RESEARCH PAPER

Efficacy and post operative sequalae of prophylactic removal of bilaterally impacted third molars using Ropivacaine with or without Dexamethasone- a randomized double blind split mouth study.

Post graduate Dr Debleena Sarkar[1*], Professor Dr Geeta Sharma[2]

[1,2*]Dr Amit Gupta, Prof And Hod. Dr Tushar Dubey, READER , ITS Center For Dental Science And Research, Muradnagar Ghaziabad-201206

***Corresponding Author:** DR GEETA SHARMA dr.geetasharma@its.edu.in

ABSTRACT

Background: This study aims to assess the effectiveness and post-operative results of using Ropivacaine, a long-acting amide local anesthetic, with or without dexamethasone for the extraction of an impacted lower third molar and assessed on the basis of duration of analgesia, pain, oedema and trismus at post operative day 1,3 & 7.

Method: A prospective, randomized split mouth study was conducted among 18 patients (36 sites) with bilateral impacted mandibular third molars who were randomly allotted to two groups group R & group R+D. Group R received 0.75% ropivacaine and group R+D received 0.75% ropivacaine + dexamethasone.

Results: The duration of soft tissue analgesia was greater in the group R+D than group R with a significant difference. Patients in the control group experienced more pain than ropivacaine group with a significant difference. Patients in the group R+D was significantly better in control in oedema than the group R. Both the groups had no difference in terms of trismus.

Conclusion: Post-operative comfort in the group R+D were higher than the control group R, establishing the clinical efficacy of dexamethasonized ropivacaine.

Keywords: Ropivacaine, impacted third molars, oedema, pain, ropivacaine and dexamethasone

INTRODUCTION

Surgical removal of impacted mandibular third molar is the routine procedure for oral and maxillofacial surgeon performed generally under local anaesthesia[1]. Lidocaine, a short-acting amide local anesthetic, is regarded as the gold standard anesthetic agent in oral and maxillofacial surgery[2]. Pain typically peaks within 3–5 hours postoperatively, leading to significant uneasiness, agitation, and anxiety. Proper postoperative pain management enhances emotional well-being, promotes faster recovery[1]. In dentistry, long-acting local anesthetics are the preferred choice for pain control. Administering these anesthetics pre-emptively helps block pain signals, thereby reducing pain intensity. Bupivacaine poses cardiac risks; thus, ropivacaine is preferred for its longer anaesthesia duration, lower cardiotoxicity, and selective analgesia targeting pain fibres without affecting motor function[3,4,5].

Many postoperative complications associated after extraction of third molar which may include pocket formation distal to adjacent tooth, alveolitis sicca, haemorrhage, inferior alveolar nerve injury, and even the fracture of mandible[2] but pain and swelling are the most commonly occurred postoperative complication in every patients[6].

Dexamethasone, a synthetic corticosteroid about 25 times more active than hydrocortisone, is clinically effective in reducing post-operative side effects. Its anti-inflammatory properties stem from the inhibition of phospholipase A2, which lowers the release of important inflammatory mediators like prostaglandins, leukotrienes, and thromboxane. As a result, it significantly alleviates inflammation, which typically reaches its peak two days after surgery[7,8].

The aim of our study was to evaluate the efficacy and post operative sequalae of prophylactic removal of a bilaterally impacted wisdom tooth by using Ropivacaine with or without Dexamethasone in a split mouth study.

MATERIAL & METHODOLOGY

A prospective, randomized split mouth study was carried out in the Department of Oral and Maxillofacial Surgery at ITS Dental College & Research Centre, Muradnagar, Ghaziabad on patients having bilaterally impacted mandibular third molars. The study was approved by research ethical committee (ITSCDSR/Director-Principal/2024/L/096). The study was conducted among 18 patients (36 sites) who were above 18 years of age with bilateral impacted mandibular third molars who were randomly allotted to two groups A & group B. Presence of acute infection in patients at time of surgery, presence of pericoronitis , history of allergy to any anesthesia were excluded from this study.

