# Assessment of a bone preservation technique in surgical removal of impacted lower third molar teeth (A clinical Study)

**Original Article**

***Salaheldin Osman ElAbbasy***

*Associate Professor , Department of Oral and Maxillofacial surgery, Faculty of Dentistry, Cairo University*

## ABSTRACT

**Aim:** The aim of this study was to assess the post-operative clinical outcomes of a bone preservation technique compared to conventional technique in surgical removal of impacted mandibular third molar teeth.

**Materials and Methods:** Twenty four female patients (Mean age of 25.3 ± 4.8 years) with impacted mandibular third molar teeth (Vertical class 1 position B) were included in the study. The patients were divided randomly and equally into two equal groups. Group I patients were subjected to surgical removal of the impacted mandibular third molar teeth through a bone preservation technique (Study group) and group II patients underwent the surgeries with the conventional technique of bone removal (Control group).

**Results:** Group I showed a statistically significant less pain scores compared to group II after 1, 3 and 7 days postoperatively. After three days postoperatively, swelling measurements in Group I were statistically significantly lower than those in Group II. After one as well as three days, Group I showed statistically significantly more maximum inter-incisal opening measurements compared to group II.

**Conclusion:** Surgical techniques that preserve the alveolar bone during the extraction of impacted mandibular third molars result in reduced pain, swelling, and trismus compared to more invasive approaches. Our bone preservation technique showed excellent results regarding the clinical outcomes compared to the conventional technique and we recommend it for further clinical trials with different classifications of impacted mandibular third molar teeth.

**Key Words:** Impaction, Third molar, Bone preservation, Extraction .

**Received:** 27 February 2025, **Accepted:** 1 March 2025.

**Corresponding Author:** Salaheldin Osman ElAbbasy , Associate Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Cairo University, **Mobile:** 00201001408066 , **E-mail:** drsalahosman@hotmail.com
**ISSN:** 2090-097X, July 2025, Vol. 16, No.

## INTRODUCTION

Extracting impacted teeth is among the most frequently performed surgical procedures by oral surgeons in the dental practice where approximately 33% of the population are presented with at least one impacted lower third molar.[1, 2]

Some impacted mandibular third molars are indicated for extraction due to therapeutic reasons such as pericoronitis, caries and presence of pathosis while others are removed for prophylactic reasons as in patients with high risk of infection or patients dealing with contact sports.[3, 4]

Pain, swelling and trismus are common postoperative temporary complications associated with the surgical removal of impacted mandibular third molar teeth.[5- 7] Decreasing the severity of postoperative complications requires reduction of the soft and hard tissue trauma in terms of adequate flap design, minimal bone removal and proper wound closure.[8]

In conventional techniques for surgical removal of impacted mandibular third molars, buccal bone guttering is performed for reduction of resistance and for providing a point of application for tooth extraction.[9, 10 ]

Various studies have indicated that excessive bone removal leads to the release of more inflammatory mediators, which contribute to an increase in postoperative pain, swelling, and trismus.[11- 13 ]

The adverse effects of third molar surgeries were found to impact the patient's quality of life during the postoperative period where some patients even needed to receive infusion treatment to decrease pain and discomfort. [14- 16]

The aim of this study was to evaluate the post-operative clinical outcomes of a bone preservation technique compared to conventional technique in surgical removal of impacted mandibular third molar teeth.

## MATERIALS AND METHODS:

Twenty four female patients (Mean age of 25.3 ± 4.8 years) with impacted mandibular third molar tooth (Vertical class 1 position B) were selected from the outpatient clinic of Oral and Maxillofacial Surgery, Faculty of Dentistry, Cairo University. Patients with psychological disorders, pregnancy or any systemic disease that contraindicates the surgical procedure were excluded from the study. Panoramic radiograph was performed preoperatively for all the

 *DOI:10.21608/omx.2025.363862.1280*

patients (Fig.1). This study was accepted by the committee of research ethics of Cairo University #23- 12- 24.

