European Journal of Molecular & Clinical Medicine (EJMCM)
ISSN: 2515-8260 Volume 07, Issue 09, 2020

Original research article

Comparative assessment of the outcome of two different approaches for Lower Third Molar Impactions

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Abstract

Aim: The aim of the present study to determine the efficacy of Piezo surgery In Comparison With Conventional Rotatory Technique.

Methods: A prospective observational study was conducted in the Department of Dentistry, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India, for 10 months. Group I (N=70) consisted of patients who gave consent for piezoelectric technique and group II (N=70) consisted of the same patients undergoing conventional rotator osteotomy technique. The intra-operative time was measured in minutes. Post-operative pain, edema and trismus were evaluated on day 1, 3 and 7.

Results: The intra-operative time was 26.18±4.976 minutes in Piezoelectric Osteotomy and 8.14 ± 2.37 minutes in Conventional Rotatory Osteotomy. There was a statistically significant difference in the intra-operative time between Piezoelectric & Conventional Rotatory Osteotomy techniques. (p=0.001).Mean post-operative pain on day 1 was 3.44 ± 1.32 in Piezoelectric Osteotomy and 6.88 ± 0.89 in conventional Rotatory Osteotomy. After 7 days, it was 0.11±0.27 in Piezoelectric and 1.48±0.68 in conventional Rotatory Osteotomy. Mouth opening on post-operative day 1 was 27.02±3.55 mm in Piezoelectric Osteotomy and 23.21±2.48 mm inRotatory Osteotomy on day 1. After 7 days, mouth opening was almost same in both the groups and it was 31.11±3.6 mm in Piezoelectric and 31.17±3.22 mm in Rotatory Osteotomy. There was statistically significant change in Postoperative Trismus/Mouth Opening (mm) from day 1 to day 7 among the Piezoelectric & Conventional Rotatory Osteotomy techniques. (p=0.001).Mean post-operative edema significantly reduced from day1 to day 3 and from day 3 to day 7. Mean swelling sizewas 2.33±1.27 mm among Piezoelectric and 5.12±1.07 mm among Rotatory Osteotomy on day 1. After 7 days itwas 0.05±0.212 and 0.79±0.68 in Piezoelectric and Conventional Rotatory Osteotomy techniques respectively.

Conclusion: Piezosurgery technique improves quality of patient's life in form of decrease of postoperative pain, trismus, and swelling. Furthermore, it enhances bone quality within the extraction socket and bone quantity along the distal aspect of the mandibular second mol

Introduction

Impacted third molars are frequently reported in clinical practice, with a prevalence of 33–58.7% and are well documented to be associated with several complications including periodontitis, regional pain, dentoalveolar abscess, trismus, distal caries on the second molar, cysts, tumors, and dental arch crowding.[1] The surgical removal of these impacted third molars may lead to various post-operative side effects including pain, swelling, trismus, nerve injury, bleeding, and dry socket.[2]

Third molars are, directly or indirectly, the underlying cause of numerous disorders in the mouth, jaw and facial regions. Impacted or semi-impacted third molars in the mandible may have several consequences. These include pericoronitis, regional pain, abscess, trismus, distal caries, periodontal pocket of the second molar, development of follicular cysts, and crowding of lower incisors. As a result, their removal is often necessary, and their surgical removal is the most frequently undertaken oral surgical procedure.[3] One of the most critical steps in disimpaction is cutting the bone or osteotomy, for which many techniques are used, and if they are used injudiciously, they can be dangerous.[4] However, rotary cutting instruments are potentially injurious because they produce excessively high temperatures during cutting of the bone, which can produce marginal osteonecrosis and impair regeneration and healing.[5] Horton *et al*. (1970) were the first to propose the clinical application of ultrasonics in oral surgery and found its results superior than conventional methods of osteotomies. Piezo surgery was developed by Italian oral surgeon Vercellotti in 1988 to overcome the limits of traditional instrumentation in oral bone surgery by modifying and improving conventional ultrasound technology.[6] Piezo surgery is an osteotomy technique using micro vibrations at an ultrasonic frequency to perform efficient bone cutting.[7] The piezoelectric device has been useful for application in complex surgical sites, such as the posterior mandible, where the osteotomy lines are of necessity close to vulnerable structures such as nerves and blood vessels; ultrasonic vibrations allow a selective and defined cutting action, leading to a higher level of precision and safety and less tissue damage than using common rotating instruments (burs).[8,9]

