Original Article

Comparative evaluation of efficacy of Halstead technique, Clark and Holmes technique, Gow Gates technique, and Sargenti technique for mandibular anesthesia

ABSTRACT

Aim: This study aimed to evaluate the inferior alveolar nerve block, that is, the Halstead technique, Clark and Holmes technique, Gow Gates technique, and Sargenti technique, for mandibular anesthesia.

Methodology: This prospective, double-blinded, in-vivo study was conducted amongst 100 patients, requiring mandibular anesthesia. These patients were divided into four groups. Parameters assessed were time required for appearance of subjective and objective symptoms and signs, positive aspiration, need for supplementary anesthesia, and ease of administration.

Results: The means for subjective symptoms for the four techniques, that is, Halstead technique, Clark and Holmes technique, Gow Gates technique, and Sargenti technique, were 78.44, 120.76, 176.6, and 203.08, respectively. The means for objectives symptoms for the four techniques, that is, Halstead technique, Clark and Holmes technique, Gow Gates technique, and Sargenti technique, were 110.6, 269.8, 287.48, and 154.08, respectively. Halstead technique had statistically significant ($P < 0.05$) faster objective signs than all the other techniques. Supplementary block if required was noted for all four techniques.

Conclusion: The Clark and Holmes technique showed maximum complications, while Gow Gates technique was most difficult to administer. The Angelo Sargenti technique gave good results, same as standard Halstead technique.

Keywords: Clark and Holmes technique, Gow Gates technique, Halstead technique, inferior alveolar nerve block, Sargenti technique

INTRODUCTION

The inferior alveolar nerve block is the most common injection technique used in dentistry. This block is considered easy and successful if given with appropriate caution, which involves inserting a needle in the surroundings of the mandibular foramen to deposit local anesthetic solution near the nerve just before it enters the inferior alveolar canal.[1] Inferior alveolar nerve block produces analgesia of the lower lip, gingiva, and lower teeth until the midline.

Approximately 15–20% failure rate has been documented in the literature for inferior alveolar nerve block.[2] To overcome these failures, which are attributed to anxiety, anatomical variations, and errors in administration, various modifications, such as the Clark and Holmes technique, Gow

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Sayali Awate, Kalyani Bhate, Uday Londhe, Murtaza Contractor, Tushar Bhosale, Shreyas Lokhande

Department of Oral and Maxillofacial Surgery, Dr. D. Y. Patil Dental College and Hospital, Dr. D. Y. Patil Vidyapeeth, Pune, Maharashtra, India

Address for correspondence: Dr. Kalyani Bhate, Department of Oral and Maxillofacial Surgery, Dr. D. Y. Patil Dental College and Hospital, Dr. D. Y. Patil Vidyapeeth, Pimpri, Pune, Maharashtra, India.
E-mail: kalyani.bhate@dpu.edu.in

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Gates technique, and Sargenti technique, have been made and enlisted in the literature.[3-5] The direction of the needle, level of needle insertion, and area of diffusion of the local anesthetic solution varied for all these techniques. The ease of administration of anesthesia also varies for each technique.

The Halstead technique is considered an indirect technique, wherein the approach is from the lower premolar of the contralateral side.[1] Another indirect technique, that is, the Gow Gates technique, is considered very effective in which the needle is inserted parallel to the imaginary line that is formed by connecting the intertragic lines and corner of the mouth. The needle is inserted until the point of contact with the condylar neck. Generally, at an average depth of 25 mm, bone contact occurs. The target area in this type is at the level of the sigmoid notch, well above the mandibular foramen.[6]

The Clark and Holmes technique is an indirect technique that achieves anesthesia by depositing solution immediately behind the mandibular foramen, where the anterior portion of the nerve is concealed by the lingula and sphenomandibular ligament. Angelo Sargenti is a direct technique wherein the approach of the needle is at a higher level than usual, that is, at the level of the maxillary premolar of the opposite side. This ensures that the variation in the level of the mandibular foramen is addressed.[7] The four techniques mentioned above have their own advantages and disadvantages. The published literature similar to the subject shows that conflicting is replete with studies showing conflicting results. Thus, this study evaluated the inferior alveolar nerve block, that is, the Halstead technique, Clark and Holmes technique, Gow Gates technique, and Sargenti technique, for mandibular anesthesia.

METHODOLOGY

A prospective double-blind, *in-vivo* study was conducted amongst 100 patients (aged 18–60 years) requiring any surgical procedures such as mandibular anesthesia. Participation of the patients for the study was voluntary, and written informed consent was obtained from those who agreed to participate. Patients were selected from the Outpatient Department of the Oral and Maxillofacial Surgery Department ethical clearance was obtained from Institutional Ethical Committee with Ref no (DYPDCH/IEC/123/131/19 dated 13th November 2019.

