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COMPARISON AND CLINICAL ASSESSMENT OF THREE DIFFERENT TECHNIQUES OF MANDIBULAR NERVE BLOCK

Dental Science

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ABSTRACT

Background and Objectives: Inferior dental anesthesia is administered regularly in dental practice. Modification of conventional Inferior alveolar nerve block was introduced by Akinosi and Gow-Gates in which anesthesia of all the three branches of mandibular nerve can be obtained. This study aims to compare and clinically assess the three different techniques of mandibular nerve block.

Method: A total of 300 patients who presented for minor oral surgical procedure (extraction or surgical removal of impacted tooth) were enrolled and randomly divided into 3 groups. Each group was given injection of 3ml of 2% lidocaine with 1:80,000 adrenaline solution by using three different techniques for mandibular block anesthesia. The patients were evaluated using parameters like pain during injection, positive aspiration, depth of anesthesia, onset and duration of anesthesia.

Results: No significant difference was found between the groups in pain experienced during the injection and depth of anesthesia. Akinosi technique achieved better buccal nerve anesthesia compared to Gow-Gates ($P=0.03$). The onset of anesthesia was significantly slower ($P<0.001$) with the Gow-Gates technique in comparison with the other two methods. And Classical technique was significantly quicker in the onset of anesthesia among the three techniques ($P=0.001$). Akinosi technique had a lower duration of action compared to the other two techniques.

Conclusion: The Classical inferior alveolar technique is effective in inducing profound mandibular anesthesia, it produces anesthesia at a faster rate and also has a reasonable duration of action. A decision to select one of these techniques should be based on the ability to determine the techniques respective to the anatomical landmarks, the need to anesthetize the buccal nerve, trismus or a marked gag reflex.

KEYWORDS

Mandibular nerve block; Gow-Gates; Akinosi; Inferior alveolar nerve block

INTRODUCTION

The primary method of pain control in dentistry is the injection of the local anesthetic agent and the ultimate goal is complete analgesia.[1] The inferior alveolar nerve block is the most frequently used injection technique for achieving local anesthesia for mandibular surgical procedures.[2] Anatomical variation in shape and size of the mandible may make the accurate localization of mandibular foramen difficult, thereby increasing the failure rates with the conventional inferior alveolar nerve block. To overcome these failures, modification of conventional Inferior alveolar nerve block was introduced by Akinosi and Gow-Gates in which anesthesia of all the three branches of the mandibular nerve can be obtained.[3]

In 1973 George Albert Edwards Gow-Gates, a general practitioner of dentistry in Australia described a new approach to mandibular anesthesia. The Gow-Gates technique is a true mandibular nerve block because it provides sensory anesthesia to the entire distribution of the third division of the trigeminal nerve. The Inferior alveolar, lingual, mylohyoid, mental, incisive, auriculotemporal and buccal nerves are all blocked in the Gow-Gates technique.[4] The technique uses extra-oral landmarks to aid in directing the needle towards the neck of the mandibular condyle in the superior aspect of the pterygomandibular space.[5] Similarly in some of the patients, where conventional direct block technique involves a subsequent injection at a different site to anesthetize the long buccal nerve which would be rather distressing to some uncooperative patients, Gow- Gates technique offers a convenient alternative.[1]

Dr. Joseph Akinosi in 1977 was first to describe the mandibular nerve block in closed-mouth approach. This is also called as Vazirani Akinosi technique, closed-mouth mandibular nerve block or tuberosity block. This technique is used when its primary indication remains in those situations in which limited mandibular opening precludes the use of other mandibular injection techniques.[4] This technique is given in closed-mouth position with intraoral landmarks for needle insertion and the needle is inserted to its predetermined depth without contacting a hard tissue landmark.[6]

In this study, we compare the clinical efficacy, onset, duration of anesthesia, pain during injection, frequency of positive aspirations, depth of anesthesia of the Classical, Akinosi and Gow-Gates techniques of the mandibular nerve.

