Original Article

DOI: 10.7860/JCDR/2017/22204.9302

Dentistry Section

Evaluation of Efficacy of Intraligamentary Injection Technique for Extraction of Mandibular Teeth-A Prospective Study

RAUNAK PRADHAN[1], DEEPAK KULKARNI[2], LAKSHMI SHETTY[3]

ABSTRACT

Introduction: Fear of dental pain is one of the most common reasons for delaying dental treatment. Local Anaesthesia (LA) is the most commonly employed technique of achieving pain control in dentistry. Pterygomandibular Nerve Block (PNB), for achieving mandibular anaesthesia has been the traditional technique used and is associated with a few set of complications which include pain, nerve injury, trismus, and rarely facial nerve palsy, and sustained soft tissue anaesthesia. These complications have resulted in a rapid need for research on alternative local anaesthetic techniques.

Aim: This study was undertaken with the objective to determine pain, duration, profoundness and complications associated with administration of Intraligamentary Injection Technique (ILT).

Materials and Methods: This study was conducted on 194 patients (male=122, female=72) who reported for dental extractions in mandibular posteriors. The ILT was administered with ligajet intraligamentary jet injector using cartridge containing lignocaine hydrochloride 2% with adrenaline 1:80000 and a 30 gauge needle at buccal (mesiobuccal), lingual, mesial and distal aspect of the mandibular molars. The data was analyzed by using statistical computer software SPSS 11.0 (Statistical package for social sciences 11.O version of SPSS Inc.). Median was derived for Pain on Injection (PI) and Pain during Procedure (PP). Mean and standard deviation was derived for Duration of Anaesthesia (DA).

Results: Various advantages were seen such as, localized soft tissue anaesthesia, decreased PI (SD=0.83), and minimal PP (SD=0.94). The DA (SD=4.62) and mean value of 24.06 minutes.

Conclusion: This study is one of its kinds where intraligamentary injection has been used for extraction of mandibular molars. It was also successfully used in patients with exaggerated gag reflex and patients suffering from trismus due to oral submucous fibrosis. The intraligamentary injection technique can thus be used effectively to anaesthetize mandibular molars, as a primary technique for extraction of mandibular posterior teeth.

Keywords: Anaesthesia, Molar, Pain

INTRODUCTION

Pain is an emotional experience of unpleasant, sensory in nature and associated with potential tissue damage [1]. Pain and dentistry are often synonymous in the minds of patients especially those with grossly carious teeth requiring multiple extractions. The patients generally find the treatment rendered by an oral and maxillofacial surgeon good if there is little or no discomfort during the procedure. In turn oral surgeons identify a good anaesthetic as one that allows them to focus solely on oral surgical procedures without distractions due to pain.

Williamson A and Hoggart B have shown that the fear of pain in dentistry is closely associated with the most common method for blocking pain during dental procedures that is intraoral administration of local anaesthetics [2]. Bahl R reported that patients with fear for dentistry had reconceived anxiety to receive intraoral injections and thus, missed or delayed their appointments [3].

Pain may be abolished by interrupting the pathways that carry the information of the stimulus from the periphery of the body to the central nervous system, by blocking the central nervous system, or by removing the stimulus. Local anaesthetics have the capacity to block sensory neuronal conduction of stimuli which are noxious from reaching the central nervous system. Thus, LA is the most commonly employed technique of achieving pain control in dentistry [4].

Extraction is one of the most common procedures in oral surgery that requires the administration of LA for painless procedure. The PNB is the technique of choice used for the extraction of mandibular posterior teeth. It is associated with a few set of complications which include pain, nerve injury, trismus and rarely facial nerve palsy [5]. There have been alternative methods for administration of LA to prevent complications. One such technique called as the ILT, introduced in the early twentieth century. This intraligamentary or periodontal technique, had standard dental syringe with blind placement of a hollow bore metal needle on the gingival sulcus [6]. This technique is understood today as non trephinating intraosseous injection.

The ILT usually requires deposition of at least 0.2 ml of local anaesthetic solution for each root of the tooth as represented in [Table/Fig-1]. It is administered in the vicinity of the tooth to be extracted so that the injury to the vital structures can be avoided [7].

There have been many published studies done on the efficacy and use of ILT for root canals, crown preparations and periodontal procedures [7]. However, they included significantly less number of patients for extraction of teeth.The aim of this study was to evaluate the efficacy of ILT for extraction of mandibular posterior teeth.

[Table/Fig-1]: Ligajet injector–insertion of needle on lingual aspect.