Grouping

Hundred patients who fit in the selection criteria were divided into four groups: Halstead technique (n = 25), Clark and Holmes technique (n = 25), Gow Gates technique (n = 25), and Sargenti technique (n = 25).

Selection criteria

The inclusion criteria were patients requiring extractions or surgical procedures requiring mandibular anesthesia in patients above 18 years old who were willing to participate in the study. Patients with a history of allergies to 2% lignocaine with adrenaline and patients with a history of medication with cimetidine, tricyclic antidepressants, β-adrenoreceptor antagonists, antipsychotics, α-adrenoreceptor blockers, adrenergic neuronal blockers, thyroid hormones, smokers, alcoholics, and pregnant patients were excluded from the study.

In total, 150 patients were screened over a period of 12 months, and 123 patients requiring mandibular anesthesia were selected, out of which 23 patients opted out when informed about the study. Hundred selected patients were randomly allotted to four groups with the help of sequentially numbered opaque sealed envelopes.

Randomization and blinding

The randomization group was written on the paper and placed in an opaque sealed envelope by a researcher. The patients and the statistician were blinded to the type of anesthesia technique used [Figure 1].

Procedure

Standard operative procedures for sterilization and asepsis were followed. The operator administered anesthesia after a topical anesthetic agent was applied. The same operator administered anesthesia to all patients. The amount of anesthesia was kept standard at 2 ml for all techniques except the Gow Gates technique, where the amount used was 5 ml, as per the requirement of the technique. A 5-ml syringe and a 26.5-in gauge needle were used for all blocks. According to the technique, the direction of the needle and level of insertion were determined.

Statistical analysis

Data were analyzed using R software version 4.1.2, GraphPad Prism 9.3.1 (San Diego, CA, USA) and Excel. One-way ANOVA was used to compare the four different anesthetic techniques. Tukey's post-hoc test was computed to analyze in-between group differences of four different anesthetic techniques. A Chi-square test was applied to find the association of attributes.

RESULTS

The mean age of the patients was 35.8 ± 14.03 years. The majority of patients were between 30 and 40 years of age. Out of 100 patients, 47 were male and 53 were

