



COMPARISON BETWEEN PIEZOELECTRIC AND CONVENTIONAL ROTARY INSTRUMENTS FOLLOWED BY PLATELET-RICH FIBRIN AFTER REMOVAL OF IMPACTED MANDIBULAR THIRD MOLARS

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ABSTRACT The comparison between piezoelectric surgery and the conventional rotary bur technique along incorporation of platelet-rich fibrin (PRF) in both groups after the surgical extraction of impacted mandibular third molars reveals several advantages and considerations. Piezoelectric surgery demonstrates superior soft tissue healing, while the conventional rotary bur technique may present quicker procedural durations, appealing to those seeking expedited procedures. The gentleness of piezoelectric instruments contributes to improved bone preservation and regeneration, contrasting with the potentially reduced trismus and postoperative swelling observed in the conventional group. When considering the integration of PRF, both techniques benefit from its regenerative properties, supporting tissue healing and reducing inflammation. Piezoelectric surgery, with its minimally invasive nature, aligns with favorable long-term outcomes, even though it requires a longer duration than the traditional rotatory technique, the piezoelectric device was effective in reducing the short-term effects of pain and swelling. The innovation and precision associated with piezoelectric surgery, albeit requiring specialized training, contribute to a more comfortable patient experience. While upfront costs may be higher for piezoelectric surgery, the potential for faster healing and reduced complications may lead to long-term cost savings. Ultimately, the choice between these techniques, guided by patient preferences. This paper has intricately explored the nuanced advantages arising from the strategic application of platelet-rich fibrin (PRF) in conjunction with both piezoelectric surgery and conventional techniques during the 30 surgical extraction of impacted mandibular third molars. The relatively modest sample size, the presence of age-specific considerations particularly among the younger demographic, and the deliberate choice not to define the angulation of impacted mandibular molars introduces an additional layer of complexity. By doing so, we can foster a more nuanced and universally applicable understanding of the advantages conferred by PRF application, especially in navigating the intricacies of challenging extraction scenarios.

KEYWORDS : piezoelectric surgery, conventional rotary bur technique, of impacted mandibular third molars, platelet-rich fibrin (PRF).

INTRODUCTION

The most commonly performed minor surgical procedure in department of OMFS is transalveolar extraction of impacted mandibular 3rd molar. Conventional mandibular 3rd molar removal produces tissue trauma that induces an inflammatory reaction leading to postoperative sequelae, the most common being pain, swelling and trismus which influences the patient's postoperative phase. Wound healing is another concern in addition to the above-mentioned treatment sequelae.¹

Most commonly, the impacted third molar is surgically extracted using the rotary handpiece. To cut bone with the help of external saline irrigation, a micromotor would be used in conjunction with a surgical straight handpiece. The rotary handpiece's speed ranges from 25,000 to 35,000 RPM, allowing for rapid cutting and reduced operating time. But these could be harmful since they lead to unusually high temperatures when drilling bones, which may interfere with regeneration of osseous structure. The use of piezoelectric devices has recently exploded in popularity thanks to the rise of minimally invasive surgery. Unlike traditional rotational devices, piezosurgery uses precise vibrations to chip away at bone at the exact spot where the blade is applied, resulting in less tissue and bone loss.²

Interchangeable inserts with different dimensions, shapes, and cutting edges are the working tips of a piezoelectric system used in surgery, depending on the intended therapeutic purpose.³ Surgical operations including osteotomy and osteoplasties are best performed in the "boosted mode," which includes frequency over modulation and a higher pace; on the other hand, periodontal and bone smoothing procedures benefit more from the "high mode," which is less efficient.⁴

PRF is a biomaterial derived from natural fibrin that promotes microvascularization and epithelial cell migration to its surface. The

goal of this membrane is to protect open wounds and speed healing.⁴ In 2001, Choukroun et al. were the first to develop PRF in France. He claimed that he could reduce postoperative discomfort and speed recovery by applying autogenic platelet concentrate to the injured region. All the blood components that aid in healing and immunity are gathered on a single fiber membrane in PRF, which is a second-generation immune and platelet concentrate.⁵

This prospective study is carried out to see how different methods—including applying platelet-rich fibrin to the extraction sockets and utilizing piezoelectric and conventional rotary instruments—performed when it came to extracting an impacted mandibular third molar. We measured the amount of time spent in the operating room as well as the duration of postoperative discomfort, edema, tissue healing, and bone healing about the extraction socket.