MATERIALS AND METHODS

This prospective study was conducted on 194 patients who reported to the Department of Oral and Maxillofacial Surgery, Dr. D.Y. Patil Dental College and Hospital, Pune, Maharashtra, India, for extraction of mandibular molars between 2011 to 2014.The sample size was determined after a pilot study was conducted on 20 patients with 95% confidence interval.

This study was reviewed and approved by the ethics committee of the Dr. D.Y. Patil Dental College and Hospital and was performed in accordance with the ethical standards laid down in the 2013 revision of the Declaration of Helsinki. The written informed consent was taken from all the patients included in the study.

The ILT was administered with ligajet intraligamentary jet injector (Micro Mega Company) using cartridge containing lignocaine hydrochloride 2% with adrenaline 1:80000 and a 30 gauge needle [Table/Fig-1] [8].

The needle was inserted in periodontal ligament region and advanced apically till resistance was met. This insertion was done at four sites- buccal, lingual, mesial and distal aspect of the tooth. Deposition of minimum 0.2 ml LA was done at each of these sites. However, more than 1.8 ml of LA was not used in any of the case.

After the administration of LA the patient was asked about the intensity of the pain that was experienced and it was recorded by Visual Analogue Scale (VAS) [9]. The time of administration of LA was noted.

Fifteen seconds after the end of deposition of LA the objective symptoms were checked using a moon's probe till maximum time period of thirty seconds. This was recorded as the rate of onset of anaesthesia.

The profoundness of the anaesthesia was assessed objectively while separating the gingiva and during the application of forceps to the tooth. The pain was assessed using a standardized Verbal Rating Scale (VRS) [2].

The extraction was performed and at any given time during the extraction if the patient experienced pain, the procedure was abandoned and routine inferior alveolar nerve block was given. Post extraction instructions were given to the patient and analgesic was prescribed to the patient. Antibiotics were prescribed wherever required. The patient was then asked to wait and was instructed to note the time at which the rescue medication was taken. This was recorded as the duration of LA.

STATISTICAL ANALYSIS

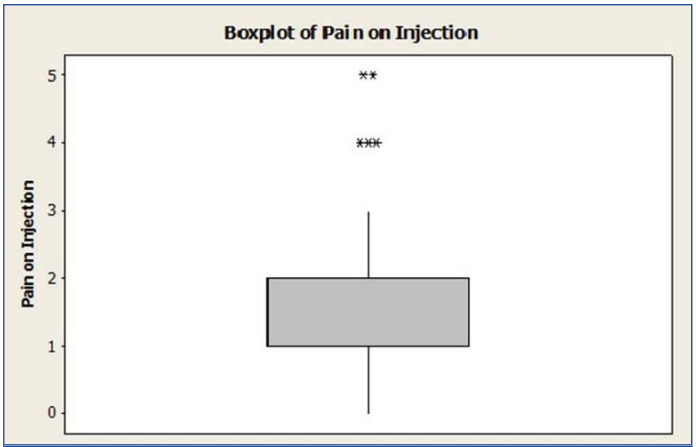
Descriptive analysis was done and data was analyzed by using statistical computer software SPSS 11.0 (Statistical package for social sciences 11.0 version of SPSS Inc.). Median was calculated with box plots. Mean and standard deviation for PI and PP. Mean and standard deviation was derived for DA.

RESULTS

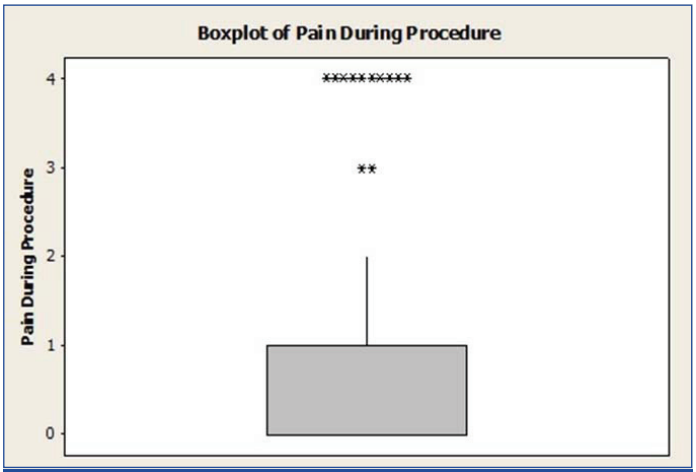
A total of 194 patients were included in the study and the gender wise distribution of patients is given in [Table/Fig-2]. The mean age of study participants was between 25-30 years. The mean value for PI 1.55±0.83 minutes and median value ranged from 1-5 with median at 1 as described in [Table/Fig-3]. The rate of onset of anaesthesia in all the 194 patients was between 15-20 seconds. PP mean was 0.95±0.94 minutes and median value ranged from 1-4 with median at 1 as described in [Table/Fig-4]. Mean and SD are described in [Table/Fig-5]. The mean for DA was 24.06±4.62 minutes.