Material and methods

A prospective observational study was conducted in the Department of Dentistry, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India, for 10 months after taking the approval of the protocol review committee and institutional ethics committee. After taking informed consent detailed history was taken from the patient or the relatives. The technique, risks, benefits, results and associated complications of the procedure were discussed with all patients. Total 70 patients were included in this study.

Pre-operatively all cases were investigated with Orthopantomographs. Bilaterally symmetrical impacted teeth with the same difficulty score were evaluated and chosen by Pederson's difficulty index.[10] Group I (N=70) consisted of patients who gave consent forpiezoelectric technique and group II (N=70) consisted of the same patients undergoing conventional rotator osteotomy technique. All patients were given a prophylactic dose of amoxicillin 500 milligrams 1 hour before operation. All operations were done by the same surgeon under local anaesthesia consisting of 2% lignocaine hydrochloride with 1:80,000 adrenaline. In both groups, the site was prepared with povidone–iodine solution, and a conventional Ward's incision was made to reflect the flap. A mucoperiosteal flap was raised with a periosteal (Molt's No. 9) elevator to expose the impacted tooth and surrounding bone. A no. 702 straight fissure bur in a straight hand piece at 30,000 rpm or the piezo tip was used for guttering at the buccal or distal aspect of the tooth.A no. 703 straight fissure bur was used to section the tooth when needed. At all times cutting of bone and tooth was accompanied by copious irrigation with saline solution.Following the guttering, the tooth was elevated out of the socket using coup

land's elevator. The wound was irrigated with povidone iodine and saline solution. The flaps were repositioned and the socket sutured with 3-0 black silk. Patients were recalled for suture removal on day 7. The post-operative protocol included antibiotic therapy (amoxicillin 500 mg in three daily doses for 5 days and Metronidazole 400 mg in three doses for 4 days) and analgesics (diclofenac 50 mg every eight hours) asnecessary for pain control, supplementary with a chlorhexidine 0.2% mouthwash (three times daily for one week). All subjects were advised to use cold compresses immediately after extraction. The intra-operative time was measured in minutes. Post-operative pain, edema and trismus were evaluated on day 1, 3 and 7.

Results

The intra-operative time was 26.18±4.976 minutes in Piezoelectric Osteotomy and 8.14 ± 2.37 minutes in Conventional Rotatory Osteotomy. There was a statistically significant difference in the intra-operative time between Piezoelectric & Conventional Rotatory Osteotomy techniques. (p=0.001).

Table 1: Comparison of Intra-operative time between Piezoelectric & Conventional Rotatory Osteotomy techniques

	Piezoelectric Osteotomy techniques	**Conventional Rotatory Osteotomy techniques**	**P value**
Mean Intra-operative time	26.18±4.976 minutes	8.14 ± 2.37 minutes	0.001

Mean post-operative pain on day 1 was 3.44 ± 1.32 in Piezoelectric Osteotomy and 6.88 ± 0.89 in conventional Rotatory Osteotomy. After 7 days, it was 0.11±0.27 in Piezoelectric and 1.48±0.68 in conventional Rotatory Osteotomy. There was a statistically significant difference in post-operative pain (VAS Score) between Piezoelectric & Conventional Rotatory Osteotomy. (p=0.001).

