Original Article

COMPARISON OF EFFICACY OF 2% LIDOCAINE AND 0.75% ROPIVACAINE ACTIVITY IN ACHIEVING QUALITATIVE AND QUANTITATIVE ANALGESIA DURING SURGICAL REMOVAL OF IMPACTED MANDIBULAR THIRD MOLARS

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ABSTRACT

Background: Ropivacaine has been successfully used in surgery, gynaecology and obstetrics, but is not currently available for dentists. Reports support the use of Ropivacaine as a long acting local anaesthetic in oral and maxillofacial surgical procedures requiring surgical anaesthesia and post-operative analgesia.

Aim: The aim of the study was to compare the anaesthetic efficacy of 0.75% Ropivacaine with that of 2% Lidocaine Hydrochloride during the surgical removal of impacted mandibular third molars.

Material and Methods: A prospective randomized double-blind clinical trial was conducted on 28 subjects who required surgical extracted of one or both of their impacted mandibular third molars. A single operator performed the extractions following injection of either 0.75% Ropivacaine or 2% Lidocaine Hydrochloride + 1: 80,000 conc. adrenaline, randomly in a double-blind manner. Pain during the surgery was assessed using a Visual Analog Scale. Other parameters that were considered, included the time of onset of anaesthesia, duration of anaesthesia and the need for re-anaesthesia during the procedure.

Results: The results showed that differences in time of onset for 0.75% Ropivacaine (92.27 ± 34.85 secs) and 2% lidocaine (79.14 ± 11.065 secs), duration of action for 0.75% Ropivacaine (5.03 ± 0.41 hrs) and 2% Lidocaine (3.27 ± 056 hrs) and intraoperative pain for 0.75% Ropivacaine (1.27) and 2% Lidocaine (0.00) were statistically significant. Also, 2% of subjects required a re-anaesthesia using 0.75% Ropivacaine whereas none of the subjects which were given 2% Lidocaine, required re-anaesthesia.

Conclusion: The study concludes that the clinical effects of 2% Lidocaine with 1: 80,000 conc. Adrenaline in terms of latency, intraoperative pain control and depth of anaesthesia are superior to 0.75% Ropivacaine, though the latter gives a prolonged duration of anaesthesia.

KEYWORDS:

Lidocaine , Ropivacaine, Impacted Molars

INTRODUCTION

Pain is defined as an unpleasant emotional or sensory experience associated with actual or potential tissue damage or described in terms of

such damage (Burkit). Effective control of pain during dental treatment has been one of the most important prerequisite for practice of painless dentistry. The discovery of anaesthesia has been a great boon to the field of dentistry and surgery in general. Local anaesthesia forms the back bone of pain control techniques in dentistry. Their advantage to block the perception of pain only in limited portion of body and no need of circulation as an intermediate carrier made it more popular as compared to general anaesthetics for local procedures. Lidocaine, an intermediate acting local anaesthetic, still remains the most commonly used agent in a dental setup, owing to its safety and effectiveness. In a quest to discover a more effective anaesthetic, Lidocaine has become a pattern for comparison among newer agents. First used in the Royal Hospital for Women, Sydney in 1992, Ropivacaine is a new amide long-acting local anaesthetic with chemical similarity to Bupivacaine and Mepivacaine. Chemically, Ropivacaine is a monohydrate of the hydrochloride salt of 1-propyl-20,60-pipecoloxylidide. It is less lipophilic than bupivacaine and less liable to penetrate large myelinated motor fibres, therefore has a selective action on the pain transmitting Aδ and C nerves rather than Aδ fibres alone, which are involved in motor function. It is metabolised extensively in the liver, predominantly by aromatic hydroxylation, and excreted through the kidneys. Ropivacaine has been successfully used in surgery, gynaecology and obstetrics, but is not currently available for dentists. Reports support the use of Ropivacaine as a long acting local anaesthetic in oral and maxillofacial surgical procedures requiring surgical anaesthesia and post-operative analgesia[10]. One report also assessed the anaesthetic efficacy of different Ropivacaine concentrations for inferior alveolar nerve block[9]. The anaesthetic efficacy of Ropivacaine, to our knowledge has not been compared with that of the most commonly used Lidocaine. Our study, thus aims at comparing the efficacy of plain 0.75% Ropivacaine with conventional 2% Lidocaine + 1: 80,000 conc. Adrenaline in terms of latency, duration of anaesthesia, pain and need for re-anaesthesia during the surgical removal of impacted mandibular third molars.