Gender	Number of Patients (n)	Percentage
Male	122	63%
Female	72	37%

[Table/Fig-2]: Gender wise distribution of patients.



[Table/Fig-3]: Boxplot of pain on injection.



[Table/Fig-4]: Boxplot of pain during procedure.

Parameters	N	Mean	SE Mean	SD
PI	194	1.5515	0.0603	0.8394
PP	194	0.9536	0.0675	0.9401
DA	182	24.06	0.343	4.623

[Table/Fig-5]: Mean and standard deviation of pain on injection (PI), pain on procedure (PP), duration of anaesthesia (DA).
N- No. of patients
SD- Standard deviation

DISCUSSION

Pain management is important for any oral surgical procedure to be successful. The dental pain fear is strong in some patients that makes them not to report for treatment [10]. LA which is administered without pain causing reduced anxiety aids in management of pain. In the branch of oral surgery, extraction of teeth is the most commonly conducted procedure and thus adequate anaesthesia is essential.

Thus, to overcome the complications of conventional inferior alveolar nerve block alternative techniques were introduced; one amongst them was the ILT.

In the ILT, the anaesthetic solution diffuses apically through the marrow spaces into the intraseptal bone [6].

Malamed SF in 1982 conducted a study to compare the intraligamentary anaesthesia as an alternative to inferior alveolar nerve block technique in root canal treatment, crown preparations, periodontal procedures and extractions [7]. He concluded that the periodontal injection gave a positive result in achieving adequate anaesthesia and could be used as an alternative to inferior alveolar nerve block technique. Malamed SF stated that further research was required in this field as the sample size included for dental extractions in this study was low [7].

Moore PA et al., in 2011 conducted a study in which they used intraligamentary and intraosseous injection technique as an

alternate technique for producing anaesthesia in mandibular teeth [8]. They compared these two techniques with inferior alveolar nerve block and concluded that both techniques provided sufficient anaesthesia, and thus, can be used effectively for managing failed mandibular nerve blocks. But the authors also stated that with the intraosseous injection technique, perforation at the injection site caused increased pain during as well as after the procedure [8]. The separation of the perforator or needle could cause injury to the root of the teeth during administration of intraosseous injection technique. Considering this disadvantage of the intraosseous technique, the present study was done using ILT. Prama R et al., in 2013 conducted a study in which they compared the ILT with the inferior alveolar nerve block. But this study was conducted to evaluate pulpal anaesthesia in mandibular molars, and anaesthetic effect for dental extractions was not considered [11].

One of the disadvantages of the ILT as stated by Froum SJ et al., in 2000, was that after 24 hours of injection, limited localized inflammation was present in the periodontal ligament [12]. By the end of seven days the periodontal ligament appeared normal. Thus, the author concluded that though the ILT did cause damage to the periodontal ligament, it was minimal [12].

In our study the viability of these fibers was not required to be preserved as the teeth included were to be extracted and therefore the ILT was chosen.

The efficacy of ILT for extraction of mandibular posterior teeth was assessed based on following parameters that were pain on administration of local anaesthesia, duration of onset of local anaesthesia, profoundness of local anaesthesia during procedure, duration of local anaesthesia, complications.

Pain on Administration of Local Anaesthesia: Our results were concurrent with the study in terms of use of ILT where Prama R et al., reported that pain during needle penetration was less in ILT as compared to INB [11]. Hence, there appeared to be less discomfort during ILT technique.

Duration of Onset of Local Anaesthesia: In our study the onset of anaesthesia for all the patients was between 15 and 20 seconds. Malamed SF in 1980, in his study stated that the duration of onset of anaesthesia was less than 30 seconds [5].

Profoundness of Local Anaesthesia: In our study the profoundness of LA was evaluated using the VRS [2] and 182 patients experienced very mild pain.

The study conducted by Prama R et al., showed a success rate of 90% using ILT and 60% using inferior alveolar nerve block. The pain experienced during access opening and pulp extirpation was lesser when compared with the INB, although not statistically significant. Also, the need for supplementary anaesthesia was more in the inferior alveolar group [11].

