

COMPARISON OF POSITIVE ASPIRATION DURING INFERIOR ALVEOLAR NERVE BLOCK USING CONVENTIONAL METALLIC DENTAL SYRINGE VS. DISPOSABLE PLASTIC SYRINGE

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ABSTRACT

Objective: To compare the frequency of positive aspiration during inferior alveolar nerve blocks using conventional metallic dental syringe and disposable 3cc plastic syringe and to observe the efficacy of aspiration of both syringe systems.

Study Design: Comparative prospective study.

Place and Duration of Study: Oral and Maxillofacial Surgery Department, Institute of Dentistry, CMH Lahore Medical College, from May 2019 to Jul 2019.

Methodology: One hundred patients requiring administration of inferior alveolar nerve block for mandibular oral surgery procedures were selected on the basis of consecutive convenience sampling. Inclusion criteria was patients undergoing oral surgery procedures of mandible. Two groups were made. 1st patient was allotted to group A by coin-toss method. Every alternate patient was included in group B. Group A was administered inferior alveolar nerve block using conventional metallic dental syringe while for group B, 3cc disposable hypodermic plastic syringe was used. A single operator administered all inferior alveolar nerve blocks. Frequency of positive aspiration was noted down for each group.

Results: Forty six (46%) subjects were males and 54 (54%) were females. Mean age was 35.9 ± 13.7 years. Frequency of positive aspiration in the metallic syringe group was 15 (15%) and in the disposable syringe group was 8 (8%). Using Pearson chi square test, no statistically significant difference was found between aspiration frequency of the two groups ($p=0.09$).

Conclusion: The statistically insignificant difference between the aspiration rates of both syringes implies that neither of the systems is superior to the other in aspiration.

Keywords: Anesthesia dental/instrumentation, Disposable syringe, Mandibular anesthesia, Metallic syringe, Needles.

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INTRODUCTION

Local anaesthesia administration is one of the most routinely performed procedures in dentistry¹. More than one billion local anaesthetic injections are administered annually all over the world². The inferior alveolar nerve block (IANB) is a conventional technique used for achieving mandibular anaesthesia and is also the most effective and frequently used technique for this purpose^{3,4}. Administration of IANB is achieved by depositing local anaesthetic agent into the pterygomandibular space⁵. Within the pterygomandi-

bular space, the injection target site i.e. mandibular foramen is in close proximity to the inferior alveolar artery, vein and pterygoid venous plexus, therefore making the area highly vascular⁶. In order to achieve a successful IANB, performing aspiration prior to deposition of local anaesthetic solution is a basic rule. Failure to do so may cause an ineffective block owing to an intravascular injection. In addition to this, a wide variety of systemic complications is likely to occur. Most of these complications can be prevented by avoiding an intravascular injection and performing a simple manoeuvre i.e aspiration².

A variety of armamentarium has been developed overtime for the ease of performing aspi-

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ration⁷. Amongst these are non-disposable conventional metallic dental syringes and a range of disposable syringe systems⁸. According to a study conducted in South Africa, published in 2015, use of non-disposable dental syringes accounts for one third of all reported sharp injuries. Among these injuries, most were encountered either during the removal or disposal of needle from conventional metallic syringe⁹. Another study conducted in London and published in British Dental Journal, highlights the reporting of multiple sharp injuries owing to the use of non-disposable syringes. The research also elaborated on the considerable psychological trauma that health-care personnel go through following a needle stick injury. They concluded that these injuries were avoidable by introduction of disposable syringes, however cost may be a factor to consider if safety syringe system was used¹⁰.

Keeping in mind the risk of a needle stick injury, cost-effectiveness and the necessity for performing aspiration before administering IANB, we decided to study the frequency and efficacy of aspiration using conventional metallic dental syringes and 3cc disposable plastic syringes during an inferior alveolar nerve block.

METHODOLOGY

This was a comparative prospective study, conducted in Oral and Maxillofacial Surgery Department, Institute of Dentistry, CMH Lahore Medical College from 27th May to 31st July 2019. Sample size estimation was done using WHO calculator version 12.2.6 using the following formula $n = \frac{z_{1-\alpha}^2 P(1-P)}{d^2}$ where confidence interval $(1-\alpha)=95\%$, $p=0.30$ and d (absolute precision) = 0.10. The sample size was calculated to be 81.

