000 to 25,000 rpm used in oral surgery produces macro vibration and requires a supplemental force to oppose the rotating couple of the instrument. The present study was planned to to compare surgical and post-surgical outcome of impacted third molar removal using piezoelectric on one side and rotary bur on contralateral side.
The present study was planned in the Department of Dentistry, Anugrah Narayan Magadh Medical College, Gaya, Bihar. Total 10 patients were selected for the present study to compare surgical and post-surgical outcome of impacted third molar emoval using piezoelectric on one side and rotary bur on contralateral side.. Preoperative orthopantomogram and intraoral periapical radio figures were taken. The patients were subjected to removal of impacted mandibular third molars using piezoelectric and rotary bur.
The data generated from the present study concludes that piezoelectric instrument is better alternative for removal of impacted tooth than rotary instruments. Extensive studies are required to be conducted for its different uses in osseous surgeries, so that its range of applications can be widened with fewer limitations in the field of oral and maxillofacial surgery with improving patient's compliance and satisfaction.

Keywords: third molar surgery, Piezotome, rotary, Distoangular, post-operative, etc

Introduction
Impacted wisdom teeth is a disorder where the third molars (wisdom teeth) are prevented from erupting into the mouth. This can be caused by a physical barrier, such as other teeth, or when the tooth is angled away from a vertical position [1]. Completely unerupted wisdom teeth usually result in no symptoms, although they can sometimes develop cysts or neoplasms. Partially erupted wisdom teeth can develop cavities or pericoronitis. Removal of impacted wisdom teeth is advised in the case of certain pathologies, such as nonrestorable caries or cysts [2].
Wisdom teeth likely become impacted because of a mismatch between the size of the teeth and the size of the jaw. Impacted wisdom teeth are classified by their direction of impaction, their depth compared to the biting surface of adjacent teeth and the amount of the tooth's crown that extends through gum tissue or bone. Impacted wisdom teeth can also be classified by the presence or absence of symptoms and disease. Screening for the presence of wisdom teeth often begins in late adolescence when a partially developed tooth may become impacted. Screening commonly includes clinical examination as well as x-rays such as panoramic radiographs.
Infection resulting from impacted wisdom teeth can be initially treated with antibiotics, local debridement or surgical removal of the gum overlying the tooth. Over time, most of these treatments tend to fail and patients develop recurrent symptoms. The most common treatment to recurrent pericoronitis is wisdom tooth removal. The risks of wisdom tooth removal are roughly proportional to the difficulty of the extraction. Sometimes, when there is a high risk to the inferior alveolar nerve, only the crown of the tooth will be removed (intentionally leaving the roots) in a procedure called a coronectomy. The long-term risk of coronectomy is that chronic infection can persist from the tooth remnants. The prognosis for the second molar is good following the wisdom teeth removal with the likelihood of bone loss after surgery increased when the extractions are completed in people who are 25 years of age or older. A treatment controversy exists about the need for and timing of the removal of disease-free impacted wisdom teeth. Supporters of early removal cite the increasing risks for extraction over time and the costs of monitoring the wisdom teeth. Supporters for retaining wisdom teeth cite the risk and cost of unnecessary surgery.
Piezoelectric Bone Surgery is a process that utilizes piezoelectric vibrations in the application of cutting bone tissue. The process was developed by Tomaso Vercellotti and has been patented [3]. It is indicated for use in oral, maxillofacial, cranial and spinal procedures.

By adjusting the ultrasonic frequency of the device, it is possible to cut hard tissue while leaving soft tissue untouched by the process. The ultrasonic frequency is modulated from 10, 30, and 60 cycles/s (Hz) to 29 kHz. The low frequency enables cutting of mineralized structures, not soft tissue. Power can be adjusted from 2.8 to 16 W, with preset power settings for various types of bone density. The tip vibrates within a range of 60–200 µm, which allows clean cutting with precise incisions. A recent article on the topic of piezoelectricity has named piezoelectric surgery as one of the most important applications of this concept, in addition to medical ultrasound imaging [4].

The great advantage of piezo surgery in dentistry is that it is selective for calcified materials such as bone and teeth. While the surrounding soft tissue absorbs the vibration of the (generally) metallic working attachments and vibrates with the working tip, calcified tissue is selectively ablated for preparation specifically of bone. This offers significant advantages for various indications which require atraumatic bone preparation in the immediate vicinity of important soft-tissue structures such as nerves, gingiva and even the mucous membrane in the sinus cavity.