METHODOLOGY

A prospective randomized double-blind clinical trial was conducted on 28 subjects over a period of 2 months. Subjects were divided into two groups. The first group comprised 15 patients who received 0.75% Ropivacaine (Ropin,Neon) while the second group of 14 patients received 2% Lidocaine with 1: 80,000 conc. Adrenaline (Lignospan special, Septodant1:80000 adrenaline). Informed written consent was obtained and surgical extraction of impacted mandibular third molar was carried out by a single operator. All injections were administered using a self-aspirating syringe (Septodont) fitted with a long 30-gauge needle (Septodont) for Lidocaine and 3 ml Dora-One syringe with long needle for Ropivacaine. Inferior Alveolar Nerve block was given by administering 1.8 ml of solution (1ml Inferior alveolar nerve, 0.5ml Lingual nerve, 0.3ml Long buccal nerve) at the rate of 1 ml/min. After injection of the anaesthetic solution, the time of onset of anaesthesia was recorded as the time elapsed from full needle withdrawal until the onset of subjective signs of anaesthesia. The duration of anaesthesia was then recorded as the time from initial patient perception of the anaesthetic effect to the moment when the effect began to fade. The need to re-anaesthetize the surgical site was also recorded. The anaesthetic techniques used to re-anesthetize the surgical site comprised intraligamentous and intrapulpal approaches. Also, a Visual Analogue Scale (VAS) was used to subjectively assess the overall pain intensity during surgery. Data was statistically analysed using Windows SPSS Version 16.0. Student's T-test was used to derive the significance in the collected data.

RESULTS

The study comprised a total of 28 patients, of which 11 were males and 17 were females between the age group of 17-40 years, with a mean age of 26.2 years. All patients who had undergone surgical removal of impacted mandibular third molar were evaluated preoperatively. The study group comprised 14 subjects who received 0.75% Ropivicaine whereas the control group consisted of 13 subjects that received 2% Lidocaine with 1:80000 epinephrine. Of the 28 subjects, only one patient underwent surgical extraction of bilateral

impacted mandibular third molars where 0.75% Ropivacaine was given on one side and 2%

Table No 1

Gender	LA used				Total	
	Ropivacaine		Lignocaine			
	N	%	*N*	%	*N*	%
Male	5	33.3	6	42.8	11	39.2
Female	10	66.6	8	57.1	17	60.7
Total	15	100.0	14	100.0	28	100.0

Table No.2

	LA used	N	mean
AGE	Ropivacaine	15	27.6
	Lignocaine	14	24.9

Table No.3

Group Statistics

GROUP		N	Mean	Std. Deviation	Std. Error Mean
ONSET OF ANESTHESIA	0.75 % ROPIVACAINE	15	92.27	34.850	8.998
	2% LIDOCAINE	14	79.14	11.065	2.957

Table No.4

Group Statistics

GROUP		N	Mean	Std. Deviation	Std. Error Mean
DURATION OF ANESTHESIA	0.75 % ROPIVACAINE	15	302.13	24.816	6.407
	2% LIDOCAINE	14	196.43	33.936	9.070

Table No 5

NEED FOR RE - ANESTHESIA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	2	6.9	6.9	6.9
	NO	27	93.1	93.1	100.0
	Total	29	100.0	100.0	

Table No. 6

Group Statistics

GROUP		N	Mean	Std. Deviation	Std. Error Mean
VAS - INTRA OPERATIVE	0.75 % ROPIVACAINE	15	1.27	1.387	.358
	2% LIDOCAINE	14	.00	.000	.000

Lidocaine was administered on the contralateral side. Thus a total of 29 interventions were included in the study. (Table No.1 & 2) The time of onset of anaesthesia, need for reinjection, duration of action and VAS scores for pain preoperatively, intraoperatively & postoperatively were recorded and the results were tabulated in the tables and depicted in the graphs. The mean time for onset of anaesthesia for 0.75% Ropivicaine was 92.27+34.85 secs and for 2% Lidocaine was 79.14+11.065 secs, being statistically significant (p value<0.002). (Table No.3) The mean duration of anaesthesia was 5.03 ± 0.41 hrs for 2% Lidocaine and that for 0.75% Ropivacaine was 3.27 ± 056 hrs which was statistically significant (p value<0.001). (Table No.4) In 2 of the 14 patients receiving 0.75% Ropivacaine, a second injection was required whereas none of the patients receiving 2% Lidocaine required re-injection. (Table No.5) Subjective intraoperative pain scorings by the patients showed statistical significance (p value<0.01), with a mean VAS scores of 1.27 and 0 for 0.75% Ropivacaine and 2% Lidocaine respectively, on a scale of 1-10. (Table No.6).