Ethics approval was obtained from Institutional Review Board (Case no #: 392/ERC/CMH/LMC). Among all the patients presenting to dental outpatient department for mandibular oral surgical procedures, 100 patients requiring administration of inferior alveolar nerve block were selected on the basis of consecutive convenience sampling. Inclusion criteria was consenting patients undergoing oral surgery procedures

of mandible and patients above 18 years of age. Exclusion criteria was cognitively impaired patients, for instance those suffering from Parkinsons, patients under 18 years of age and those not consenting to participate in the research.

For administration of local anaesthesia, 2 groups were made. Group A was administered IANB using conventional metallic dental syringe while for group B, 3cc disposable hypodermic plastic syringe was used. For assigning the first patient to one of the groups, coin-toss method was used and was included in Group A. Every alternate patient was then included in group B (3cc disposable hypodermic plastic syringe). A single operator administered all IANBs. In group A, the conventional aspirating crab-jaw metallic dental syringe manufactured by Falcon was used (fig-1). Anaesthetic cartridge (1.8ml, 2% lidocaine with epinephrine 1:00,000) (manufactured by Houns under brand name Medicaine) was loaded and crab-jaw carefully engaged in rubber plunger. An assistant then loaded a 42mm long, 27 gauge needle onto the syringe. In group B, the disposable hypodermic syringes used were man-



Figure-1: Conventional metallic dental syringe.



Figure-2: 3cc disposable hypodermic syringe.

ufactured by YMS (fig-2) and had a 1" (25.4mm) long, 24 gauge needle and local anaesthesia ampules (2% lidocaine with epinephrine 1:100,000) were used. A verbal informed consent was taken from each patient and the patient was briefed about his/her right to withdraw from the procedure/research at any time. For administration of inferior alveolar nerve block, the patient was placed in a supine position and the mouth opened wide. For the right IANB, the operator

took 8 o' clock position while for left IANB 10 o' clock position was taken. Height of the injection was determined by palpation of coronoid notch. Pterygomandibular raphe was then visualized. With barrel of the syringe over the contralateral premolars, 8-10mm above the occlusal plane and needle bevel towards bone, the needle was inserted just lateral to the pterygomandibular raphe. The needle was then penetrated to achieve bony contact. Not more than 25mm depth was penetrated to achieve gentle bony contact. In case of no bony contact, the needle was retrieved 1-2mm, a drop of anaesthetic was deposited and the needle was then redirected away from the midline. On achieving bony contact, aspiration was performed in two planes by rotating the syringe a quarter turn. For performing aspiration in group A, the metallic ring was pulled back 1-2mm to create negative pressure within the cartridge. For performing aspiration with 3cc disposable syringe, after bony contact, the operator used her non-dominant hand to hold syringe and pulled back the plunger with her dominant hand. After the first aspiration, the syringe was rotated a quarter turn and aspiration repeated, thereby performing it in two planes. Presence of any sign/streak of blood was considered as a positive aspirate. No sign of blood or presence of an air bubble (vacuum) was considered as negative aspiration. In case of positive aspiration, needle was withdrawn and the injection repeated with a new cartridge/3cc syringe. The repeat block injection was not included in the study.

Data was entered and analyzed using Statistical Package for Social Sciences Software (SPSS) (version 22). Quantitative variables were presented using mean \pm SD while frequency and percentage were used for qualitative variables. Pearson Chi Square analysis was used to establish presence or absence of a correlation between syringe type and aspiration rate, as well as to analyze statistical difference between aspiration rates on the right and left side of mandible. An alpha level of 5% was taken, thereby considering a p -value ≤ 0.05 to be statistically significant.

RESULTS

Amongst the total sample size ($n=100$), 54 (54%) patients were female while 46 (46%) were male. The mean age of patients was 35.9 ± 13.7 years, with the minimum age being 18 years and maximum being 72 years. The overall rate of positive aspiration was 23 (23%). No significant difference was observed between aspiration rates of the right and left side of mandible ($p=0.70$). Frequency of positive aspiration in the conventional metallic dental syringe group was 15 (15%) and

Table-I: Comparison of aspiration between the two syringe systems.