METHODOLOGY

Three hundred adult patients who required extraction or surgical removal of mandibular third molars were included in the study after obtaining informed consent. Patients with acute infection, who had trismus, who had taken any analgesic medication 48 hours before the procedure, who are pregnant or who are allergic to Lignocaine were excluded from the study. The patients were randomly divided into 3 groups, Classical inferior alveolar nerve block group, Akinosi nerve block group and Gow-Gates nerve block group using simple randomization. Patients in each group were given 3ml of 2% lidocaine with 1:80,000 adrenaline solution by using three different techniques for mandibular block anesthesia. Conventional luer mount syringe (5ml) with 26 gauge needle measuring 1 ½ inch was used in all cases.

Immediately before the anesthetic solution was injected an aspiration test was conducted & was recorded if positive. Soon after the nerve block, the patients were asked about the pain experienced during injection which was recorded as mild, moderate or severe on a subjective visual analog scale (VAS).

The onset of anesthesia was determined by subjective symptoms like tingling sensation or numbness of the lower lip, cheek and half of the tongue on side of injection. Objective signs like a demonstration of anesthesia between the first & second premolars for the inferior alveolar nerve, the lingual gingiva for the lingual nerve, buccal gingiva in the 3rd molar region for the long buccal nerve.

Absence of subjective symptoms and objective signs, 10 minutes after the deposition of the solution was considered as a failure of the block and it was repeated. When there was a failure of long buccal nerve anesthesia following the Akinosi or Gow-Gates technique, the whole procedure was not repeated and instead a long buccal nerve injection was given at the distobuccal aspect of the third molar tooth. In case of failure of the direct block technique, long buccal nerve anesthesia was not taken into consideration, since it was achieved with separate injection. The supplementary injections and the total amount of local anesthetic solution used was recorded.

The duration of anesthesia was recorded from the time of onset to time

of loss of lip numbness as told by the patient. The depth of anesthesia has been assessed by asking the patient whether pain or pressure was present during the procedure.

Statistical Analysis:
Results are expressed as Mean ± SD for continuous data and categorical data as numbers and percentages. One way ANOVA was used for multiple group comparisons followed by Post-Hoc Tukey's test for groupwise comparisons. Categorical data were analyzed by Chi-Square test. A 'P' value of 0.05 or less was considered for statistical significance.

RESULTS

The conventional method was used on 100 patients, aged between 17-70 years (Table 1) with a mean age of 30.5 years (out of which 56 were males and 44 were females). It was observed that 57 had mild pain, 42 patients had moderate pain and 1 patient had severe pain during injection of local anesthetic solution. In 12 patients out of 100, the aspiration test was positive. 94 patients had tissue insensitivity or no pain on the pinprick test on the individual mandibular branch of inferior alveolar nerve and 94 patients had no pain on lingual tissue. 6 patients required supplementary injections due to the failure of the inferior alveolar and lingual nerve anesthesia and the frequency of successful anesthesia was found to be 94%. The mean onset of anesthesia was found to be 3.3 minutes with a range of 2-5 minutes. The mean duration of anesthesia was found to be 232 minutes with a range of 135-400 minutes. The frequency of long buccal nerve anesthesia was not taken into consideration since this required a separate injection to anesthetize in this technique.

Akinosi Technique was employed in 100 patients with a mean age of 28.1 years and a range of 14-72 years (Out of these 59 patients were males and 41 patients were females). With this technique it was observed that 59 patients had mild pain, 37 patients had moderate and 3 patients had severe and 1 patient had no pain during injection. Again in 12 patients, aspiration test was positive, on pinprick test of sensory mandibular nerve branches 85 patients had no pain on inferior alveolar nerve tissue, 85 had no pain on lingual tissue and 60 had no pain on buccal nerve anesthesia. In 85% of patients, a satisfactory level of depth of anesthesia was obtained. The mean onset of anesthesia was found to be 4.8 minutes with a range of 3-7 minutes. The duration of anesthesia was found to be 205 minutes with a range of 140-300 minutes. 40 cases required a second injection to anesthetize the long buccal nerve and success rate was found to be 60%.

