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Comparative evaluation of Twin Mix versus Modified Twin Mix anesthetic solutions in impacted mandibular third molar surgeries: A split-mouth clinical study

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Abstract
Background: Surgical removal of impacted mandibular third molars often results in postoperative pain, swelling, and trismus. Corticosteroids like dexamethasone have been used to mitigate these sequelae. This study compares the efficacy of Twin Mix (2% lignocaine + dexamethasone) with Modified Twin Mix (4% articaine + dexamethasone) in controlling postoperative complications.
Materials and Methods: A prospective split-mouth study was conducted on 20 patients with bilaterally impacted mandibular third molars. Group A received Twin Mix and Group B received Modified Twin Mix. Parameters assessed included onset and duration of anesthesia, pain (VAS), mouth opening, and facial swelling on postoperative days 2, 7, and 14.
Results: Modified Twin Mix demonstrated significantly faster onset ($p < 0.001$) and longer duration of anesthesia ($p < 0.001$). It also showed significantly reduced pain scores and better mouth opening on postoperative day 7. No significant differences were observed in swelling at S1 and S2, but S3 showed significantly less swelling in the Modified Twin Mix group on day 14.
Conclusion: Modified Twin Mix is more effective than Twin Mix in providing prolonged anesthesia, faster onset, and improved postoperative comfort, making it a suitable alternative in third molar surgery.

Keywords: Articaine, Lidocaine, Dexamethasone, mandibular third molar, Twin Mix, anesthetic efficacy, split-mouth study

Introduction

Tooth impaction is a frequently encountered dental anomaly, affecting approximately 20% of the population, with the mandibular and maxillary third molars being the most commonly impacted teeth [1]. Impacted mandibular third molars can lead to various complications such as pericoronitis, periodontitis, resorption of adjacent tooth roots, pain, cyst formation, odontogenic tumors, and dental crowding, which adversely affect patients' oral health and quality of life. Therefore, early surgical removal of impacted third molars is widely recommended to prevent these pathological conditions [1].

The surgical extraction of impacted mandibular third molars is one of the most commonly performed procedures in oral and maxillofacial surgery. However, this procedure is associated with significant postoperative sequelae including pain, swelling, and trismus, mainly due to soft tissue and bone trauma, vascular dilation, increased capillary permeability, and obstruction of local lymphatic drainage by fibrin clots [2, 3]. These inflammatory responses impair routine activities such as mastication and speech, prompting the use of anti-inflammatory medications postoperatively to improve patient comfort [4].

Corticosteroids, especially dexamethasone, are powerful anti-inflammatory agents frequently used in oral surgery to reduce postoperative edema and pain. Their mechanism involves suppressing the synthesis of inflammatory mediators such as prostaglandins and leukotrienes, stabilizing cell membranes, and reducing proteolytic enzyme release [5, 6, 7]. Additionally, corticosteroids have been suggested to promote nerve healing and improve recovery [8]). While intravenous and intramuscular routes of steroid administration are well-studied, local administration during dental procedures is less commonly practiced by general dental surgeons, despite its clinical relevance [9, 10].

Effective local anesthesia is crucial in third molar surgery to manage intraoperative pain. The inferior alveolar nerve block is the most frequently used technique in mandibular procedures but has a notable failure rate. Lidocaine (2% with 1:80,000 or 1:200,000 adrenaline) has been considered the standard anesthetic since its introduction in 1948 due to its safety and effectiveness. However, articaine (4% with 1:200,000 adrenaline) has gained attention for its superior liposolubility, faster onset, longer duration, and better bone penetration, making it a promising alternative [13, 20].

Traditionally, third molar extractions are performed using inferior alveolar, lingual, and buccal nerve blocks with lignocaine, followed by corticosteroid administration to manage postoperative discomfort. This study was designed to compare the clinical effectiveness of Twin Mix (2% lignocaine with 1:200,000 adrenaline and 4 mg dexamethasone) versus Modified Twin Mix (4% articaine with 1:200,000 adrenaline and 4 mg dexamethasone) for mandibular nerve block in third molar surgeries. The study was conducted as an analytical prospective case series in patients reporting to the Oral and Maxillofacial Surgery Department.