METHOD AND MATERIALS

The study protocol was approved by the local ethics committee (decision no: 2016/009). We planned a prospective and split-mouth study. Thirty patients were randomly selected.

Inclusion criteria were being age group between 18- 35yrs of age, having asymptomatic impacted mandibular third molar (Pell and Gregory class I, II, position A, B) and being otherwise medically healthy. Exclusion criteria were as follows: (Pell And Gregory Classification class III, position C), compromised bone health, pregnant females and any bony pathology. In the course of study Thirty patients aged between 18 and 35 (mean age of 30.53) included to the study. Maximal interincisal opening (MIO) was noted before the surgery (fig 4). Under a local anesthetic mixture of 2% lignocaine hydrochloride and 1:80,000 adrenaline bitartrate was given. Both sets of patients had a 5% povidone-iodine solution applied to the incision site before the traditional Ward's incision, which mirrored the

trapezoidal flap, was made. In the control group, a conventional rotary handpiece and tungsten carbide burs were used under copious irrigation for removing the overlying bone (fig 5). In the experimental group, piezosurgery (EMS, Piezon Master Surgery, Switzerland) was employed for the same purpose. In both groups, after removal of the bone, when required tungsten carbide surgical burs were used for tooth sectioning. Extraction wounds were closed with 3-0 silk sutures.

The time passed from first incision until suturing was recorded as "duration of the operation" (DO). The patients were postoperatively prescribed a 5-day course of antibiotics. They were invited after 1 week for removing the sutures and postoperative assessment. During the first postoperative week, pain was self-evaluated by using a Wong Baker Pain Scale (WBPS).

Estimation of swelling was done by the method/ technique used by Dutta et al. [14]. Evaluation of facial swelling was based on the modification of three-line measurement (in cm) using five fixed points on the surgical side of the face before and after the 7th days of surgery (Fig. 5). (Line 1): Horizontal line connecting two anatomically significant points: first being outer corner of the mouth and the other being middle of tragus of ear. (Line 2): Horizontal line connecting two anatomically significant points: first being pogonion and the other being middle of tragus of ear. (Line 3): Vertical line connecting two anatomically significant points: first being outer canthi of eye and the other being mandibular angle. (Fig 1)

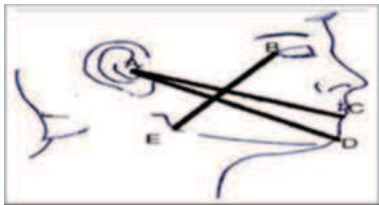


Fig 1: Swelling Criteria

In postoperative 7th day, when the patients came for removing the sutures, MIO was measured to assess trismus and soft tissue healing.

The criteria for bone healing (including lamina dura, overall density, and trabecular pattern) and scoring system were based on the method described by Ogundipe et al which was assessed preoperatively and on 4th month with the help of IOPA (fig 8).

The criteria for soft tissue healing was evaluated on the index given by Landry et al, 1988 postoperatively on the 1st and 7th day respectively.



Fig 2: Preoperative OPG



Fig 3: Preoperative Swelling Criteria



Fig 4: Preoperative Mouth Opening

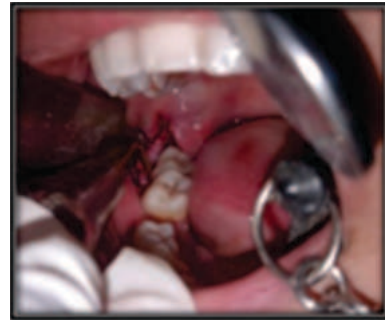


Fig 5: Trephination

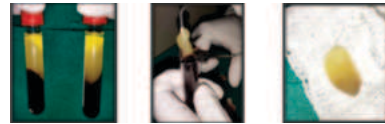


Fig 6: Preparation of PRF



Fig 7: Final Closure



Fig 8: Bone healing at 1st Day and 4th Month Postoperatively

Statistical Analysis

The data for the present study was entered in Microsoft Excel 2007 and analyzed using the SPSS statistical software 23.0 Version. The descriptive statistics included mean, standard deviation frequency, and percentage. The level of significance for the present study was fixed at 5%. The intergroup comparison was done using the independent t-tests and the intragroup comparison was done using the Paired t-test. The Shapiro-Wilk test was used to investigate the distribution of the data and Levene's test to explore the homogeneity of the variables.