Group A have received ropivacaine. Group B have received ropivacaine with Dexamethasone.

Bilateral mandibular third molars were removed within a period of 10-14 days between each other. Among these two groups, onset of anaesthesia, pain, oedema and trismus were assessed.

After administering local anaesthesia (LA) or a twin mix to the designated group, an incision was made. A modified Ward's incision was done followed by the gentle elevation of a full-thickness mucoperiosteal flap to avoid any tearing. The bone covering the tooth was

*Author for Correspondence: dr.geetasharma@its.edu.in

removed with a round bur under continuous saline irrigation to expose the entire crown. After carefully removing all parts of the tooth, the surgical area was washed with saline. The flap was sutured to effect primary wound closure.

Subjective evaluation was based on self-assessment of pain intensity i.e. pain with a Visual analogue scale VAS), Objective evaluation was done by measuring the mouth opening i.e., inter-incisal distance with a metallic scale. Facial oedema was assessed on Postoperative days 1, 3 and 7 using constant soft tissue landmarks i.e., linear measurement between corner of lip and tragus, between outer canthus of eye and angle of mandible, between tragus and chin.

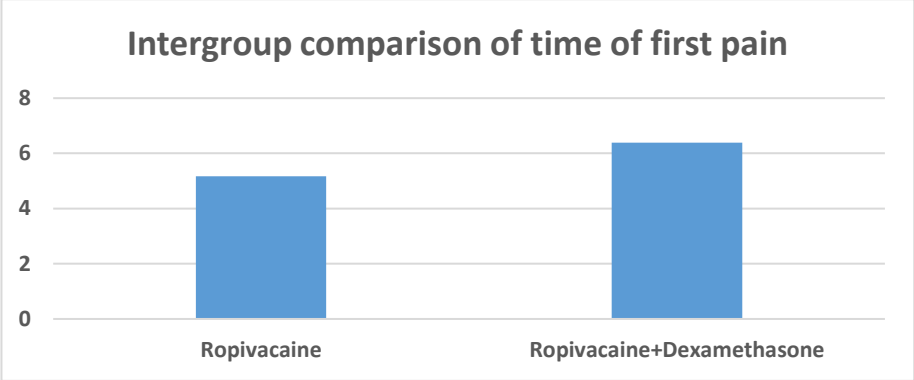
Statistical analysis was performed with SPSS v 26 Comparison of pain, oedema and trismus was done either using two way ANOVA or Mann Whitney test.

RESULTS

Group	Mean	SD	Difference	p-value
Ropivacaine	5.17	0.71	-1.22	<0.001*
Ropivacaine+Dexamethasone	6.39	0.85		

Mann Whitney test; * indicates a significant difference at p≤0.05

TABLE 1: Intergroup comparison of time of first pain

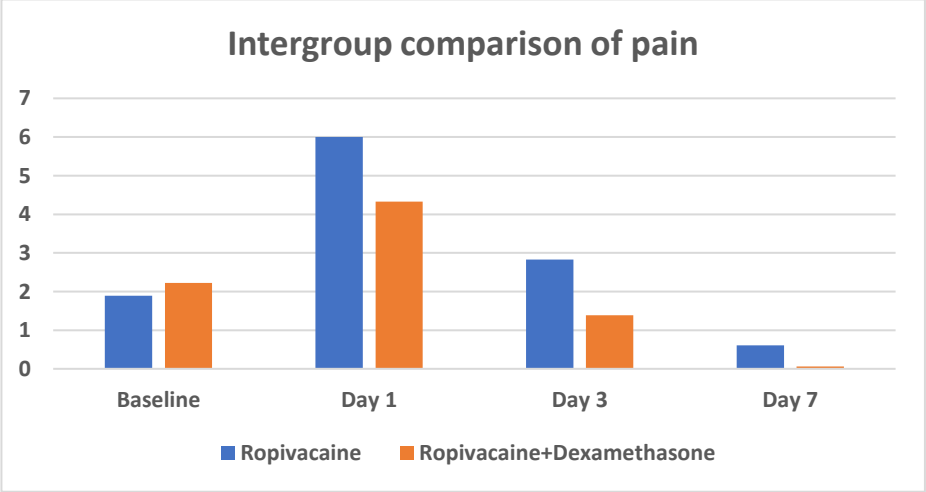


Graph 1 presents a Intergroup comparison of time of 1st pain(duration of analgesia)

