Comparison of Efficacy of Halstead, Vazirani Akinosi and Gow Gates Techniques for Mandibular Anesthesia

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Abstract

Purpose Traditionally, the “Halstead block” has been widely used to provide anesthesia in mandibular teeth. Two other techniques, the Gow Gates mandibular nerve block and the Akinosi Vazirani closed-mouth mandibular nerve block, are reliable alternatives to the conventional inferior alveolar nerve block. The purpose of this study is to evaluate the onset of anesthesia, anesthetic success and incidence of positive aspiration during administration of local anesthetic solution using the Halstead, Vazirani Akinosi and Gow Gates techniques.

Materials and method The study involves 210 subjects, divided into three different groups of 70 subjects each receiving Gow Gates, Vazirani Akinosi and conventional inferior alveolar nerve blocks. The onset of anesthesia, positive aspiration and anesthetic success was evaluated.

Results In Vazirani Akinosi technique group, patients showed highest anesthetic success of 95.71%; there was a significant difference seen between the Gow Gates and Vazirani Akinosi techniques ($p = 0.0241^*$). The mean value of the onset of anesthesia in Gow Gates technique showed the longest 343.71 ± 153.20 s, in Halstead technique it was 177.43 ± 59.94 s, and in Vazirani Akinosi technique it was 192.86 ± 61.20 s. There was a significant

difference seen between Gow Gates and Vazirani Akinosi techniques ($p = 0.0001^*$) and Gow Gates and inferior alveolar nerve block techniques ($p = 0.0001^*$).

Conclusion The Vazirani Akinosi technique was found to be significantly better than the other two techniques with respect to both onset and success of anesthesia. Positive aspirations were slightly higher in the conventional IANB technique compared to the other two, but did not reach statistical significance.

Keywords Inferior alveolar nerve block · Vazirani Akinosi · Gow Gates technique · Pterygomandibular space

Introduction

Mandibular anesthesia can be achieved in many ways like the conventional inferior alveolar nerve block, Vazirani Akinosi and Gow Gates techniques. The most widely used technique for achieving local anesthesia for mandibular surgical procedures is the conventional inferior alveolar nerve block technique [1].

Traditionally, the inferior alveolar nerve block (IANB), also known as the “standard mandibular nerve block” or the “Halstead block,” has been used to provide anesthesia in mandibular teeth and bone. According to the literature, however, this technique has a success rate of only 80–85 percent [1]. Sometimes, operators may incorrectly identify the anatomical landmarks in administering the IANB, relying on assumptions as to where the needle should be positioned. Thus, a failure rate to be 20–25% is reported. [1].

Gow Gates described a new technique for mandibular anesthesia in which he used both extra-oral and intra-oral

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landmarks, and the lateral aspect of the condylar neck was the target site.

The Gow Gates technique showed higher success rates in achieving successful anesthesia approximately 99% when compared to other techniques [2].

Vazirani Akinosi technique is generally indicated in patients with trismus, where the conventional inferior alveolar nerve block technique is cumbersome to use [3]. Considering the high level at which this block is administered, it shares the advantages of other high-level blocks in the distribution of its anesthetic effect. Although this technique can be used for giving anesthesia in all patients, most clinicians reserve it for those who have severe mouth opening deficiencies or are severe gaggers.

The three techniques mentioned above have their own merits and demerits. The literature is replete with studies showing conflicting results. Thus, the present study was intended to evaluate the efficacy of Halstead, Vazirani Akinosi and Gow Gates techniques for mandibular anesthesia.

Materials and Methods

This is a comparative three-arm parallel design double-blinded study comprising of 210 patients requiring minor surgical procedures in the mandibular region. Participation of subjects for the study was voluntary, and written informed consent was obtained from those who agreed to participate. Ethical clearance was obtained from the institution before the start of the study (*Regd No: 678/ODCHRC/RBE/2014*).