	Aspiration		Chi-square p -value*
	Negative	Positive	
Conventional Metallic Dental Syringe	35 (35%)	15 (15%)	0.09
3cc Disposable Hypodermic Plastic Syringe	42 (42%)	8 (8%)	

*Statistically significant if < 0.05

Table-II: Comparison of positive aspiration rates of different studies.

Study	Positive Aspiration Rate
Martínez Gonzalez <i>et al</i> ¹¹	47%
Donkor <i>et al</i> ¹²	22%
Todorovic <i>et al</i> ¹³	13.3%
Ravi Kiran <i>et al</i> ¹⁴	7.14%
Prabhu Nakkeeran <i>et al</i> ¹⁵	0.08%
Current study	23%

in the 3cc disposable hypodermic syringe group was 8 (8%) (table-I). Pearson chi square analysis was used to study the difference in aspiration between the two syringe systems and no statistically significant result ($p=0.09$) was found.

Chi square analysis was used to find out if a correlation existed between gender and positive aspiration and no statistically significant relation was observed ($p=0.84$), with positive aspirations in 12 (12%) females and 11 (11%) males.

DISCUSSION

The overall frequency of positive aspiration in our study was found to be 23 (23%). There is a vast range of similar rates of positive aspiration

found in existing literature, ranging from as low as 0.08% to as high as 47%¹¹⁻¹⁵. The incidence of positive aspiration from multiple studies are summarized in table-II.

In our study, no statistically significant difference was found between the aspiration rates of right and left sides of mandible ($p=0.70$) and between gender and frequency of positive aspiration ($p=0.84$). This is consistent with findings of the research conducted by Kämmerer, using different syringe systems and monitoring them in vivo via video recording. He concluded an insignificant difference between positive aspiration and both the sides of mandible¹⁶.

The metallic syringe used in our study had a 27 gauge, 42 mm long needle whereas the hypodermic syringe had a 24 gauge needle with 1" (25.4mm) length. Malamed states that the smaller the gauge of the needle, greater is its lumen diameter¹⁷. Length and gauge of needles play a significant difference in the aspiration efficacy and the possible associated complications. A research conducted in Austria, published in June 2018 studied the rare but serious complication of needle breakage during local anaesthesia administration¹⁸. They accessed PUBMED for data collection and included all articles that reported needle breakage from 1980 to 2018 and analyzed the data. A total of 59 needle breakage cases were documented in all these years. Multiple parameters related to needle breakage were also studied. Amongst these were length of needle, its diameter/gauge, the injection technique used, point of needle fracture and suspected cause of needle breakage. They concluded hub of the needle to be its weakest point. It was also elaborated that most cases of needle breakage involved thin needles with gauges 30 or smaller. Hence they recommended the use of at least 27 gauge needle or preferably larger¹⁸. Aldous also briefs in his study that a greater diameter and smaller gauge needle is less likely to pose the risk of needle breakage¹⁹.

Literature reports multiple ranges of depth of penetration of needle for performing a successful IANB such as 12-38mm, 12-19mm and 12-

36mm²⁰. Menke and Gowgiel claim that for performing an IANB, depth of penetration lies within the limits of a 25mm short needle and that short needles provide more ease for estimating depth of penetration as compared to long needles²¹. Therefore, 25mm short needles are less likely to deviate from their course or go into deeper tissue, hence preventing complications like intravascular injections or accidental entry into parotid tissue²¹.

As evident from literature, it is a common misconception that smaller diameter needles i.e needles with a larger gauge e.g 30, are less traumatic and less painful for patients as compare to 27, 25 or 24 gauges²². Studying this misconception, Fuller *et al* concluded from their research that no statistically significant difference existed between pain perception and these three different needle gauges²².

LIMITATION OF STUDY AND RECOMMENDATIONS

Our research did not study the comparison of success or failure of IANBs using both these syringe systems. Further research taking larger sample size and variable experience of operators may be done and a comparison of success of both syringes may also be analyzed. This can also help in studying the learning curve and the ease of operators in the aspiration maneuver using these two syringes.

CONCLUSION

There is no statistically significant difference between the rate of aspiration of the conventional metallic dental syringe and the 3cc disposable hypodermic syringe when administering inferior alveolar nerve block, therefore both syringe systems are at par with respect to efficiency of aspiration.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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