Interval	Ropivacaine		Ropivacaine+Dexamethasone		p-value
	Mean	SD	Mean	SD	
Baseline	1.89	2.74	2.22	2.53	0.696
Day 1	6.00	0.97	4.33	0.69	<0.001*
Day 3	2.83	1.04	1.39	0.61	<0.001*
Day 7	0.61	0.70	0.06	0.24	0.020*

Mann Whitney test; * indicates a significant difference at p≤0.05

TABLE 2: Intergroup comparison of pain

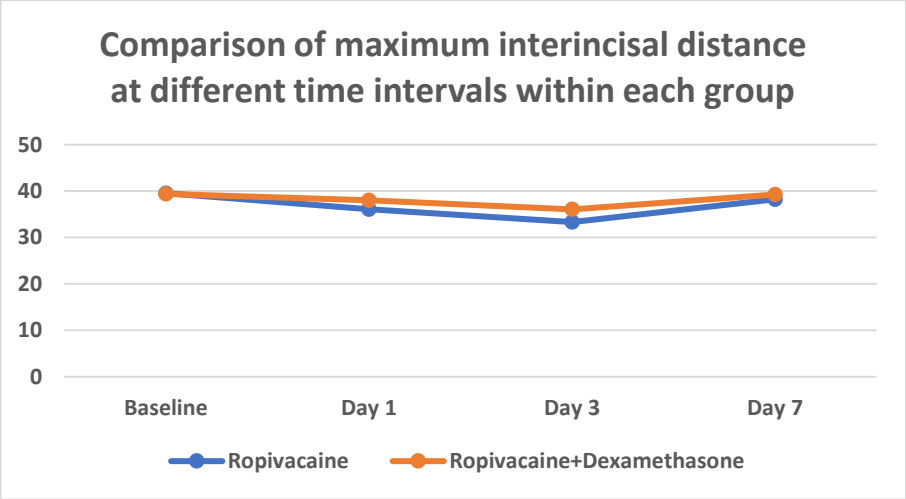


Graph 2 compares the pain scores at various time intervals within each group.

Interval	Mean	SD	p-value
Ropivacaine			
Baseline	39.56	1.50	<0.001*
Day 1	36.11	1.68	
Day 3	33.33	2.00	
Day 7	38.22	1.44	
Ropivacaine+Dexamethasone			
Baseline	39.39	1.54	<0.001*
Day 1	38.00	1.61	
Day 3	36.06	1.66	
Day 7	39.28	1.36	

Repeated measures ANOVA test; * indicates a significant difference at p≤0.05

TABLE 3: Comparison of maximum interincisal distance at different time intervals within each group