Materials and Methods

This study was designed as a split-mouth comparative study and conducted in the Department of Oral and Maxillofacial Surgery, Pacific Dental College and Hospital, Udaipur, Rajasthan, India, after obtaining approval from the Institutional Scientific and Ethical Review Board (IEC

approval) and written informed consent from all participants. A total of 20 patients, aged between 20 and 50 years, with bilaterally impacted mandibular third molars of similar difficulty index (based on Pell and Gregory classification) were selected for the study. Patients with systemic diseases affecting bone healing, pathological conditions at the surgical site, active infections, chronic smokers or alcoholics, metabolic or endocrine disorders, and pregnant or lactating women were excluded.

Each patient underwent bilateral surgical extraction of impacted mandibular third molars in two separate sessions. Group A received a Twin Mix solution consisting of 2% lignocaine with 1:200,000 adrenaline combined with 1 ml dexamethasone, while Group B received a Modified Twin Mix solution of 4% articaine with 1:200,000 adrenaline combined with 1 ml dexamethasone. In every patient, the right mandibular third molar [48] was treated with the Modified Twin Mix (Group B), and the left mandibular third molar [38] was treated with the Twin Mix (Group A).

Preoperative assessments included recording patient history, intraoral periapical radiographs, and orthopantomographs, along with baseline measurements of facial dimensions and inter-incisal mouth opening. Under standard aseptic protocols, the appropriate local anesthetic solutions were administered via inferior alveolar, lingual, and long buccal nerve blocks. Onset and duration of anesthesia were observed and documented for both groups.

Surgical extraction was performed using a straight handpiece connected to a micromotor operating at 25,000 to 35,000 RPM, with external saline irrigation. Bone cutting was achieved using SS White round carbide bur (No. 8) and straight fissure carbide bur (No. 702). After adequate bone removal, the tooth was extracted. The surgical site was debrided and irrigated with a combination of povidone-iodine and normal saline, followed by closure using non-resorbable 3-0 black braided silk sutures. Postoperatively, patients were prescribed Amoxicillin with Clavulanic Acid 625 mg thrice daily, and Aceclofenac (100 mg) combined with Serratiopeptidase (15 mg) and Paracetamol (325 mg) twice daily for five days.

Postoperative assessments were performed on the 2nd, 7th, and 14th days. Pain was recorded using a 10 cm Visual Analogue Scale (VAS), where 0 indicated no pain and 10 represented the most severe pain. Facial swelling was measured using the Gabka and Matsumura scale, with measurements taken from lateral corner of the eye to the angle of the mandible (AB = S1), tragus to corner of the mouth (CD = S2), and tragus to soft tissue pogonion (CE = S3). Trismus was evaluated by measuring the inter-incisal distance (in millimeters) at maximum mouth opening. All parameters were compared to baseline measurements recorded preoperatively.

RESULTS

A total of 20 patients (11 males and 9 females) aged between 20 and 50 years, requiring bilateral mandibular third molar removal, were included in the study. The mean age of the study population was 31.90 ± 10.06 years.

Table 1: Demographic Details of Study Population

Variable	Estimate
Age (years)	31.90 ± 10.06
Gender	Male: 11 (55%) Female: 9 (45%)

Table 2: Postoperative pain was assessed on the 2nd, 7th, and 14th postoperative days using a 10 cm Visual Analogue Scale (VAS).

Interval	Twin Mix (Mean ± SD)	Modified Twin Mix (Mean ± SD)	p-value
Day 2	5.50 ± 1.32	4.05 ± 1.23	0.001*
Day 7	3.25 ± 1.33	1.80 ± 1.11	0.001*
Day 14	1.25 ± 1.16	0.20 ± 0.41	0.002*

*Mann-Whitney test; *Significant at $p \leq 0.05$

On all postoperative intervals, the Modified Twin Mix group showed significantly lower pain scores compared to the Twin Mix group, indicating superior postoperative analgesia with Modified Twin Mix.