Piezoelectric devices have other clinical advantages in comparison with oscillating saws or even rotary milling cutters. For example, the minimal deflection of the tip enables extremely precise preparation of osteotomy gaps. When using rotary milling cutters and even oscillating saws, the initial definition of the osteotomy line is particularly difficult, and this commonly results in discrepancies between the planned and the actual course of the osteotomy. In addition, rotary instruments require a certain degree of stability to resist the shearing forces that occur during rotary ablation. Compared to piezo surgery, this results in significantly wider preparation defects followed by loss of bone tissue, which may then require augmentation.

Another problem with rotary instruments is the possibility of unintentional deflection as a result of tilting or even simply drifting across the preparation surface. Particularly when working close to adjacent teeth and nerves, a piezoelectric attachment can help to improve surgical safety and reduce the risk of injuring neighbouring structures.

Another important property of piezoelectric devices that further encourages their use is the possibility of using instruments to redirect the preparation vibrations. For example, retrograde preparation of an apical resection with microhead contra-angle handpieces is a complex process that requires the formation of extended flaps and bone access cavities. This can be done very elegantly using piezoelectric devices by redirecting the vibration energy within the application tip. The resulting reduced preparation of hard and soft tissue allows smaller accesses and thus reduces perioperative morbidity of patients following apical resection.

While piezoelectric surgery used to be considered a time-consuming procedure, the latest generation of devices has significantly improved cutting and ablation performance. The development of the innovative Piezomed device by W&H incorporates significant advances in the working tips and the general transmission energy compared to conventional performance parameters. The device also offers a 15-second power boost for short-term performance optimization to activate additional reserves and further increase ablation performance. The system also improves handling with an automatic system for detecting instrument tips, which defines the optimal settings for the specific instrument. Piezomed also provides optimal illumination of the surgical site with multiple LED lights integrated into the handpiece, providing a good view even into the posterior jaw region [5].

Removal of impacted wisdom teeth is a commonly performed procedure in oral and maxillofacial surgery, but there is a considerable debate among the surgeons, regarding the technique used for osteotomy. For this generally requires certain degree of bone removal to facilitate delivery of tooth from its position. Variousbone cutting tools, both rotatory and hand cutting have been used extensively to accomplish the same. The surgical removal of third molar teeth may result in a number of complications including pain, trismus, swelling, bleeding, alveolar osteitis, nerve dysfunction or even infections. Piezosurgery is a new and revolutionary osteotomy technique utilizing the microvibration of scalpels atultrasonic frequency. Rotary speed ranging from 15,000 to 25,000 rpm used in oral surgery produces macrovibration and requires a supplemental force to oppose the rotating couple of the instrument.

The present study was planned to to compare surgical and post-surgical outcome of impacted third molar removal using piezoelectric on one side and rotary bur on contralateral side.

Methodology

The present study was planned in the Department of Dentistry, Anugrah Narayan Magadh Medical College, Gaya, Bihar. Total 10 patients were selected for the present study to to compare surgical and post-surgical outcome of impacted third molar removal using piezoelectric on one side and rotary bur on contralateral side. Preoperative orthopantomogram and intraoral periapical radio figures were taken. The patients were subjected to removal of impacted mandibular third molars using piezoelectric and rotary bur.

Rotary Device

It consists of hand piece and foot switch which are connected to main power unit. Ahand piece is a device for holding rotating instruments, transmitting power to them, and positioning themintraorally. Rotary speed of around 35,000 rpm isused. Rotary burs 702 and 703 were used.

Piezoelectric device

Itconsists of a hand piece and afoot switch that are connected to the main power unit.This has a holder for the hand piece, and containsirrigation fluids that create an adjustable jet for 0-61ml/min through a peristaltic pump. A frequency of25-29 kHz with a microvibration of 60-200mm/sec isused with a boosted working mode. Piezoelectric bursSL 1, SL 2, & SL 3 were used.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

Following was the inclusion and exclusion criteria for the present study.

Inclusion criteria

Patients of impacted third molar teeth between 18-35 years of age having at least two previous episodesof pericoronitis.