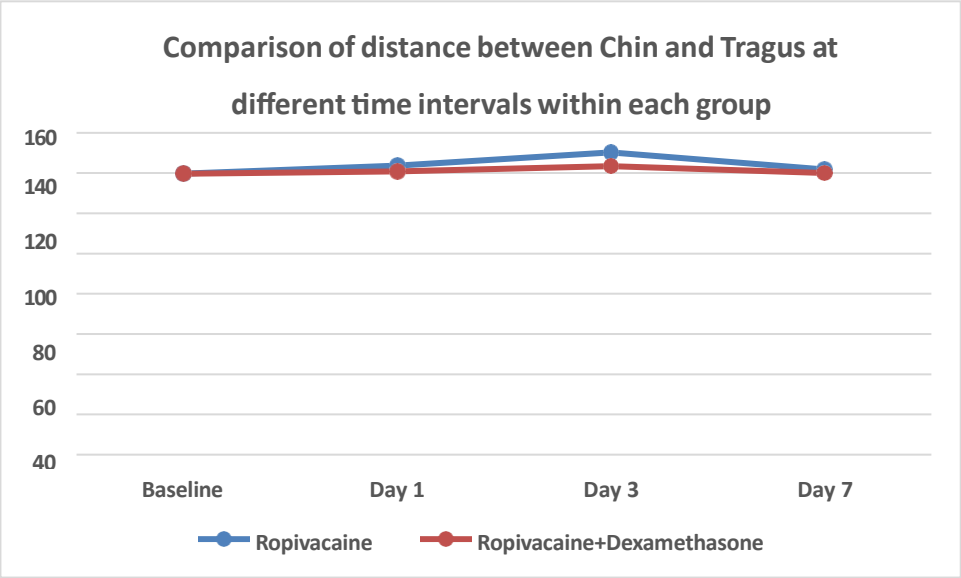


Graph 3 shows the comparison of maximum interincisal distance at different time points within each group.

Interval	Mean	SD	p-value
Ropivacaine			
Baseline	139.72	3.50	<0.001*
Day 1	143.72	3.58	
Day 3	150.28	3.43	
Day 7	141.72	3.30	
Ropivacaine+Dexamethasone			
Baseline	139.67	3.41	<0.001*
Day 1	140.83	3.71	
Day 3	143.44	3.96	
Day 7	140.11	3.29	

Repeated measures ANOVA test; * indicates a significant difference at p≤0.05

TABLE 4: Comparison of distance between Chin and Tragus at different time intervals within each group

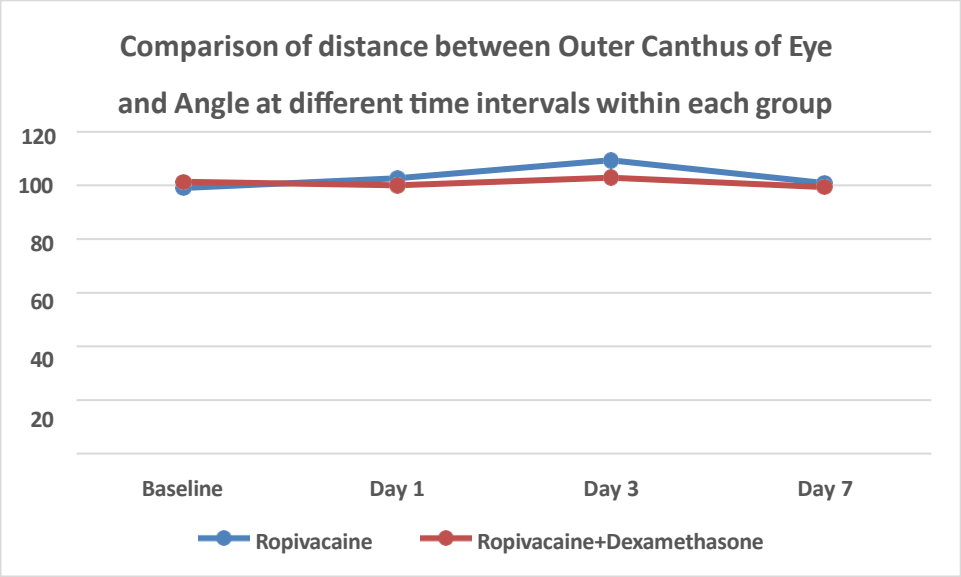


Graph 4 compares the distance between chin and tragus.