Table 3: Comparison of Mouth Opening (in mm)

Interval	Twin Mix (Mean ± SD)	Modified Twin Mix (Mean ± SD)	p-value
Pre-op	40.15 ± 2.23	40.15 ± 2.23	1.000
Day 2	31.65 ± 4.55	33.75 ± 4.55	0.153
Day 7	35.80 ± 3.07	37.80 ± 3.12	0.048*
Day 14	39.05 ± 2.19	40.10 ± 2.27	0.145

*Independent t-test; *Significant at $p \leq 0.05$

Preoperative mouth opening was comparable between groups. On day 7, patients in the Modified Twin Mix group exhibited significantly greater mouth opening compared to the Twin Mix group, indicating less trismus. Other intervals showed no significant difference.

Table 4: Comparison of Onset and Duration of Anesthesia (in minutes)

Parameter	Twin Mix (Mean ± SD)	Modified Twin Mix (Mean ± SD)	p-value
Onset	2.31 ± 0.56	1.30 ± 0.12	<0.001*
Duration	2.54 ± 0.36	3.73 ± 0.40	<0.001*

#Independent t-test (Onset); ¥Mann-Whitney test (Duration)
*Significant at $p \leq 0.05$

The Modified Twin Mix group showed significantly faster onset of anesthesia and longer duration of anesthetic effect compared to the Twin Mix group, demonstrating greater clinical efficiency.

Table 5: Comparison of Facial Measurement S1 (in cm)

Interval	Twin Mix (Mean ± SD)	Modified Twin Mix (Mean ± SD)	p-value
Pre-op	11.25 ± 0.82	11.25 ± 0.82	1.000
Day 2	11.68 ± 0.80	11.50 ± 0.82	0.056
Day 7	11.33 ± 0.82	11.33 ± 0.82	1.000
Day 14	11.25 ± 0.82	11.25 ± 0.82	1.000

*Mann-Whitney test; No significant differences observed.

Table 6: Comparison of Facial Measurement S2 (in cm)

Interval	Twin Mix (Mean ± SD)	Modified Twin Mix (Mean ± SD)	p-value
Pre-op	10.35 ± 0.42	10.35 ± 0.42	1.000
Day 2	10.76 ± 0.32	10.59 ± 0.36	0.115
Day 7	10.61 ± 0.34	10.45 ± 0.35	0.151
Day 14	10.43 ± 0.38	10.40 ± 0.35	0.763

*Independent t-test; No significant differences observed.

Table 7: Comparison of Facial Measurement S3 (in cm)

Interval	Twin Mix (Mean ± SD)	Modified Twin Mix (Mean ± SD)	p-value
Pre-op	14.57 ± 1.12	14.57 ± 1.12	1.000
Day 2	15.00 ± 1.19	14.57 ± 1.12	0.005*
Day 7	14.83 ± 1.17	14.63 ± 1.13	0.201
Day 14	14.70 ± 1.15	11.25 ± 0.82	<0.001*

*Mann-Whitney test; *Significant at $p \leq 0.05$

Facial swelling (S3) was significantly higher in the Twin Mix group on day 2 and significantly lower in the Modified Twin Mix group by day 14, suggesting better resolution of swelling with Modified Twin Mix.

Discussion

The surgical removal of third molars is frequently associated with significant postoperative discomfort due to soft tissue trauma, leading to an inflammatory response. Prostaglandins (PGs) derived from cyclooxygenase (COX) play a key role in the development of postoperative pain and swelling [5, 32]. Corticosteroids such as dexamethasone are widely used in dentoalveolar surgery due to their potent anti-inflammatory effects, minimal mineralocorticoid action, and lower adverse impact on leukocyte chemotaxis [26]. Their mechanism includes inhibition of phospholipase A2, preventing arachidonic acid formation and thus reducing prostaglandins, leukotrienes, and thromboxane synthesis [2, 5, 22, 23, 25, 32, 33].