RESULT

The conventional group, which had a mean score of 32.66, an SD 104 of 10.867, and a Std Error of 2.805; a p-value of 0.193, our piezosurgery group showed a significant reduction in trismus by the seventh postoperative day.

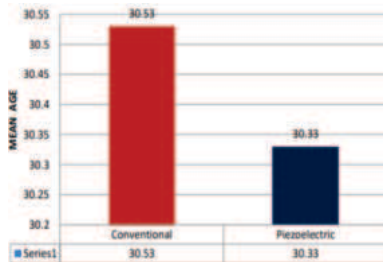
our study found that the piezosurgery group had decreased pain levels on the first day after the operation. The traditional group, on the other hand, exhibited statistically significant differences, with a mean of 4.80, standard deviation of 1.264, standard error of 0.326, and p-value of 0.021. On the seventh day after the operation, however, there was no statistically significant difference in discomfort between the two groups (mean=0.40, SD=0.828, Std Err=0.213, p=1.000).

The results showed that the soft tissue healing on the first day after surgery was significantly different between the two groups. In the piezoelectric group, it was 3.73 with a standard deviation of 0.703 and a standard error of 0.181; in the conventional group, it was 2.60 with a standard deviation of 0.507 and a standard error of 0.130; and the p-value was 0.001. On the seventh day after the surgery, both groups had PRF placed; however, the piezoelectric group showed significantly faster soft tissue healing compared to the conventional group (mean score of 4.26, standard deviation of 0.457, standard error of 0.1118). The conventional group had a mean score of 3.46, standard deviation of 0.516, and standard error of 0.133.

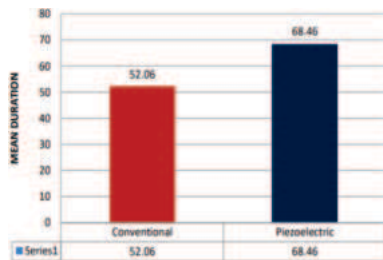
We evaluated swelling preoperatively and 7th-day postoperatively which showed different results as there was no significant difference preoperatively but on the 7th post-operative day, our study revealed a significant increase in the piezoelectric group with a mean of (BE) 0.40, an SD of 0.143, Std Error of 0.037, with a p-value of 0.001, mean of (AC) 0.52, an SD of 0.374, Std Error of 0.096, with a p-value of 0.001 and mean of (AD) 0.32, an SD of 0.217, Std Error of 0.056, with a p-value of 0.001 in comparison with the conventional group having a

mean of 0.26 (BE), an SD of 0.299, Std Error of 0.077, mean of 0.43 (AC), an SD of 1.384, Std Error of 0.037 and a mean of 0.24 (AD), an SD of 0.322, Std Error of 0.083.

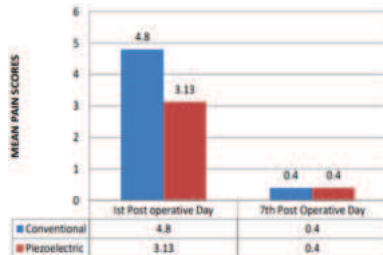
On 1st day and 4 months postoperatively, we assessed bone healing by looking at lamina dura, trabeculae pattern, and bone density. Due to a larger percentage of participants with a Score of 0 and a p-value of 0.001, we concluded that the piezoelectric group performed considerably better than the conventional group on the first day, and fourth month postoperatively when comparing lamina dura. Due to a larger percentage of participants with a Score of 1 and a p-value of 0.001, we determined that the piezoelectric group performed substantially better than the conventional group on the first day, fourth month, and postoperatively trabeculae pattern comparison. When the chi-square test was used to compare the two groups, it was found to be statistically significant (p=0.001). Due to a larger number of participants with Score 0, 1, and 2, the piezoelectric group had a considerably superior Bone Density score than the conventional group.



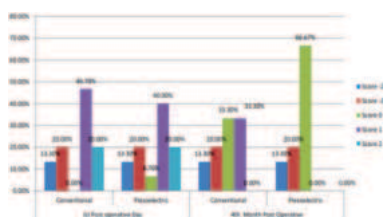
Graph 1: Intergroup Comparison of Mean Age



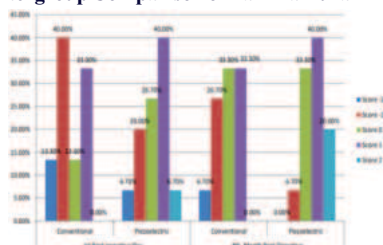
Graph 2: Intergroup Comparison of Duration