Interval	Mean	SD	p-value
Ropivacaine			
Baseline	99.06	2.41	<0.001*
Day 1	102.72	2.91	
Day 3	109.39	2.59	
Day 7	100.89	2.52	
Ropivacaine+Dexamethasone			
Baseline	101.33	9.45	0.206
Day 1	100.11	2.65	
Day 3	102.89	2.74	
Day 7	99.39	2.55	

Repeated measures ANOVA test; * indicates a significant difference at p≤0.05

TABLE 5: Comparison of distance between Outer Canthus of Eye and Angle at different time intervals within each group

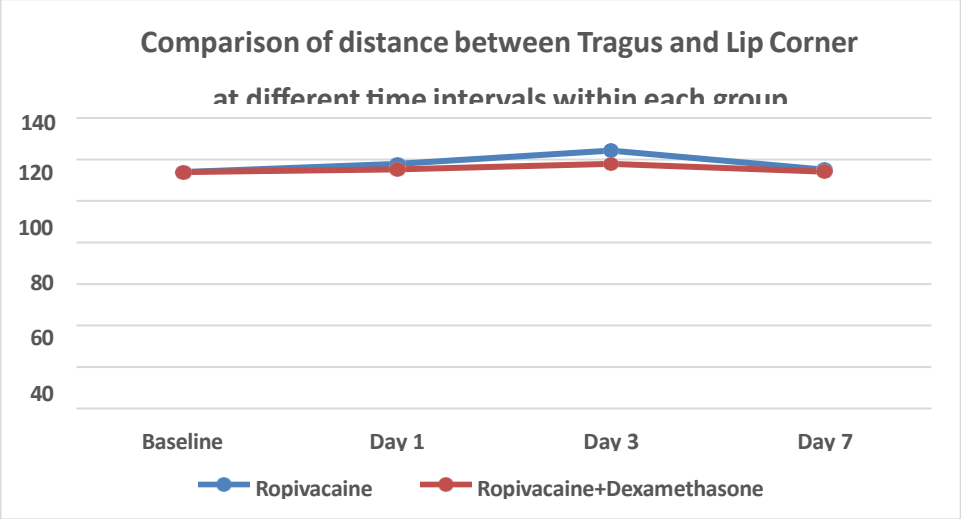


Graph 5 compares the distance between outer canthus and angle.

Interval	Mean	SD	p-value
Ropivacaine			
Baseline	113.94	1.63	<0.001*
Day 1	117.89	1.57	
Day 3	124.28	2.08	
Day 7	115.11	2.03	
Ropivacaine+Dexamethasone			
Baseline	113.94	1.63	<0.001*
Day 1	115.28	1.64	
Day 3	117.89	1.75	
Day 7	114.17	1.69	

Repeated measures ANOVA test; * indicates a significant difference at p≤0.05

TABLE 6: Comparison of distance between Tragus and Lip Corner at different time intervals within each group



Graph 6 compares the distance between tragus and lip corner.

Interval	Ropivacaine		Ropivacaine+Dexamethasone		p-value
	Mean	SD	Mean	SD	
Baseline	39.56	1.50	39.39	1.54	0.744
Day 1	36.11	1.68	38.00	1.61	0.002*
Day 3	33.33	2.00	36.06	1.66	<0.001*
Day 7	38.22	1.44	39.28	1.36	0.030*

Independent t test; * indicates a significant difference at p≤0.05

TABLE 7: Intergroup comparison of MID

Interval	Ropivacaine		Ropivacaine+Dexamethasone		p-value
	Mean	SD	Mean	SD	
Baseline	139.72	3.50	139.67	3.41	0.962
Day 1	143.72	3.58	140.83	3.71	0.023*
Day 3	150.28	3.43	143.44	3.96	<0.001*
Day 7	141.72	3.30	140.11	3.29	0.152

Independent t test; * indicates a significant difference at p≤0.05

TABLE 8: Intergroup comparison of Distance between Chin and Tragus

Interval	Ropivacaine		Ropivacaine+Dexamethasone		p-value
	Mean	SD	Mean	SD	
Baseline	99.06	2.41	101.33	9.45	0.329
Day 1	102.72	2.91	100.11	2.65	0.008*