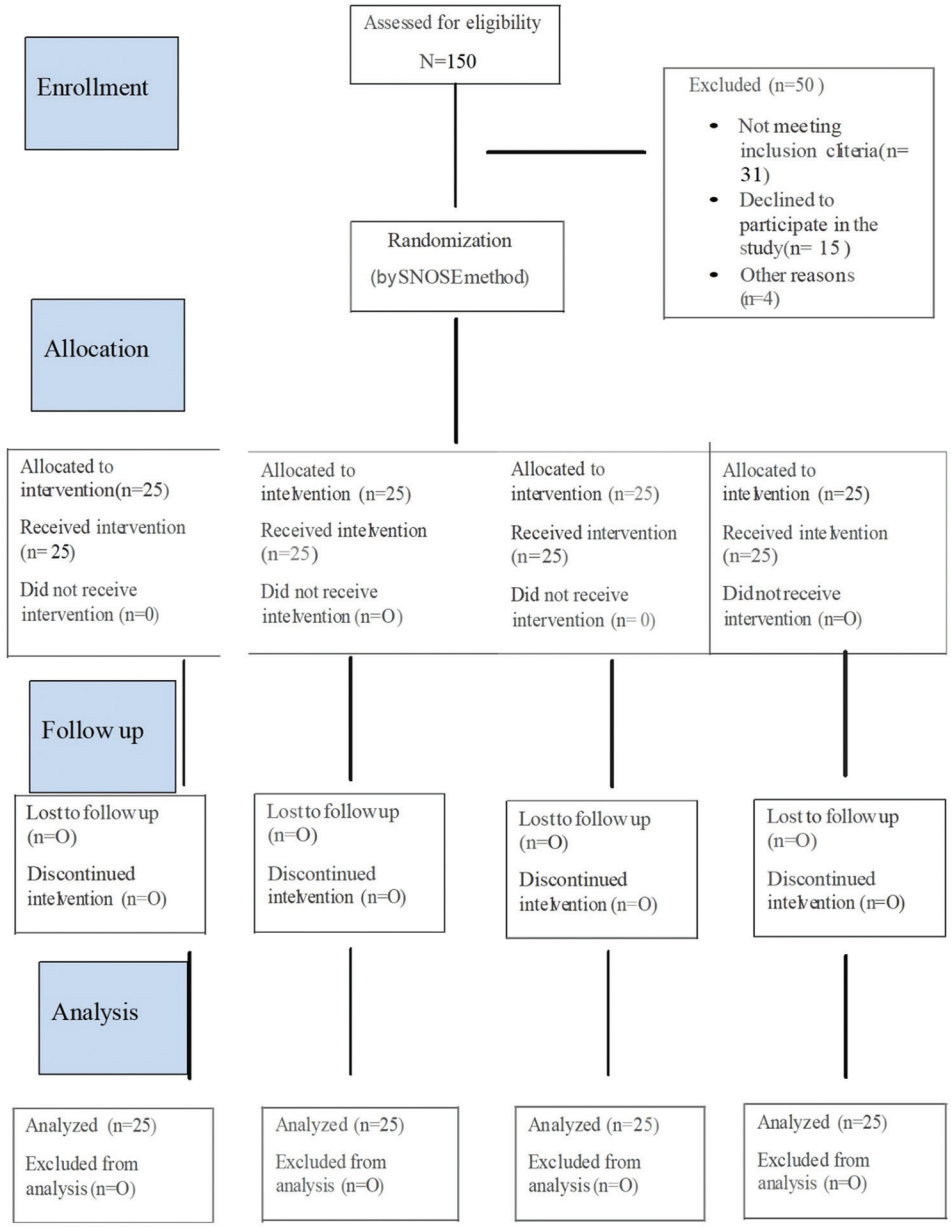
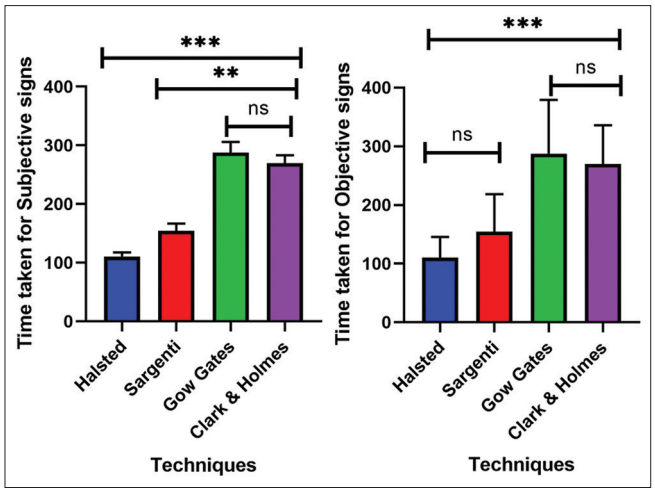


Figure 1: Recruitment process of the patients

female. The time taken for the onset of anesthesia from the time of injection to the start of subjective symptoms was noted for each of the injections. The means for the four techniques, that is, Halstead technique, Clark and Holmes technique, Gow Gates technique, and Sargenti technique, were 78.44, 120.76, 176.6, and 203.08, respectively. The time taken for the onset of anesthesia from the time of injection to the start of the objective sign was noted for each of the injections. The means for the four techniques, that is, Halstead technique, Clark and Holmes technique, Gow Gates technique, and Sargenti technique, were 110.6, 269.8, 287.48, and 154.08, respectively. Halstead technique had statistically significant ($P < 0.05$) faster objective signs than all other techniques. There was no difference between Gow Gates and Clark and Holmes for both subjective and objective symptoms [Graph 1].

Supplementary block if required was noted for all four techniques. Supplementary block was required in 1 patient where Sargenti nerve block was used, 3 patients in Gow Gates, and 9 patients in Clark and Holmes. No supplementary blocks were required for Halstead nerve block.

Table 1 reveals the positive aspiration rate with the four techniques. The positive aspiration rate was seen in seven patients. The comparison among the four groups was insignificant ($P < 0.05$).



Graph 1: Comparison of all four techniques for subjective and objectives signs to appear after anesthetic block

DISCUSSION

To make the inferior alveolar nerve block successful, local anesthetic solution must be deposited at the point close to the nerve before it goes into the mandibular foramen. The success is entirely dependent on the diffusion of local anesthesia. The important consideration here is not to deposit solution in the large vessel present near the foramen. The mandibular nerve innervates the skin, lower lip, labial gingiva, and all the teeth unilaterally from the midline on the same side of the block.[8] The mandibular foramen varies in location from patient to patient. The location has been studied in view of ramal height and its changes according to various factors, such as age and position of the foramen with respect to occlusion. Thangavelu *et al*.[9] proved that the foramen is not at the center in the anteroposterior dimension of the ramus of the mandible, but it is present 2.75 mm posterior to the middle point of the entire width of the ramus.