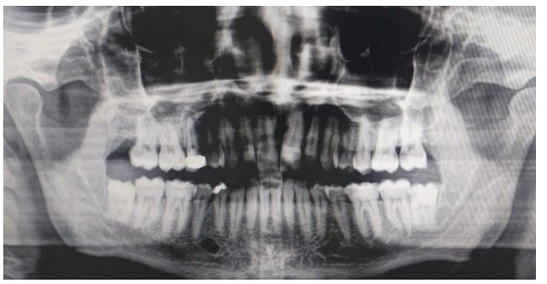

**Figure 1**: Showing preoperative panoramic radiograph

***Sample size calculation***

The primary outcome of this power analysis was the mean difference in mouth opening after seven days. Based on the findings of Shaikh et al.[17], the mean score, along with its standard deviation, was recorded as 0.78 mm (±0.55) and 2.28 mm (±1.61), respectively. Based on a statistical power analysis with an alpha level of 5%, a beta level of 0.8 (equivalent to 80% power), and an effect size (d) of 1.265, the minimum necessary sample size for conducting a Student's t-test was determined to be 12 participants per group. G*Power software (version 3.1.9.2) was used to process this calculation.

The patients were divided randomly and equally using computer software into two equal groups. Group I patients were subjected to surgical extraction of impacted mandibular third molar (Fig.2A) using a bone preservation technique (study group) (Fig. 2B), while Group II underwent the surgery using the conventional bone removal technique (Control group) (Fig. 2C).

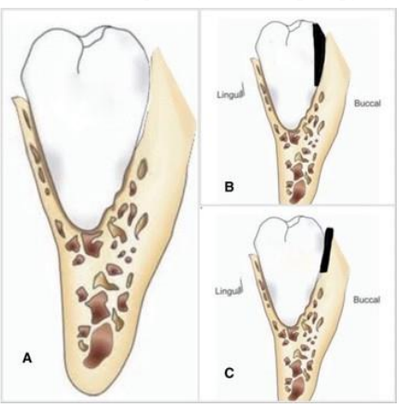


**Figure 2:** Showing a bucco-lingual diagram for (A) Impacted mandibular third molar, (B) Conservative technique for creating a buccal gutter through the tooth itself, (C) Conventional technique for guttering through buccal bone removal

In both groups, the surgical procedure was performed under local anesthesia (ARTINIBSA 40 mg/0.01, Barcelona, Spain) through inferior alveolar and lingual nerve blocks together with long buccal infiltration techniques. Modified Ward's mucoperiosteal flap was incised and reflected exposing the impacted tooth and the surrounding alveolar bone (Fig.3A).

In group I, a bone preservation technique was applied where the buccal guttering was performed within the tooth itself through grinding of the buccal surface using fissure bur down to the furcation area (Fig.3B). In group II, buccal guttering was created through the conventional way of bone removal using fissure bur (Figs.4A,4B). After tooth removal in both groups, debridement of the socket followed by irrigation with saline was performed and the flap was sutured back in place using 4-0 vicryl sutures (Assut Assucryl PGA, Switzerland) (Figs.3C, 3D) and (figs.4C, 4D).

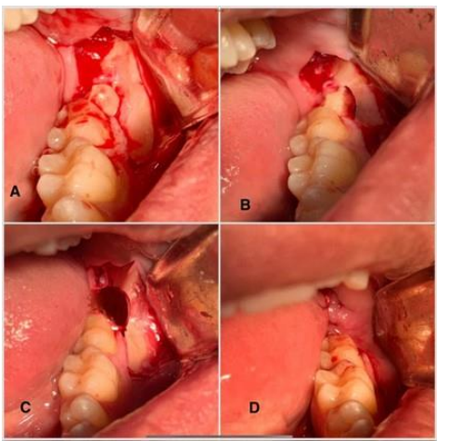


**Figure 3:** Showing the conservative approach for the surgical extraction of impacted mandibular third molar in group I: (A) Flap reflection and retraction, (B) Buccal wall grinding of the tooth, (C) Extraction socket (D) Suturing the flap in place

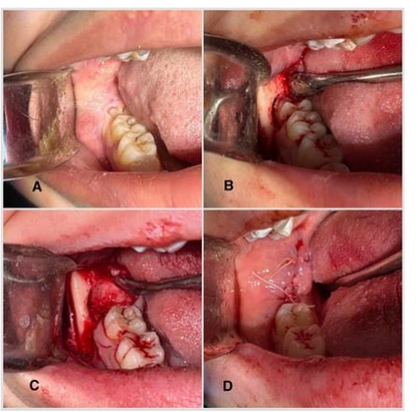


**Figure.4:** Showing the conventional technique for the surgical extraction of impacted mandibular third molar in group II: (A) Preoperative (B) Flap reflection and buccal bone guttering (C) Extraction socket (D) Suturing the flap in place

The patients in both groups were instructed to bite on a gauze pack for 60 minutes, apply ice packs on the same day of surgery and rinse with chlorohexidine mouth wash for 2 weeks postoperatively.
Antibiotic (Augmentin 1 gm. GlaxoSmithKline Co.) was prescribed prophylactically every 8 hours for 1 week and analgesics (Brufen, Ibuprofen 600 mg) was prescribed to control pain whenever needed.