In the present study, the failure of anaesthesia was seen in 12 patients. The probable reasons for the same include, in third molar teeth distal aspect is difficult to access [13]. In the first and second molar, variation of anatomy of the tooth like hypercementosis of the root, thick cortical plates [13] can lead to failures of ILT.

Duration of Anaesthesia: The duration of anaesthesia in our study was 24.06 minutes with a standard deviation of four minutes. Hemad SA in 2006 conducted a study, in which he evaluated the duration of pulpal anaesthesia which was 18.34 minutes and concluded that the duration of pulpal anaesthesia was longer in mandibular teeth than in maxillary teeth [6].

Based on the results of the present study, the following advantages were seen, such as, minimal pain on injection, rapid onset of anaesthesia between 15 and 20 seconds and minimal pain during extraction of teeth.

In the traditional techniques, even with good operator skill and proper anaesthetic technique a minimum of 1.8 ml of anaesthetic solution needs to be used, but in the present study only 0.2 ml of anesthetic solution was needed to be deposited at each side of the tooth totaling to 0.8 ml of the solution [8].

Intra Ligamentary Techinque in Unusual Situations: In our study, oral submucous fibrosis was an accidental finding in two patients out of the 194. In these patients administration of PNB was difficult as the anatomical landmarks used for the PNB could not be clearly palpated. ILT was administered in these patients and the mandibular posterior teeth were extracted successfully. These certainly emphasize the role of ILT in cases of decreased mouth opening.

Another challenging situation that was seen in our study was a patient who reported for extraction of mandibular posterior tooth having exaggerated gag reflex. As a result of this the patient could not keep his mouth open for a longer time. Since the PNB requires the local anaesthetic solution to be deposited for over one minute it would have been difficult in this patient and therefore the ILT was used [5].

ILT can be used in patients suffering from parkinsonism as they show increased involuntary movements which could cause difficulty in administration of anaesthesia.

Meechan JG and Ledvinka JI concluded in their study that ILT could be used as a primary technique or secondary technique [14]. In our study it was used as a primary technique.

Forum SJ et al., in their study, to evaluate histologic changes in intraligamentary injection, concluded that ILT caused minimal damage to the periodontal ligament [12].

Lalabonova H et al., in their prospective study on 220 general dental practitioners to evaluate the use of ILT showed that 75.91% Bulgarian dental practitioners use ILT in almost all treatments in which 32.94% showed adequate anaesthesia [15] .

Meechan JG concluded in his review on supplementary routes of LA stated that ILT have advantages where smaller doses are required compared to block or infiltration anaesthesia [16].

Complications: The ILT technique anaesthetizes only the single tooth and the extent of anaesthetized soft tissue is limited and therefore complications like lip or tongue bite can be avoided.

Other possible complications associated with PNB are pain and burning on injection, injury to the medial pterygoid muscle causing trismus, paresthesia to the lip and tongue due to injury to the inferior alveolar or lingual nerve, soft tissue injury and very rarely facial nerve paralysis [17]. In our study all these inherent complications of PNB were avoided.

The only complication noted in our study was transient blanching of tissues after administration of LA [18].

Administration of LA agent produces pain and anxiety that may cause subsequent unfavourable behaviour. Over the years alternative injection techniques have been introduced for reducing the pain on administration of LA. One such technique is the ILT [19].

In the present study, the ILT was used on 194 patients and was successful in 182 patients.

The advantages of this technique included minimal pain on administration of LA, rapid onset of anaesthesia and minimal pain during the procedure [20]. Dower JS Jr and Barniv ZM in their review of literature on periodontal ligament injection have concluded that it produces effective anaesthesia and lessen the adverse reaction of other techniques [21]. It was also successfully used in patients undergoing extraction of mandibular posterior teeth with exaggerated gag reflex and patients suffering from trismus due to oral submucous fibrosis. All the inherent complications of PNB were avoided by this technique in our study.

The only disadvantage of the ILT observed in the present study was that the duration of anaesthesia was limited to 24 minutes. Therefore,

for any oral surgical procedure which requires longer surgical time like complicated extractions, apicectomies, tooth hemisections and root resection, the ILT cannot be used.

LIMITATION

The limitation of the present study is lack of a comparative group. Further research can be done to compare ILT for extraction to other commonly used techniques.

CONCLUSION

The ILT technique helps in reducing the toxicity of LA in the patients. The effective extraction of mandibular molars can be performed with ILT.