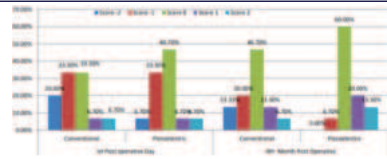
Graph 3: Intergroup Comparison of Mean Pain



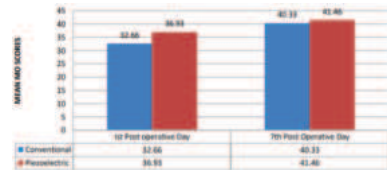
Graph 4: Intergroup Comparison of Lamina Dura



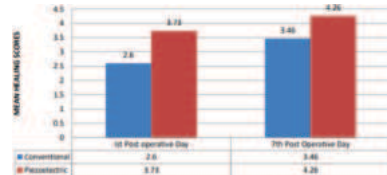
Graph 5: Intergroup Comparison of Trabeculae pattern



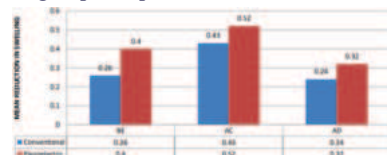
Graph 6: Intergroup Comparison of Bone Density



Graph 7: Intergroup Comparison of Mean Mouth Opening



Graph 8: Intergroup Comparison of Soft Tissue Healing



Graph 9: Intergroup Comparison of Swelling

DISCUSSION

Several studies suggest that biological mediators such as growth factors can be used to accelerate the healing of soft tissue and bone. Our study demonstrated that the use of PRF in both the groups after extraction of impacted mandibular 3rd molar was more beneficial in reducing pain, swelling, and in accelerating the healing of soft tissue and hard tissue as well.

The two groups were compared for 6 parameters that were pain, swelling, duration, trismus, soft tissue healing and osseous regeneration.

In our study, pain was recorded according to WBPS scale. We measured pain and compared the piezoelectric group with the conventional group. Pain was found out to be less for the piezoelectric group as compared to conventional group, i.e., a p value 0.021, i.e., remarkable for the PRF with piezoelectric group and were consistent with those from M Edoardo et al.

In our study, swelling was recorded according to the method/technique used by Dutta et al. [14]. We measured swelling and compared piezoelectric group with the conventional group. Swelling was found out to be more for piezoelectric group as compared to conventional group, i.e., a p value 0.001, remarkable showing decrease in swelling for conventional group was in harmony with the study conducted by Strubinger et al and Piersanti L et al.

In our study, the time passed from first incision until suturing was recorded as “duration of the operation” (DO) and compared piezoelectric group with the conventional group. After comparing the two methods, we found that piezosurgery significantly increased operating time compared to conventional surgery (p < 0.001) in accordance with study done by Sortino F et al.

Maximal interincisal opening (MIO) was noted preoperatively and on 7th day postoperatively. In our study, After comparing the two methods, we found that piezosurgery significantly showed reduced chances of trismus compared to conventional surgery (a p-value of 0.193) in agreement with Jiang Q et al.

In our study, soft tissue healing was recorded, according to the criteria as described by Landry, Turnbull and Howley [15]. We measured soft

tissue healing and compared piezoelectric group with the conventional group. Soft tissue healing inferred reduction in healing index for the piezoelectric group as compared to conventional group, i.e., a p value 0.001, in harmony with the study conducted by Dar MM et al.

In our study, osseous regeneration was assessed with the help of the radiograph (OPG) according to the criteria described by Ogundipe et al with the help of IOPA. We measured bone healing under lamina dura, trabecular pattern, overall density and compared piezoelectric group with the conventional group. We found out a significant difference between both the groups on 4th month and non-significant difference on 1st day post operatively.

To summarize, in our study we evaluated the different variables comparing both piezoelectric group with the conventional group followed by PRF placement in third molar extraction sockets on postoperative pain, swelling, duration, trismus, soft tissue healing and osseous regeneration, clinically and radiographically. It was found from the present study that piezoelectric surgery results in significantly less pain, swelling, soft tissue healing and better bone healing with disadvantages of increased trismus and longer operative time when compared with conventional group. The result suggested that piezoelectric method to conventional method. However, study with large sample size and more follow-up is required to comment on the subject.

CONCLUSION

The piezoelectric method for removal of impacted mandibular third molar along with PRF placement is a very effective and simple option for decreasing the postsurgical complications related to all the parameters. However, further studies with a larger sample size are required in this direction.

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