They have also proven that the distance between the coronoid notch and mandibular foramen is 19 mm. and the important point they have shown is that the foramen is located at the level or below the occlusal plane. The location of the foramen is 3 mm above the midpoint of an imaginary line that runs from the mandibular notch to the lower border of the mandible.[6,7] In our study, the parameters studied were time taken for subjective signs, time taken for objective signs, ease of administration, aspiration during nerve block, and need for supplementary anesthesia. All the parameters are noted and statistically analyzed. The results were compared considering all the factors. We will discuss all the parameters in detail.

To begin with, subjective signs, the Halstead technique acts faster and patient experienced heaviness at faster rate at the site of injection and progresses toward the remaining

Table 1: Depicting comparison of status of aspiration in different study groups

Status of aspiration	Halstead	Sargenti	Gow Gate	Clark and Holmes
Positive	2 (2.5%)	1 (2.4%)	4 (2.3%)	3 (2.8%)
Negative	23 (22.5%)	23 (21.6%)	19 (20.7%)	25 (25.2%)

Chi-square test, $P=0.48$

area of the nerve distribution along the respective half of the mandible. This is followed by the Sargenti and Clark and Homes technique. The Gow Gate technique requires a longer time compared to all other blocks to develop subjective signs. The needle position while administrating inferior alveolar nerve block is closest to the mandibular foramen in the Halstead technique and farthest in the Gow Gates technique. This may be the reason for the faster appearance of signs in the Halstead nerve block technique. This finding is similar to previous studies.[1]

Considering objective signs, again, the Halstead technique developed faster objective signs, which is followed by Sargenti and Gow Gates. The Clark and Homes technique was shown to develop objective signs considerably slowly. The Halstead technique, Angelo Sargenti technique, and Gow Gates technique involve hitting the medial surface of the ramus and condylar neck of the mandible, respectively. This guides the operator to the optimal target area. In the Clark and Homes technique, there is no bony stop, and therefore, the precision of the block varies from patient to patient. The amount of local anesthetic solution diffused close to the mandibular foramen also varies as the anatomy varies from patient to patient.[10,11]

In all four blocks performed by well-trained researchers, a supplementary block was required at maximum in the Clark and Homes techniques and none in the Halstead technique. In the Clark and Homes technique, there is no bony landmark involved, and the final needle position varies. This may be the reason for insufficient anesthesia and the need for supplementary anesthesia. Aspiration during the injection was not positive in any of the above-considered blocks in the study except for the Clark and Homes technique, wherein aspiration came positive in a considerable number of patients.

The ease of administration was calculated by a researcher with the help of a NetEasy scale. The Halstead technique is considered easy compared to all other techniques. The Gow Gates technique is considered very difficult. Because the Halstead technique has been performed by a researcher for years, it is easy to perform because of the practice. On the other hand, the Gow Gates technique is sensitive, and the area of insertion is the condylar neck, which is narrow in dimension. Its mediolateral dimensions are narrow, so it is difficult to

reach the area, and there is room for error.[12] The patient feels uncomfortable keeping the mouth open for a long duration, so the patient tends to close the mouth, which makes it difficult for the operator to identify the exact location of the medial aspect of the neck of the condyle. In well-trained hands, it is always beneficial to know different techniques of inferior alveolar nerve block. This can aid the operator in choosing different techniques in different iterations. In this study, design, all four blocks could not be administered to the same patients. Therefore, there remained variability in the anatomy and physiology of the patients. Even though there is evidence of the failure of classical inferior alveolar nerve block, that is, the Halstead technique, the other techniques of the blocks are not routinely used. It is important for a dental surgeon to be aware of various options to administer inferior alveolar nerve block. Regular use and practice of various techniques of inferior alveolar nerve blocks will help to minimize complications related to the block. Training dental surgeons in all types of blocks should be made part of the curriculum.

CONCLUSION

This clinical study compared the four different techniques of inferior alveolar nerve block and assessed the clinical effect and ease of administration for these techniques. The results were in favor of the Halstead technique in most of the parameters. The ease of administration was noted to be best in Halstead and most difficult in the Gow Gates technique. It can be concluded from the results that Halstead is the easiest technique, while Gow Gates is the most difficult technique to perform. The Clark and Homes technique has comparatively more chances of failure, requires supplementary anesthesia, and has high rates of positive aspirations. It is a standard method among dentists all over the world to blindly prefer the Halstead technique to administer inferior alveolar nerve block. However, studies have proven that there are 50% failures in this technique. The results of our study have proven that the Angelo Sargenti technique works as well as the Halstead technique in most patients. Gow Gates has proven to have long-lasting effects. It is now time to consider the usage of all alternative blocks for the inferior alveolar nerve to improve the efficiency of the administration of anesthetic solution.

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Conflicts of interest

There are no conflicts of interest.

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