Table 2: Comparison of post-operative pain (VAS Score) between Piezoelectric & Conventional Rotatory Osteotomy techniques

Mean post-operative pain	**Piezoelectric Osteotomy techniques**	**Conventional Rotatory Osteotomy techniques**	**P value**
On one day	3.44 ± 1.32	6.88 ± 0.89	0.001
After 3 days	2.39 ± 1.19	4.07 ± 1.12	
After 7 days	0.11±0.27	1.48±0.68	

Mouth opening on post-operative day 1 was 27.02±3.55 mm in Piezoelectric Osteotomy and 23.21±2.48 mm inRotatory Osteotomy on day 1. After 7 days, mouth opening was almost same in both the groups and it was 31.11±3.6 mm in Piezoelectric and 31.17±3.22 mm in Rotatory Osteotomy. There was statistically significant change in Postoperative Trismus/Mouth Opening (mm) from day 1 to day 7 among the Piezoelectric & Conventional Rotatory Osteotomy techniques. (p=0.001)

Table 3: Comparison of Postoperative Trismus/MouthOpening (mm) between Piezoelectric & Conventional Rotatory Osteotomy techniques

Mouth opening	Piezoelectric Osteotomy techniques	Conventional Rotatory Osteotomy techniques	P value
On one day	27.02±3.55 mm	23.21±2.48 mm	0.001
After 3 days	27.98±3.27 mm	25.19±3.15 mm	
After 7 days	31.11±3.6 mm	31.17±3.22 mm	

Mean post-operative edema significantly reduced from day1 to day 3 and from day 3 to day 7. Mean swelling sizewas 2.33±1.27 mm among Piezoelectric and 5.12±1.07 mm among Rotatory Osteotomy on day 1. After 7 days itwas 0.05±0.212 and 0.79±0.68 in Piezoelectric and Conventional Rotatory Osteotomy techniques respectively. There was statistically significant change in Postoperative swelling (mm) from day 1 to day 7 among the Piezoelectric & Conventional Rotatory Osteotomy techniques. (p=0.001)

Table 4: Comparison of Postoperative Swelling (mm) between Piezoelectric & Conventional Rotatory Osteotomy techniques

Post-operative edema	Piezoelectric Osteotomy techniques	Conventional Rotatory Osteotomy techniques	P value
On one day	2.33±1.27 mm	5.12±1.07 mm	
After 3 days	1.55±1.31mm	2.37±1.32 mm	0.001
After 7 days	0.05±0.212mm	0.79±0.68mm	

Discussion

Piezo surgery works on the principle of oscillation for performing osteotomy of mineralized tissue and it providesclean, sharp cuts of the bone. It also helps in preserving theintegrity of soft tissues as its surgical action ceases on contact with the non-mineralized tissues.[11,12] In 1975, Horton et al., conducted an experimental study to rule out the effects on healing of the alveolar bone whenthe bone osteotomy was performed by three different methods i.e. with the help of chisel, rotary bur and ultrasonic instrument.[13] The results of the 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 rotary instrument.

Piezo surgery generates very small oscillations in the amplitude of 60 to 200μm horizontally and 20 to 60μm vertically, thus it provides precise and safe osteotomy cuts.[12] It is very easy to handle the device when comparedto rotary hand piece or an oscillating saw as there is no need for supplemental force to oppose the rotation or oscillation of the instrument[14]Also, piezo surgery has an added advantage over rotatory instruments in that its ultrasonic vibrations break down the irrigation liquid into very small particles i.e cavitation phenomenon, which produces a haemostatic effect that ultimately gives a clear unhindered vision of the operating field.[15] The intensity of pain felt was evaluated based onVisual Analogue Scale (VAS).[16] The VAS score was higher when the impactions were performed using the rotatory osteotomy with a statistically significantdifference from the piezo surgical group.

In our study the mean post-operative pain on day 1 was 3.44 ± 1.32 in Piezoelectric Osteotomy and 6.88 ± 0.89 in conventional Rotatory Osteotomy. After 7 days, it was 0.11±0.27 in Piezoelectric and 1.48±0.68 in conventional Rotatory Osteotomy. There was a statistically significant difference in post-operative pain (VAS Score) between Piezoelectric & Conventional Rotatory Osteotomy. (p=0.001). Studies done byTroedhan et al., concluded that