Day 3	109.39	2.59	102.89	2.74	<0.001*
Day 7	100.89	2.52	99.39	2.55	0.085

Independent t test; * indicates a significant difference at p≤0.05

TABLE 9 : Intergroup Comparison of Distance between Outer Canthus of Eye and Angle

Interval	**Ropivacaine**		**Ropivacaine+Dexamethasone**		**p-value**
	Mean	**SD**	**Mean**	**SD**	
Baseline	113.94	1.63	113.94	1.63	1.000
Day 1	117.89	1.57	115.28	1.64	<0.001*
Day 3	124.28	2.08	117.89	1.75	<0.001*
Day 7	115.11	2.03	114.17	1.69	0.138

Independent t test; * indicates a significant difference at p≤0.05

TABLE 10: Intergroup comparison of Distance between Tragus and Lip Corner

The time of first pain in the Ropivacaine+Dexamethasone group was significantly greater than in the Ropivacaine group. At baseline, there was no significant difference in pain scores between the two groups. However, on postoperative days 1, 3, and 7, the Ropivacaine + Dexamethasone group experienced significantly lower pain levels compared to the Ropivacaine group. In the Ropivacaine group, the maximum interincisal distance at baseline was significantly higher than the values recorded on days 1, 3, and 7. In contrast, the Ropivacaine + Dexamethasone group showed a significant reduction in maximum interincisal distance on days 1 and 3 compared to baseline, while the difference between baseline and day 7 was not statistically significant. Table no. 7 shows that at baseline ,there was non significant difference in maximum interincisal distance in both the groups, however on post operative days 1,3and 7, maximum interincisal distance in ropivacaine + dexamethasone group was significantly greater than in ropivacaine group. The distances between Chin–Tragus, Outer Canthus–Angle, and Tragus–Lip Corner showed statistically significant changes from baseline to day 7 in both groups, with values increasing till day 3 and decreasing by day 7. In the Ropivacaine group, all postoperative distances remained significantly higher than baseline. In the Ropivacaine + Dexamethasone group, significant increases were seen on days 1 and 3, while day 7 values were not significantly different from baseline.

The change in distance between Chin and Tragus, Outer Canthus and Angle, and Tragus and Lip Corner from baseline to day 7 was statistically significant in both groups. At baseline, there were non-significant differences in the Distance between the Chin and Tragus, Outer Canthus of the Eye and Angle, and Tragus and Lip Corner of the two groups. However, on postoperative days 1 and 3, the Ropivacaine + Dexamethasone group showed significantly lower distances for all three comparisons than the Ropivacaine group. By day 7, differences were again non-significant for all measurements.

For the Ropivacaine + Dexamethasone group, the increase in distance from baseline was significant on days 1 and 3, but the difference was not significant on day 7. Therefore, while the overall trend from baseline to day 7 was statistically significant in the Ropivacaine + Dexamethasone group, day 7 values alone may not differ significantly from baseline in some parameters.

DISCUSSION

Managing pain effectively has been proven to enhance healing, speed up recovery, and allow for a quicker return to daily activities and lifestyle. Since Koller's 1884 statement, local anesthetics have been widely used in clinical practice for managing both acute and chronic pain, including post-surgical discomfort.

Ropivacaine was developed to lessen toxicity while enhancing sensory and motor blockade effects. It ensures effective intraoperative anesthesia and extends postoperative pain relief, offering a broader safety margin[1]. Its widespread use is due to its high success rate, rapid patient recruitment, versatility, cost-effectiveness, and superior predictability. Moreover, research has indicated that ropivacaine exhibits a greater vasoconstrictive effect compared to bupivacaine and lidocaine[9]. Ropivacaine has selective pain blockade pathway which excludes the motor function[10]. The onset of action of ropivacaine was rapid because of its dearth of binding to extra neural fat & tissues, and allow more of the drug transmission to the nerve site as credited by Akerman et al[11]. Pain after third molar extraction typically peaks in intensity within 6 to 8 hours post-surgery. Ropivacaine was effective in decreasing immediate post operative pain since it has residual analgesic effect that encompasses for 6 hours post operatively, thereby reducing the need of analgesics in the post operative period[12]. This coincides with the results of a study by Ernberg et al who used 0.75% ropivacaine[13]. This is also similar to our study in which ropivacaine was effective in lessening immediate post operative pain.