Gow - Gates Technique was employed in 100 patients, with an age range of 12-75 years and a mean age of 28.4 years. In this group, 52 were males and 48 were females. 53 patients had mild pain, 43 patients had moderate pain and 4 patients had severe pain during injection. 12 patients had positive aspirations. The onset of anesthesia was found to range between 4-8 minutes with a mean of 5.9 minutes. 88 patients had no pain on the pinprick test in the area of tissue anesthetized by inferior alveolar nerve block and lingual nerve block. The mean duration of anesthesia was found to be 245 minutes with a range of 160-375 minutes. In 12 cases, supplementary injection had to be administered due to the failure of the block, this giving a success rate of depth and frequency of anesthesia of 88%. 26 patients required additional long buccal nerve block with a frequency of 74%.

Concerning the pain experienced during the injection, there was no significant difference between the applied techniques of mandibular anesthesia (Table 2). There was no statistically significant difference between the groups in terms of positive aspiration during the injections (Table 3).

The values of tissue insensitivity to pinprick tests were not significant for the techniques concerning inferior dental and lingual nerves (Table 4). However, Akinosi technique was significantly better than Gow-Gates (P=0.03) in terms of the value of insensitivity in the innervation areas of the buccal nerve (Table 5). The depth of anesthesia was determined according to the discomfort experienced during tooth extraction. There was no significant difference found between the three groups in achieving the adequate depth of anesthesia (Table 6). Among the three groups, a total of 33 patients experienced pain and received a supplemental injection to complete the procedure.

The onset of anesthesia was significantly slower (P<0.001) with the Gow-Gates technique in comparison with the other two methods (Table 7). And Classical technique was significantly quicker in the onset of anesthesia among the three techniques (Table 8). Akinosi had a significantly lower duration of action compared to the other two techniques (Table 9 & 10) whereas Classical and Gow-Gates had a comparable duration of action.

TABLES:

Table 1: Age and Sex of patients.

Technique	No. of cases	Age (Yrs)			Sex	
		Minimum	Maximum	Mean Age	Male	Female
Classical	100	17	70	30.5	56	44
Akinosi	100	14	72	28.1	59	41
Gow –Gates	100	12	75	28.4	52	48

Table 2: Pain experienced during injection with applied techniques of Mandibular anesthesia.

Technique	No. of cases	Pain			
		Mild	Moderate	Severe	No pain
Classical	100	57	42	1	0
Akinosi	100	59	37	3	1
Gow –Gates	100	53	43	4	0
Chi Square (x2) = 4.58, P = 0.60					

Table 3: Aspiration test of applied techniques of Mandibular Anesthesia.

Technique	No. of cases	Aspiration	
		Positive	Negative
Classical	100	12	88
Akinosi	100	12	88
Gow –Gates	100	12	88

Table 4: Pin – Prick testing of sensory mandibular nerve branches after mandibular anesthesia with the three techniques.

	No. of cases	Pin – Prick					
		Inferior Alveolar		Lingual		Buccal	
		Pain	No Pain	Pain	No Pain	Pain	No Pain
Classical	100	6	94	6	94	NA	NA
Akinosi	100	15	85	15	85	40	60
Gow –Gates	100	12	88	12	88	26	74
Chi Square (x^2)		4.29		4.29		4.43	
Significance		P = 0.12 NS		P = 0.12, NS		P < 0.05, S	

Table 5: Frequency of Long buccal nerve anesthesia

Technique	No. of cases	Pain Sensation	No pain sensation	Frequency
Classical	100	NA	NA	NA
Akinosi	100	40	60	60
Gow –Gates	100	26	74	74
Chi Square(X 2)= 4.43, P=0.03				

Table 6: Depth and frequency of anesthesia achieved using applied techniques of Mandibular Anesthesia

Technique	No. of cases	Depth				Frequency
		Pain	No Pain			
			Pressure	None	Total	
Classical	100	6	54	40	94	94%
Akinosi	100	15	23	62	85	85%
Gow –Gates	100	12	28	60	88	88%
Chi Square (x2) = 4.29, P = 0.12						

Table 7: Onset of Anesthesia of applied techniques of mandibular anesthesia

Technique	No. of cases	Time (min)	
		Range	Mean + SD
Classical	100	2-5	3.38 + 0.68
Akinosi	100	3-7	4.89 + 0.83
Gow –Gates	100	4-8	5.96 + 0.88
F = 263.60 P < 0.00001, HS (One – Way ANOVA)			

Table 8: Comparison of onset of anesthesia (Time taken in minutes) between different techniques (Post Hoc Tukey's Test).