***Evaluation methods:***

1- Pain:
Pain was evaluated through the Visual analogue scale after 1, 3 and 7 days postoperatively together with counting the total number of analgesic tabs consumed during seven days postoperatively.

2- Swelling:
Swelling was assessed through the sum of measurements of three lines using a tape preoperatively and after 1, 3 and 7 days postoperatively. The first line (AC) extends from the tragus to the corner of the mouth, the second line (AD) from the tragus to the menton and the third line (BE) from outer canthus of the eye to the mandibular angle (Fig.5). [18]

3- Trismus:
Trismus was assessed by measuring the maximum inter-incisal opening using Vernier caliper preoperatively and after 1, 3, and 7 days postoperatively.

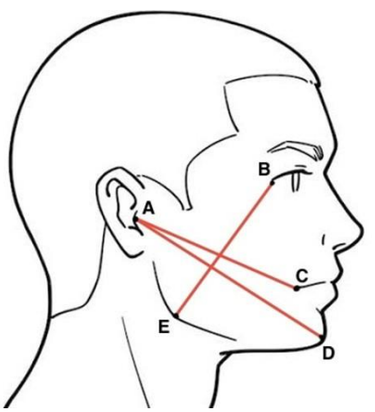


**Figure 5:** Showing swelling assessment through three lines AC, AD, and BE.

***Statistical Analysis***

The Kolmogorov-Smirnov and Shapiro-Wilk tests were among the normality tests used to evaluate the distribution of numerical data and determine whether they were normal. While the number of analgesic tablets taken and pain scores were non-parametric, swelling and maximum interincisal opening (MIO) data had a normal (parametric) distribution. The mean, median, standard deviation (SD), and range values were used to display the data. For parametric data, repeated measures ANOVA was utilized to compare the two groups and examine changes within each group.

When ANOVA results were significant, Bonferroni's post-hoc test was applied for pairwise comparisons. For non-parametric data, the Mann-Whitney U test was used for intergroup comparisons, while Friedman's test analyzed changes within each group. Dunn's test was conducted for pairwise comparisons following a significant Friedman's test, with a significance level $P \leq 0.05$. IBM SPSS Statistics for Windows, Version 23.0 was used to perform the statistical analysis.

## RESULTS:

***Pain (VAS score)***

Group I showed a statistically significant less pain scores compared to group II after 1, 3 and 7 days postoperatively. In both groups, pain scores changed significantly over time. Pairwise comparisons between time points revealed a significant reduction in pain scores from day one to day three and from day three to day seven (Table 1) (Fig.6 ).

**Table (1).** Descriptive statistics and the Mann-Whitney U test were used to compare pain scores between both groups and Friedman's test was used to evaluate the changes within each group

| Time | Group I (n = 12) | | Group II (n = 12) | | P-value | Effect size (d) |
|---|---|---|---|---|---|---|
| | Median (Range) | Mean (SD) | Median (Range) | Mean (SD) | | |
| 1 day | 3 (2, 5) $^{A}$ | 3.25 (0.87) | 6 (4, 8) $^{A}$ | 5.92 (1.08) | <0.001* | 2.68 |
| 3 days | 2 (1, 3) $^{B}$ | 1.83 (0.72) | 3 (1, 5) $^{B}$ | 3.17 (1.03) | 0.002* | 1.504 |
| 7 days | 0 (0, 1) $^{C}$ | 0.33 (0.49) | 1 (0, 3) $^{C}$ | 1.17 (1.11) | 0.044* | 0.814 |
| P-value | <0.001* | | <0.001* | | | |
| Effect size (w) | 0.924 | | 1 | | | |

*: Statistically significant at $P \leq 0.05$. Significant changes within the group are indicated through different superscripts within the same column

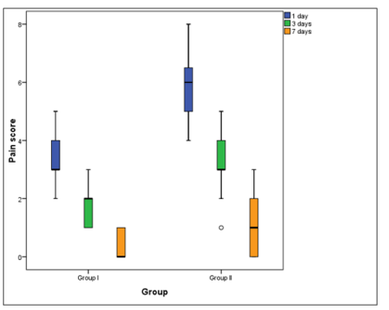


**Figure 6:** Showing a box plot displaying the median and range of pain scores in group I and group II, with a circle indicating an outlier.