Patients of impacted mandibular third molar havinghorizontal and distoangular impactions. Patients having moderate and very difficult Pederson difficulty index mandibular molars.

Exclusion criteria

Acute infection in relation to third molar, Periapical pathology, severe periodontal disease, uncontrolled systemic disease, Debilitating disease, Patents having minimum difficult Pederson difficulty index mandibular molars.

Results & Discussion

The data from the both types of surgery that is piezoelectric and Rotary Surgery were collected and presented as below. Recently, after painstaking research and the application of advanced principles of physics, newer instruments have been introduced to reduce the difficulty and morbidity in third molar surgery. One such innovation is piezosurgery or the application of piezoelectric, ultrasonic vibrations to make precise and safe osteotomies [6]

Table 1: Time required for surgery

Type of Surgery	Piezoelectric Surgery	Rotary Surgery
Time for Surgery	14 – 90 mins	16 – 45 mins

Table 2: Patients satisfaction grade

Type of Surgery	Piezoelectric Surgery	Rotary Surgery
Total Patients	**5**	**5**
Very satisfied	3	4
Fairly satisfied	1	1
Fairly unsatisfied	1	0
Very unsatisfied	0	0

Table 3: Mouth opening and postoperative pain

Type of Surgery	Piezoelectric Surgery	Rotary Surgery
Total Patients	**5**	**5**
Mouth Opening		
Normal above 3.5cm	3	3
2.5 -3.5 cm	2	1
Below 2.5 cm	0	1
Postoperative Pain		
No Pain	0	0
Slight Pain	1	0
Mild Pain	5	5
Severe Pain	0	0

Vercelotti *et al.* [7] compared piezosurgery with carbide burs in ostectomy and osteoplasty and proved that there is better bone healing in terms of quantity and quality when using piezosurgery in osseous surgeries. Moreover, Rullo *et al*. [8] analysed the bone histology and found well-defined histological differences between the bone samples collected with the bur and the ultrasonic device. They reported that more integrity of the bony structure, well-designed osteotomy lines, and no evidence of bone heat osteonecrosis characterized the bone samples harvested with the piezoelectric device.

The surgical removal of impacted mandibular third molars produces a significant degree of trauma to the soft tissues and bony structures of the oral cavity, potentially resulting in a significant inflammatory reaction. The latter produces the usual postoperative signs and symptoms of pain, oedema, and limited mouth opening due to muscle spasm [9, 10].

Ultrasound osteotomy is a new surgical technique used in oral and maxillofacial surgery to section hard tissue without damaging adjacent soft tissue. Piezosurgery was developed by Italian oral surgeon Tomaso Vercellotti in 1988 to overcome the limits of traditional instrumentation in oral bone surgery by modifying and improving conventional ultrasound technology [11].

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Piezosurgery is a new and revolutionary osteotomy technique utilizing the micro vibration of scalpels at ultrasonic frequency [12, 13]. The piezoelectric effect was discovered in 1880 by Jacques and Pierre Curie [14]. This is the phenomenon whereby an electric potential develops across certain crystalline materials when they are compressed; and these materials become deformed in an electric field. If the polarity of the applied field alternates, the crystal transduces this alternation into an oscillation of its surface, and this movement is transmitted to adjacent matter. The vibrations thus obtained are amplified and transferred on to the insert of a drill [12].

The piezotome delivers an extremely micrometric cut involving minimum surface area; this may represent one of the factors that contribute to the positive results obtained. Also the management of flap through careful tissue manipulation might explain our findings for pain, swelling and trismus. The main advantage of piezosurgery is its selective cut that recognizes tissue hardness and works only on the mineralized structures, therefore causing no soft tissue damage (mucous membrane, nerves & vessels etc.)

The main disadvantage of piezosurgery noticed so far besides expense and the risk of breakage of the surgical tips is the increased operating time as a result of the slow rate of cutting. The time of surgery can be improved by the operator's experience. Increasing the sample size with longer duration of follow-up and taking bone specimen for histological examination from the surgical site can add valuable findings to the previous results.

Conclusion

The data generated from the present study concludes that piezoelectric instrument is better alternative for removal of impacted tooth than rotary instruments. Extensive studies are required to be conducted for its different uses in osseous surgeries, so that its range of applications can be widened with fewer limitations in the field of oral and maxillofacial surgery with improving patient's compliance and satisfaction.

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