In this study we aimed to assess the efficacy and post operative sequalae of removal of mandibular impacted third molar by using long-acting amide local anaesthetic agent ropivacaine with or without Dexamethasone.

The duration of analgesia was determined by measuring the number of hours the patient remained pain-free after receiving local anaesthesia until pain returned and an analgesic tablet was taken.The duration of soft tissue

analgesia (in hours) in the Ropivacaine+ Dexamethasone group was significantly greater than in the Ropivacaine group. In a study by K Varun Reddy[1] et al. the durations of soft tissue anaesthesia and postoperative analgesia for ropivacaine was found to be in slight accordance with our study. Another study by Shivangi Gaur[14] et al. which compared the clinical potency of injection of 2 long acting local anaesthetic agents- bupivacaine and ropivacaine with and without 4 mg dexamethasone in patients who went through wisdom tooth disimpaction. In this ropivacaine + dexamethasone was found to be significantly better in providing extended period of numbness compared to others and was in accordance with our study in terms of providing prolonged analgesia in ropivacaine + dexamethasone group than only ropivacaine group.

Pain is a complex and multifaceted phenomenon that can have a great impact on an individual's quality of life. Steroids reduces the activity of phospholipase A thereby affecting the release of arachidonic acid from cell membrane and further blocking the production of prostaglandins, leukotrienes and thromboxane[10,15,16]. Seah et al. confirmed that triamcinolone acetonide combined with bupivacaine enhanced the analgesic effect[17]. Dexamethasone has often been contemplated for managing pain, oedema & trismus after mandibular disimpaction[18]. Boonsiriseth et al. suggested that pre-operative dexamethasone can reduce postoperative pain, facial swelling and trismus[19]. Another study by Mojsa[20] et al. confirmed that a submucosal injection of dexamethasone both pre and post operatively relieved pain more effectively. Another study by Veena Mathur[21] et al. confirmed that Group RD (ropivacaine + dexamethasone) had a significantly lesser VAS score than Group R(ropivacaine) from the 2nd postoperative hour until the 12th hour. In our study, maximum oedema was on third postoperative day in both the groups. This oedema was decreased gradually on subsequent post operative days. The reason behind gradual decrease is that dexamethasone reaches its peak action within 1- 2 hours and its half-life reaches within 36-54 hours.

Restricted mouth opening may occur because of the protective response of the surrounding muscles, which try to alleviate pain from jaw movement due to significant inflammation that affects the chewing muscles, with swelling limiting their elasticity[10]. In our study, maximum interincisal distance is minimum on post operative day 3 which corresponds to maximum oedema on day 3. Ropivacaine + dexamethasone group has statistically more mouth opening than that of ropivacaine group. The maximum interincisal distance decreased till day 3 and thereafter showed an increase on day 7.

We conclude that dexamethasonized Ropivacaine is better than plain 0.75% Ropivacaine in terms of reduced pain, oedema and trismus. We also found that R+ D (ropivacaine + dexamethasone) significantly better in prolonging duration of analgesia.

However, our study does not report the prolonged chemical stability of these admixed solutions. Additional research is needed to evaluate their production, storage, and shelf life for optimal use in everyday practice.

Ethics approval

Ethical clearance was obtained from the Institutional Ethical Committee prior to commencement.

Consent for publication

Written consent was obtained from all patients .

Competing interest

The authors declare that they have no competing interests.

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Author's contributions

MA: Conceptualization; data curation; formal analysis; methodology; writing; comparison of data. **GS**: Guidance & supervision. **AC:** Conceptualization; assistance in manuscript writing.

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