there was 50% reduction inthe pain when piezo surgery was used for surgicalextraction for third molars.[17] The studies done by Barone etal., and Sivolella et al., showed a higher VAS score withconventional instruments but their results were notstatistically significant.[18,19] Rullo et al., reported that therewas reduction in pain when odontectomy was performedwith piezosurgical instrument only for "simple extraction"cases, whereas in "complex extraction" cases the post-operative pain was significantly greater in thepiezosurgical group.[20] This was attributed to the longertime taken for the extraction of complex cases with morerelease of mediators of pain like prostaglandin E2,bradykinin and other mediators.[21] Mantovani et al., statedthat, despite more time taken for the surgical procedure,the VAS score was lower in the piezosurgical group.[22] These were similar to our study and can be attributed to theminimal damage to the soft tissue caused by piezosurgery. Trismus was evaluated by a set of vernier callipers, whichwas a frequently cited method.
In this study the mouth opening on post-operative day 1 was 27.02±3.55 mm in Piezoelectric Osteotomy and 23.21±2.48 mm inRotatory Osteotomy on day 1. After 7 days, mouth opening was almost same in both the groups and it was 31.11±3.6 mm in Piezoelectric and 31.17±3.22 mm in Rotatory Osteotomy. There was statistically significant change in Postoperative Trismus/Mouth Opening (mm) from day 1 to day 7 among the Piezoelectric & Conventional Rotatory Osteotomy techniques. (p=0.001). Studies by Barone et al., showed significant improvement in mouth openingon post-operative days 1, 3 and 7 in the piezosurgery groupbut wasn't statistically significant.[19] Significant highervalues were recorded in the piezosurgical group on post- operative days 3, 5 and 7 in the comparative study done by Goyal et al.,[23] Sortino et al., showed that 24 hours post extraction values of piezosurgery group were statistically better than the rotary group.[24] Even the results of Piersanti et al , which evaluated trismus everyday post-operatively, found statistically better trismus value on post-operative day 2.[18] Our follow up of the study on post- operative day 7, showed the same mouth opening value in both the groups indicating complete recovery of the subject afterthe surgery in both the groups.

In our study the technique used for measurement of edema provided a volumetric measurement. Mean post-operative edema significantly reduced from day1 to day 3 and from day 3 to day 7. Mean swelling sizewas 2.33±1.27 mm among Piezoelectric and 5.12±1.07 mm among Rotatory Osteotomy on day 1. After 7 days it was 0.05±0.212 and 0.79±0.68 in Piezoelectric and Conventional Rotatory Osteotomy techniques respectively. There was statistically significant change in Postoperative swelling (mm) from day 1 to day 7 among the Piezoelectric & Conventional Rotatory Osteotomy techniques. (p=0.001). Barone et al., mentioned that the measurement of swelling has highly observational bias as it involves three dimensional registration and intraoral swelling can also manifest as facial oedema, their study showed significantly higher value of swelling in the micro motor group.[11] Goyal et al., concluded that significant lower values of swelling was present inpiezosurgery group on post-operative day 3, 5, and 7.[23] Troedhan et al concluded that there was 50% reduction in the swelling when piezosurgery was used for surgical extraction for third molars.[9] Mantovani et al showed statistical significant difference in swelling especially on post-operative day 7, so were the results of study done by Piersanti et al.[18,22]

According to the study done by Oikarinen, there's a direct effect of duration of operation on post-operative pain, trismus and swelling.[21] However, Benediktsdóttir et al reported that post-operative outcomes were independent of the time taken for the surgical procedure.[25] Our study shows that despite of more time (mean time = 26.18±4.976 minutes) taken by piezosurgery unit as compared to the rotatory osteotomy (mean time = 8.14 ± 2.37 minutes) there was statistically significant reduction in the post-operative pain,trismus and swelling.

These findings were to the studies done by Goyal et al, Sivolella et al, Mantovani et al which 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.[22,23,26] As our study considered the mean value to statistically analyse the time taken for allthe procedures and no attempt was made to analyse thetime taken according to the difficulty of extraction. 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.

Conclusion

Piezosurgery technique improves quality of patient's life in form of decrease of postoperative pain, trismus, and swelling. Furthermore, it enhances bone quality within the extraction socket and bone quantity along the distal aspect of the mandibular second mol

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Received: 09-07-2020 // Revised: 26-08-2020 // Accepted: 17-09-2020