***Number of consumed analgesic tablets***

Group I showed a statistically significant less analgesic tabs consumed compared to group II during a period of 7 days postoperatively. (Table 2).

**Table (2)**. Descriptive statistics and Mann-Whitney U test results analyzing the differences in analgesic tablet consumption between the two groups

| Group I (n = 12) | | Group II (n = 12) | | P-value | Effect size (d) |
|---|---|---|---|---|---|
| Median (Range) | Mean (SD) | Median (Range) | Mean (SD) | | |
| 5 (3, 7) | 5.08 (1.24) | 10 (7, 14) | 10.25 (1.66) | <0.001* | 3.056 |

*: Significant at P ≤ 0.05

***Swelling (cm)***

A non-statistically significant difference between the two groups was reported preoperatively and after 1 and 7 days postoperatively. However, there was a significantly less swelling measurements in group I patients compared to group II after 3 days postoperatively (Table 3) (Fig.7).

In Group I, there was a statistically significant swelling measurements change over time. Pairwise comparisons revealed a significant increase in swelling after one day and from day one to day three. From three to seven days, there was a statistically significant decrease in swelling measurements. Swelling measurements after seven days showed non-statistically significant differences from pre-operative measurement.

In Group II, there was a statistically significant swelling measurements change over time. Pair-wise comparisons between time periods revealed that there was a statistically significant increase in swelling measurements after one day, from one to three days. From three to seven days, there was a statistically significant decrease in swelling measurements. Swelling measurements after seven days showed statistically significantly higher mean value compared with pre-operative measurement.

**Table (3).** Descriptive statistics and repeated measures ANOVA results for comparing swelling measurements (cm) between the two groups and assessing changes within each group.

| Time | Group I (n = 12) | | Group II (n = 12) | | P-value | Effect size (Partial Eta squared) |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | |
| Pre-operative | 34.33 $^{C}$ | 0.98 | 34.33 $^{D}$ | 1.3 | 1 | 0 |
| 1 day | 35.17 $^{B}$ | 1.11 | 35.83 $^{B}$ | 1.19 | 0.171 | 0.083 |
| 3 days | 35.67 $^{A}$ | 1.37 | 37.17 $^{A}$ | 1.59 | 0.021* | 0.218 |
| 7 days | 34.5 $^{C}$ | 1.09 | 35.17 $^{C}$ | 1.8 | 0.284 | 0.052 |
| P-value | <0.001* | | <0.001* | | | |
| Effect size (Partial Eta squared) | 0.783 | | 0.939 | | | |

*: Statistically significant at P ≤ 0.05. Different superscripts within the same column denote significant changes within the group.

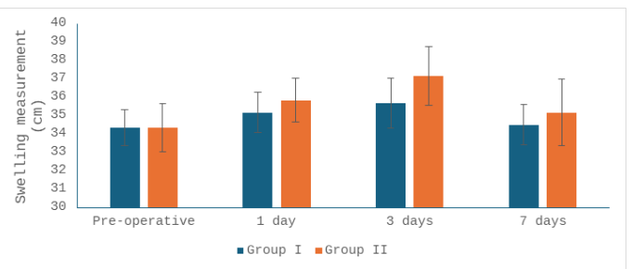


**Figure 7**: A bar chart showing the mean and standard deviation for swelling values in both groups

***Maximum Inter-incisal Opening [MIO in mm]***

A non-statistically significant difference between both groups was reported preoperatively and after seven days postoperatively. However, group I showed a statistically significant more MIO compared to group II after 1 and 3 days postoperatively (Table 4) (Fig.8).

In Group II, MIO measurements exhibited a statistically significant change over time. Pairwise comparisons between time periods indicated a statistically significant decrease in MIO measurements after one day and from one to three days. From three to seven days, there was a statistically significant increase in MIO measurements. There was a statistically significant lower MIO measurement after 7 days postoperatively compared to preoperative measures.