Glucocorticoids can be administered orally or parenterally, with intramuscular injections providing prolonged anti-inflammatory action and rapid effect, without the adrenal suppression risk of repeated systemic doses [29, 32]. Dexamethasone is especially advantageous due to its long-acting properties and high potency [10]. NSAIDs, while commonly used, have limited anti-inflammatory effects and potential side effects like gastric irritation and allergic reactions [38].

In this study, a single dose of 4 mg dexamethasone was added to the local anesthetic solution, comparing Modified Twin Mix (4% Articaine + Adrenaline + Dexamethasone) with standard Twin Mix (2% Lignocaine + Adrenaline + Dexamethasone) in 20 patients (mean age 31.90 years; 55% males, 45% females).

Postoperative pain, assessed by VAS, was significantly lower in the Modified Twin Mix group across all time points: Day 2 (4.05 vs. 5.50, $p = 0.001$), Day 7 (1.80 vs. 3.25, $p = 0.001$), and Day 14 (0.20 vs. 1.25, $p = 0.002$). This suggests superior analgesic and anti-inflammatory effects, potentially reducing the need for additional analgesics.

Trismus was significantly less on Day 7 in the Modified Twin Mix group (37.80 mm vs. 35.80 mm, $p = 0.048$), indicating reduced postoperative muscle stiffness and inflammation. By Day 14, no significant difference was noted, showing both groups had largely recovered.

Regarding anesthesia, Modified Twin Mix showed significantly faster onset (1.30 min vs. 2.31 min, $p < 0.001$) and longer duration (3.73 min vs. 2.54 min, $p < 0.001$), likely due to the greater liposolubility and better bone diffusion of articaine [13].

Facial swelling was assessed at three points (S1, S2, S3). No significant differences were observed for S1 and S2. However, S3 swelling was significantly lower in the Modified Twin Mix group both on Day 2 (14.57 mm vs. 15.00 mm, $p = 0.005$) and Day 14 (11.25 mm vs. 14.70 mm, $p < 0.001$), reflecting a more effective early and sustained anti-inflammatory action.

In conclusion, the Modified Twin Mix demonstrated advantages over the standard Twin Mix, offering faster and prolonged anesthesia, better pain control, reduced trismus, and less facial swelling. These improvements could lead to enhanced patient comfort, decreased analgesic requirement, and overall improved postoperative recovery in third molar surgeries.

Conclusion

This study evaluated the efficacy of Twin Mix and Modified Twin Mix anaesthetic solutions in managing postoperative

outcomes following the surgical removal of impacted mandibular third molars. A total of 20 patients with bilateral impacted lower third molars were treated using a split-mouth design, where Group A received the Twin Mix solution (2% Lignocaine with 1:200,000 Adrenaline and 1 ml Dexamethasone) and Group B received the Modified Twin Mix solution (4% Articaine with 1:200,000 Adrenaline and 1 ml Dexamethasone). Preoperative measurements of interincisal mouth opening and facial dimensions were recorded, and postoperative evaluations were carried out on the 2nd, 7th, and 14th days to assess pain (using the Visual Analogue Scale), facial swelling, and trismus. Additionally, the onset and duration of anaesthesia were recorded for each group.

The results showed that the Modified Twin Mix group experienced significantly lower postoperative pain at all time points compared to the Twin Mix group. While facial swelling did not differ significantly between groups, trismus improved significantly in the Modified Twin Mix group by the 7th postoperative day. Furthermore, the Modified Twin Mix solution provided a significantly faster onset and longer duration of anaesthesia. These findings indicate that the Modified Twin Mix offers superior clinical performance, with enhanced postoperative analgesia and better management of trismus. Therefore, the Modified Twin Mix can be considered a safe and effective alternative, improving patient comfort and overall outcomes in mandibular third molar surgeries.

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