Systemically, healthy patients aged between 18 and 55 years were included in the study. Patients allergic to local anesthetic agent, smokers, alcoholics and pregnant patients were excluded from the study. These patients were divided into three groups. The principal investigator, who recorded the outcome measures for all the subjects, was unaware about the intervention received by each subject. After obtaining the informed consent, the patients recruited in the study were allotted to three groups in a sequential manner. The distribution of patients was done based on computer-generated chart given by statistician. Each group received mandibular anesthesia by a different technique, namely the inferior alveolar technique (Group A) (Fig. 1), Vazirani Akinosi technique (Group B) (Fig. 2) and Gow Gates technique (Group C) (Fig. 3). The anesthesia administration of all three techniques was done by second investigator. The principal investigator and the patient were unaware of the technique administered ensuring double blindness of the study. The procedures which were included in the study were normal extractions of the

Fig. 1 Depicting the administration of conventional inferior alveolar nerve block technique

Fig. 2 Depicting the administration of Vazirani Akinosi technique

Fig. 3 Depicting the administration of Gow Gates technique

mandibular premolars, canines and incisors in the lower arch.

The anesthetic used was 2% lignocaine with 1:80,000 adrenaline. The amount of local anesthesia used was 2.8 ml in all the patients. The onset of anesthesia, anesthetic

success, the incidence of aspiration, requirement for any additional nerve blocks and any associated complications were recorded.

Evaluation of Anesthetic Success

The anesthetic success was evaluated with the help of an electric pulp tester (Digitest II), in 3 min cycles for 60 min at the first molars, first premolars and lateral incisors. The electric pulp tester is a battery-operated instrument, which is connected to a probe that is applied to the tooth under investigation. It functions by producing a pulsating electrical stimulus, the initial intensity of which should be at a very low value to prevent excessive stimulation and discomfort. The intensity of the electric stimulus is then increased steadily at a preselected rate, and a note is made of the readout on the digital display when the patient acknowledges a warm or tingling sensation. Anesthesia was considered successful when 2 consecutive 80 readings were obtained within 15 min and the 80 readings continuously sustained through the 60th minute.

Evaluation of Onset of Anesthesia

The onset of anesthesia was evaluated with the help of a straight probe which was run around the gingival sulcus of the first premolar, lateral incisor in the area of anesthesia.

Evaluation of Aspiration

Positive aspiration was evaluated by the use of self-aspirating syringe (Septodont) and local anesthesia (2% lignocaine) cartridges with adrenaline 1:80,000 (Septodont).

Requirement for Any Additional Nerve Blocks

Following the administration of the mandibular nerve block in all the patients, failure to achieve proper anesthesia may require an additional nerve block. Such instances were recorded in all the three groups of patients.

Associated Complications

Generally, an inferior alveolar nerve block is associated with complications like trismus and transient facial nerve palsy. Following the administration of local anesthesia for inferior alveolar nerve block by the above-mentioned three techniques, its associated complications were recorded.

Statistical Analysis

All the analysis was done using Statistical Package for the Social Sciences (SPSS) version 18. A *p* value of < 0.05

was considered statistically significant. As the data did not follow the normal distribution, nonparametric test was done. The comparison among the groups in relation to percentage of aspiration rate, anesthetic success and onset of anesthesia was done using Chi-square test.

Results

In the present study, 210 patients were selected and were divided into three groups consisting of 70 patients each. The mean age (years) for Gow Gates technique was 34.87 ± 11.75 , for IANB was 33.83 ± 11.13 , and for Vazirani Akinosi was 34.50 ± 11.32 . The common mean age between all the three groups was 34.40 ± 11.36 .

Table 1 reveals the positive aspiration rate with the three techniques. The positive aspiration rate was 1.43% in both Gow Gates technique and Vazirani Akinosi technique, compared to Halstead block which was 7.14%. The comparison among the three groups was insignificant ($p = 0.0948$).

Table 2 reveals the percentage of anesthetic success in all the three groups. In Vazirani Akinosi technique group, patients showed highest anesthetic success at 95.71%, with 92.86% success for IANB technique and with 84.29% success for Gow Gates technique. There was a significant difference seen between the Gow Gates and Vazirani Akinosi techniques ($p = 0.0241^*$).