**Table (4).** Descriptive statistics and repeated measures ANOVA findings for evaluating MIO measurements (mm) between the two groups and analyzing variations within each group over time.

| Time | Group I (n = 12) | | Group II (n = 12) | | P-value | Effect size (Partial Eta squared) |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | |
| Pre- | 42.67 $^{A}$ | 1.83 | 41.17 $^{A}$ | 2.25 | 0.087 | 0.128 |
| 1 day | 40 $^{B}$ | 1.76 | 37.17 $^{C}$ | 2.52 | 0.004* | 0.317 |
| 3 days | 37.75 $^{C}$ | 1.91 | 33.92 $^{D}$ | 2.87 | 0.001* | 0.402 |
| 7 days | 42.25 $^{A}$ | 1.82 | 40.5 $^{B}$ | 2.35 | 0.054 | 0.159 |
| P-value | <0.001* | | <0.001* | | | |
| Effect size (Partial Eta | 0.949 | | 0.976 | | | |

*: Statistically significant at P ≤ 0.05. Significant changes within the group are indicated by different superscripts within the same column.

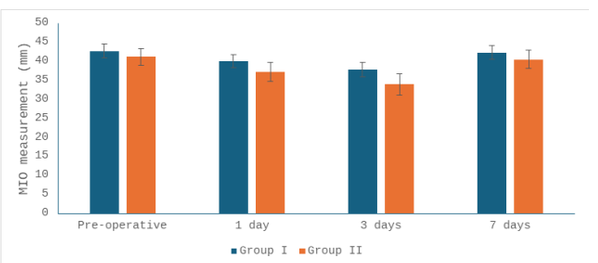


**Figure 8 :** A bar chart showing the mean and standard deviation for MIO values in both groups

## DISCUSSION

Following the surgical removal of impacted teeth, the patients usually suffer from pain and swelling that may impact their quality of life during the postoperative period. This necessitates clinical trials for more conservative approaches in an attempt to minimize these complications.[5, 7, 14] In the present study, both groups showed highest pain scores after one day postoperatively that decreased gradually over the 3rd day and the 7th day postoperatively. This agrees with Ayaz et al [19] who reported that the peak level of pain following surgical removal of impacted teeth was 12-24 hours postoperatively where mild pain was reported on the 3rd day and the pain almost subsides on the 7$^{th}$ day postoperatively.

In this study, group II (Control) showed a statistically significant higher pain scores compared to group I (Study) after 1, 3 and 7 days postoperatively with statistically significantly more number of analgesic tabs consumed. This coincides with Al-Omiri and Khraisat [20] and Bello et al [21] stating that increased tissue injuries and bone removal lead to more release of inflammatory mediators including bradykinin which has been shown to be responsible for pain production.

In our study, both groups showed minor edema and swelling after 1 day postoperatively that gradually increased to reach the peak after 3 days with almost complete resolution after 7 days postoperatively. This is found to be in agreement with other authors [19, 22] reporting that the onset of edema after third molar surgeries is gradual reaching the maximum swelling after 48-72 hours postoperatively where regression starts after 4 days and resolution occurs by the 7$^{th}$ day postoperatively.

In the current study, group II (Conventional group) showed a statistically significant more swelling values in comparison to group I (Conservative group) after 3 days postoperatively. This supports the results of Atalay et al [23] who reported that the amount of bone removal is strongly related to the level of edema where a statistically significant more edema was found following the surgical removal of complete bony impactions compared to partial bony impactions.

In the present study, both groups showed decrease in the maximum inter-incisal opening after 1 day postoperatively with more decrease after 3 days and almost returning to the normal values after 7 days postoperatively mainly in group I patients. Our results concerning trismus after one day postoperatively with the peak level of pain score reported after 1 day coincides with Miloro et al [24] who reported that patients in pain avoid opening their mouths and that pain is one of the main reasons for the limited mouth opening after surgical removal of impacted mandibular third molar teeth. Our results concerning more limitation in mouth opening after 3 days postoperatively with the peak level of edema reported on the third day agrees with other authors [23, 24] reporting a significant correlation between edema and trismus.

In this study, group II patients showed a statistically significant more trismus compared to group I after 1 and 3 days postoperatively. This is found to be in agreement with the findings of Bello et al [21], Atalay et al [23]and Miloro et al [24] who reported that impacted mandibular third molars that require more bone removal results in more postoperative pain and edema and subsequently more limitation in mouth opening.

## CONCLUSION:

Surgical techniques that preserve the alveolar bone during the extraction of impacted mandibular third molars result in reduced pain, swelling, and trismus compared to more invasive approaches. Our bone preservation technique showed excellent results regarding the clinical outcomes compared to the conventional technique and we recommend it for further clinical trials with different classifications of impacted mandibular third molar teeth.

## CONFLICT OF INTEREST

This clinical study was self-funded by the authors, with no conflict of interest.

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