DISCUSSION

Ropivacaine is a long-acting amide local anaesthetic with chemical similarity to bupivacaine and mepivacaine[1]. Ropivacaine belongs to pipecoloxylidide group of local anaesthetics[2]. It is available as an enantiomerically pure form (S-enantiomer), contrasting to bupivacaine which is a racemic mixture of (R)- and (S)-enantiomers[1,3]. Because of its favourable qualities such as low toxicity, long duration of action and affinity for nociceptive nerve fibres, Ropivacaine is being used in various fields of surgery. Despite many positive observations and wide use in surgical anaesthesia and obstetrics, there are only a few articles about the use of Ropivacaine in dentistry. Kennedy et al. (2001) reported the first study on the anaesthetic effect of Ropivacaine. The author found that maxillary lateral incisor infiltration anaesthesia for a concentration of 0.5% Ropivacaine was only 68% effective when used without a vasoconstrictor and 75% effective for the same concentration when administered with epinephrine, which was proved using an electrical pulp tester[7]. The low efficacy of Ropivacaine encouraged Ernberg & Koop (2002) to conduct a dose–dependent study of Ropivacaine as a local anaesthetic in dentistry. The anaesthetic effects of plain Ropivacaine, when used in concentrations of 0.2%, 0.5% and 0.75% respectively, was

investigated in a group of 30 patients using an electrical pulp tester. The authors concluded that the administration of Ropivacaine even in the highest concentration did not assure satisfactory anaesthesia[4]. As a consequence, subsequent studies were conducted, which showed a more profound pulpal anaesthesia with 0.75% concentration of Ropivacaine[5,10]. El-Sharrawy & Yagiela (2006) conducted a similar study comparing four concentrations of Ropivacaine (0.25%, 0.375%, 0.5% and 0.75%) for the administration of Inferior Alveolar nerve block, achieving successful anaesthesia with the use 0.5% and 0.75% concentrations[6]. As per an article published by Akerman et al, the onset of action for Ropivacaine was found to be faster because of its lack of binding to extraneural fat and tissues and to its greater availability for transfer to the nerve site. However, other studies suggest otherwise. The dissociation constant (pKa) of local anesthetics directly affects the latency period. Thus, greater the pKa value, greater will be the latency, thereby longer onset time. Reviewing the pKa values of 0.75% Ropivacaine and 2% Lidocaine, 0.75% Ropivacaine (pKa = 8.1) should have a greater latency than 2% Lidocaine (pKa = 7.9)[19]. In this study similar results were obtained with the latency of Ropivacaine being 1.16 times greater than Lidocaine. Buric N in his paper described the application of Ropivacaine in oral surgery. The achieved anaesthesia in all patients enabled analgesia in the course of the operation, and the expected intraoperative and postoperative bleeding, whereas postoperative analgesia lasted long enough (up to 380 minutes) to prevent the intake of analgesics[18]. Decreased blood flow at the site of local anaesthetic injection not only provides a bloodless field of surgery, but also considerably decreases the rate of absorption, reduces the incidence of systemic toxicity and prolongs the duration of action of anasthesia[17]. All local anaesthetics currently available for dental use have vasodilating activity[10]. Ropivacaine has a biphasic vascular effect, which could be useful in dentistry. At low concentrations (0.063–0.5%), it shows vasoconstriction per se, whereas at higher concentrations of 1%, it produces a vasodilatory effect[8,9]. The vasoconstriction induced by the local anaesthetic at low doses mainly depends on the calcium influx through voltage-operated calcium channels and lipid solubility[15,16]. In this study the duration of the anaesthetic effect of Ropivacaine varied from 270 to 360 minutes (mean 302.13 minutes) while for Lidocaine it varied from 160 to 210 minutes (mean 196.43 minutes). Although performing an electric pulp test for the objective assessment of anesthetic efficacy is the gold standard, it could not be adhered to in the given clinical situation for obvious reasons. Hence the need for re-injection was considered one of the parameters to evaluate the efficacy of the test solution. In 2 interventions (6.9% of cases), a second dose of anesthetic solution had to be administered (intrapulpal / intraligamentous) in the group that received 0.75% Ropivacaine. Postoperative pain after third molar surgery usually reaches its maximum intensity within 6–8 h of operation as a result of the release of chemical mediators[13]. Ropivacaine was effective in reducing immediate postoperative pain because of its residual analgesic property which extends for 6 h postoperatively, thereby reducing the need for analgesics in the immediate postoperative period. Thus in our study, we found that postoperative pain was considerably reduced when 0.75% Ropivacaine was administered. However, Ropivacaine is said to have a selective action on the pain-transmitting Aδ and C nerves due of its relatively less lipophilic nature[14]. This was probably why we found lesser intraoperative pain control with the use of 0.75% Ropivacaine (Mean VAS score-1.27) when compared to 2% Lidocaine (Mean VAS score-0.00) which was statistically significant. The efficacy of the solution in infected and inflamed tissue is still questionable. Postoperative paraesthesia or altered nerve sensations was not detected in any of the patients participating in the study.

CONCLUSION

The results obtained suggest that 2% lidocaine with adrenaline offers better clinical effect than 0.75% Ropivacaine in terms of latency in surgical removal of impacted 3rd molars, whereas 0.75% Ropivacaine had a longer duration of action, thereby reducing postoperative pain, compared to 2% lidocaine. However, a multi-centric study with a larger sample size is essential to validate the findings.

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