REFERENCES

[1] Second YKL, Neelakantan P. Local anaesthetics in dentistry: Newer methods of delivery. Int J Pharma Clinical Res. 2014;6:4-6.
[2] Williamson A, Hoggart B. Pain. A review of three commonly used pain rating scales. J Clin Nurs. 2005;14:798–804.
[3] Bahl R. Local anaesthesia in dentistry. Anesth Progress. 2004;51:138-42.
[4] Reed KL. A brief history of anaesthesiology in dentistry. Tex Dent J. 2002;119:219-24.
[5] Malamed SF. Supplemental injection technique. In: Malamed SF, editor. Handbook of Local Anaesthesia, St. Louis: The C.V. Mosby Company, 1980; pp. 255-60.
[6] Hemad SA. Anaesthetic efficacy of periodontal ligament injection of 2% lidocaine with 1:80,000 adrenaline. Al–Rafidain Dent J. 2006;6:26-34.
[7] Malamed SF. The periodontal ligament (PDL) injection: An alternative to inferior alveolar nerve block. Oral Surg Oral Med Oral Path. 1982;53:117-21.
[8] Moore PA, Cuddy MA, Cooke MA, Sokolowski CJ. Periodontal ligament and intraosseous anaesthetic injection techniques: Alternatives to mandibular nerve blocks. J Am Dent Assoc 2011;142:13-18.
[9] Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain. Arthritis Care and Research. 2011;63:240-52.
[10] Margolis FA. Painless injection: An Oxymoron? International Dentistry. 2008;11:46-50.
[11] Prama R, Padhye L, Pawar H, Rajput N. Efficacy of intraligamentary injections as a primary anesthetic technique for mandibular molars and a comparison with inferior alveolar nerve block. Ind J Multidisc Dent. 2013;3:1-5.
[12] Froum SJ, Tarnow D, Caiazzo A, Hoch man M. Histologic response to intraligament injections using computerized local anesthetic delivery system. A pilot study in mini swine. J Periodontol. 2000;71:1453-59.
[13] Endo T, Gabka J, Taubenheim L. Intraligamentary anaaesthesia: Benefits and limitations. Quintessence Int. 2008;39:e15-25.
[14] Meechan JG, Ledvinka JI. Pulpal anaesthesia for mandibular central incisor teeth: A comparison of infiltration and intraligamentary injections. Int End J. 2002;35:629-34.
[15] Lalabonova H, Kirova D, Dobreva D. Intraligamentary anaesthesia in general dental practice. Journal of IMAB. 2005;11:22-24.
[16] Meechan JG. Supplementary routes to local anaesthesia: Review. Int Endod J. 2002;35:885-96.
[17] Haas DA, Lennon D. A 21 year retrospective study of reports of paresthesia following local anesthetic administration. J Can Dent Assoc. 1995;61:319-30.
[18] Hochman M, Friedman M, Williams W, Hochman CB. Interstitial tissue pressure associated with dental injections: A clinical study. Quintessence Int. 2006;37:469-76.
[19] Blanton PL, Jeske AH. Dental local anaesthetics: Alternate delivery methods. J Am Dent Assoc. 2003;134:228-34.
[20] Kaufman E, Leresche L, Sommers E, Dworkin SF, Truelove EL. Intraligamentary anaesthesia a double blind comparative study. Journal of American Dental Association. 1984;108:175-78.
[21] Dower JS Jr, Barniv ZM. Periodontal ligament injection: Review and recommended technique. Gen Dent. 2004;52:537-42.

PARTICULARS OF CONTRIBUTORS:
1. Postgraduate Student, Department of Oral and Maxillofacial Surgery, Dr. D.Y. Patil Dental College and Hospital, Dr. D.Y. Patil Vidyapeeth, Pune, Maharashtra, India.
2. Professor, Department of Oral and Maxillofacial Surgery, Dr. D.Y. Patil Dental College and Hospital, Dr. D.Y. Patil Vidyapeeth, Pune, Maharashtra, India.
3. Associate Professor, Department of Oral and Maxillofacial Surgery, Dr. D.Y. Patil Dental College and Hospital, Dr. D.Y. Patil Vidyapeeth, Pune, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Lakshmi Shetty,
Associate Professor, Department of Oral and Maxillofacial Surgery, Dr. D.Y. Patil Dental College and Hospital,
Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune-411018, Maharashtra, India.
E-mail: lacchu33@yahoo.co.in

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Jun 24, 2016**
Date of Peer Review: **Aug 24, 2016**
Date of Acceptance: **Sep 26, 2016**
Date of Publishing: **Jan 01, 2017**