Table 3 shows the mean time of the onset of anesthesia in all the three groups. The mean value of onset of anesthesia in Gow Gates technique was found to be the longest 343.71 ± 153.20 s. The mean value of onset of anesthesia in IANB technique was found to be 177.43 ± 59.94 s. The mean value of onset of anesthesia in Vazirani Akinosi technique was found to be 192.86 ± 61.20 s. Mean time of onset showed a difference of 15 s between Vazirani Akinosi and Halstead. There was a significant difference seen between Gow Gates and Vazirani Akinosi techniques ($p = 0.0001^*$) and Gow Gates and IANB techniques ($p = 0.0001^*$).

Out of the 70 subjects in Group C, 10 subjects (14.2%) required an additional nerve block. Subjects in Group A and Group B did not require an additional nerve block. None of the patients in the three groups have encountered any trismus or transient facial palsy following the administration of local anesthesia for inferior alveolar nerve block.

Discussion

In terms of osteology, mandible differs from maxilla. Mandible is a cortical bone, while maxilla is a porous bone which mandates an operator to administer an effective

Table 1 Depicting comparison of status of aspiration in the study groups

Status of aspiration	Gow Gates	%	Inferior alveolar nerve block	%	Vazirani Akinosi	%	Total
Positive	1	1.43	5	7.14	1	1.43	7
Negative	69	98.57	65	92.86	69	98.57	203
Total	70	100.00	70	100.00	70	100.00	210

Between three groups, Chi-square = 4.7292, $p = 0.0948$

Between Gow Gates and inferior alveolar nerve groups, Yates Chi-square = 1.5672 $p = 0.2111$

Between Gow Gates and Vazirani Akinosi groups, Chi-square = 0.0000, $p = 1.0000$

Between inferior alveolar nerve and Vazirani Akinosi groups, Yates Chi-square = 1.5672, $p = 0.2111$

Table 2 Comparison of three study groups with status of anesthetic success

Status of anesthetic success	Gow Gates	%	Inferior alveolar nerve block	%	Vazirani Akinosi	%	Total
Positive	59	84.29	65	92.86	67	95.71	191
Negative	11	15.71	5	7.14	3	4.29	19
Total	70	100.00	70	100.00	70	100.00	210

Between three groups, Chi-square = 6.0181 $p = 0.0493^*$

Between Gow Gates and inferior alveolar nerve groups, Chi-square = 2.5403 $p = 0.1111$

Between Gow Gates and Vazirani Akinosi groups, Chi-square = 5.0796 $p = 0.0241^*$

Between inferior alveolar nerve and Vazirani Akinosi groups, Yates Chi-square = 0.1323 $p = 0.7161$

* $p < 0.05$

Table 3 Comparison of three study groups with status of onset of anesthesia

Status of onset of anesthesia	Gow Gates	%	Inferior alveolar nerve block	%	Vazirani Akinosi	%	Total
Negative	11	15.71	5	7.14	3	4.29	19
180	0	0.00	59	84.29	55	78.57	114
300	6	8.57	6	8.57	12	17.14	24
Total	70	100.00	70	100.00	70	100.00	210

Between three groups, Chi-square = 171.6842, $p = 0.0001^*$

Between Gow Gates and inferior alveolar nerve groups, Chi-square = 46.0548, $p = 0.0001^*$

Between Gow Gates and Vazirani Akinosi groups, Chi-square = 46.5655, $p = 0.0001^*$

Between inferior alveolar nerve and Vazirani Akinosi groups, Chi-square = 2.6403, $p = 0.2673$

* $p < 0.05$

nerve block to facilitate surgical interventions in the mandible in contrary to maxilla where one can get away with proper local anesthetic infiltrations. Mandible is subjected to diverse surgical interventions like extraction of teeth, surgical removal of impacted teeth and mandibular tori removal.

Traditionally, IANB has been used to anesthetize mandibular teeth. This technique, however, has success rate of only 80–85% with even few reports of even lower success rate [3]. The other two techniques are considered as alternative to the IANB. The practitioners who are aware

about all the three techniques increase their probability of providing successful anesthesia in any patient.

The reasons attributed to the low success rate of IANB are the following. Firstly, the operator might do technical errors such as improper angulation of the syringe or improper identification of the landmark. Secondly, the presence of infected tissue may impair the onset of anesthesia. Thirdly, the apprehension of the patient may lead to anesthetic failure. The key landmark of IANB is mandibular foramen which highly varies anatomically and can attribute to the failure of IANB. The above-mentioned reasons may address the reasons for IANB failures. Thus,

in the hands of inexperienced operators the failure rates may increase.

Thus, the operators who are skilled at using Gow Gates and Vazirani Akinosi techniques will have high likelihood of successfully providing anesthesia in patients who have anatomical variability. These two techniques have an edge over the conventional IANB as they deliver the anesthetic solution at a site deeper than that accomplished by IANB [3].

Gow Gates injection involves deposition of anesthetic solution near to the pterygoid fovea adjacent to head of condyle. The point of solution deposition is higher than in conventional IANB. Because of gravity, the solution diffuses in an inferior direction, filling the pterygomandibular space and moving as forward as buccinator muscle. Thus, all oral sensory branches of the mandibular nerve, including nerve to mylohyoid, are exposed to anesthetic solution. The length of nerve exposed to anesthetic solution is significantly more than in conventional IANB, thus increasing the number of voltage-gated channels exposed to local anesthesia solution [4]. An imaginary line is drawn from the intertragic notch (the point immediately inferior to the tragus of the ear) to the corner of the mouth which is taken as extra-oral landmark. Align the syringe parallel to this plane during insertion. Intraorally, the needle lies just below the mesiopalatal cusp of the maxillary second molar, which can be a reliable landmark, provided that this tooth has not drifted or rotated [3]. A major limitation with Gow Gates injection is the operator's learning curve with the technique. Also, the maxillary artery and pterygoid plexus are present near the point of deposition of solution. Accidental injury can cause pain and hematoma. Another limitation of this technique is the dependence on extra-oral landmarks [4].

The positive aspiration rate in this study was 1.43% in Gow Gates technique compared to Halstead block which was 7.14%. This rate may be lower because the inferior alveolar vein and artery are further away from the target site than they are with the IANB, which also may be the reason that the investigators reported that exogenous epinephrine absorption is lower with the Gow Gates technique than with the IANB. After the injection was administered, the patients were asked to keep their mouths open for at least 20 s, if possible, to keep the inferior alveolar nerve closer to the site of injection and improve onset of anesthesia. Disadvantage is the onset of anesthesia which is usually 5 to 10 min, which is longer than that for the IANB (usually 3–5 min) [3].

The other technique evaluated in the present study was “high” Vazirani Akinosi closed-mouth anesthesia. It gave a high success rate. As the name suggests, this technique involves deposition of solution in a closed-mouth position. The solution is deposited higher than the conventional

IANB, thus increasing the length of the nerve exposed to the anesthetic solution. It is highly advantageous in conditions limiting mouth opening. The only disadvantage is that there is no bony contact end point [4].

Although some studies reported success rates for these alternative blocks, others have reported comparable results. Haas et al. [3] reported better rate of success for conventional IANB due to the experience of the dentist administering the block. However, Todorovic et al. [5] reported higher success rate with IANB than Gow Gates block; on the contrary, Montagnese et al. [6] reported both the techniques to be equivalent. Sisk [7] and Todorovic et al. [5] found the Vazirani Akinosi technique equivalent to IANB. However, Donkor et al. [8], Yucel and Hutchinson [9] and Martínez Gonzales et al. [10] reported IANB superior to Vazirani Akinosi.

Conclusion

In conclusion, the Vazirani Akinosi technique gave the best results in this study with low positive aspiration rate, quick onset of anesthesia and good anesthetic success, though there was no significant difference between Vazirani Akinosi technique and conventional inferior alveolar nerve block technique. There were no major complications associated with any of the three techniques, but Gow Gates technique demands surgical expertise. A significant difference was found between onset of anesthesia and the anesthetic success of Vazirani Akinosi technique and Gow Gates technique.

Compliance with Ethical Standards

Conflict of interests Authors declare that they have no conflict of interest.

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