Comparison between	No. of cases	Range	Mean	S.D.	Significance
Classical	100	2-5	3.38	0.68	P<0.01 HS
Akinosi	100	3-7	4.89	0.83	

Classical	100	2-5	3.38	0.68	P<0.01 HS
Gow –Gates	100	4-8	5.96	0.88	
Akinosi	100	3-7	4.89	0.83	P<0.01 HS
Gow-Gates	100	4-8	5.96	0.88	

Table 9: Duration of Anesthesia (One Way ANOVA)

Technique	No. of cases	Duration (min)	
		Range	Mean + SD
Classical	100	135-400	232 + 58
Akinosi	100	140-300	205 + 36
Gow –Gates	100	160-375	245 + 49
F = 17.90, P < 0.001,HS.			

Table 10: Comparison of duration of anesthesia (In minutes) Between Different Techniques (Post Hoc Tukey's Test).

Groups compared	No. of cases	Duration (In minutes)		
		Mean	SD	Significance
Classical V/s Akinosi	100	232	58	P < 0.001 HS
	100	205	36	
Classical V/s Gow –Gates	100	232	58	P < 0.14 NS
	100	245	49	
Akinosi V/s Gow –Gates	100	205	36	P < 0.001 HS
	100	245	49	

DISCUSSION

Pain relief and prevention have been one of the main objectives of dentistry. The purpose of this study was to compare and clinically assess the three different mandibular local anesthetic techniques with regards to the degree of pain during the injection, frequency of positive aspiration, depth of anesthesia, onset and duration of anesthesia.

In our study, there was no significant difference between the three groups in the success rate of achieving the mandibular anesthesia. We achieved a success rate of 94% with the Classical technique, which is similar to that of Ergun Yucel et al[7] who achieved a higher success rate of 98% and that of Todorovic et al[8] and Donker P et al[9] where they achieved 96.6% of success rate. In our study, an 88% success rate obtained by the Gow-Gates technique. Montagnese TA et al claimed 78% of success rate[1] and Goebel WM claimed a success rate of 91% with Gow-Gates technique[10]. A study by Berezowski BM et al[11] demonstrated the Gow-Gates technique to be significantly less effective than conventional techniques. Montagnese TA et al[1] explained the lower success rate might be because of difficulty in duplicating the technique of palpating the bone of the mandibular condyle using external landmarks. In our study, an 85% success rate was obtained with the Akinosi technique. While Donkor P et al[9] claimed a 79% success rate and Todorovic L et al[8] who claimed a 76.6% success rate in using the Akinosi technique. The lower success rate of the closed-mouth technique in anesthetizing the inferior alveolar nerve may have been due to the anesthetic solution being deposited far from the target area, resulting in inadequate perfusion of the nerve. However, Akinosi JO[3] claimed a success rate of 93% with the technique devised by him. Similarly, Sisk AL[12] and Goebel WM[10] claimed 90% and 93% success rates respectively.

In the present study, a 60% success rate of long buccal nerve anesthesia was achieved with the Akinosi technique while in the Gow-Gates technique the success rate was 74%. Success rates of 71% and 80% achieved by Donkor P et al[9] and Sisk AL[12] respectively using the Akinosi technique. Studies by Malamed SF[13], Goebel WM[10], Levy TP[14], and Sisk AL[5] have demonstrated long buccal nerve anesthesia to be 68%, 65%, 77%, & 78% respectively using the Gow- Gates technique.

The significance of performing an aspiration before deposition of the anesthetic solution to eliminate vascular accidents are well known. The most frequent positive aspiration of all intraoral injections is reported for mandibular block injection[8]. In this study, the aspiration test proved to be negative in 88% of cases in all the three techniques so there were no differences found. This agrees with the studies of Bishop PT, Todorovic L et al [8] and Montagnese TA et al[1] for Classical techniques who obtained a positive rate of 15.4%, 13.3%, and 5% respectively. Aspiration rate for Akinosi and Gow Gates techniques was found to be 6.6% in the study done by Todorovic L et al[8]. Coleman RD et al[15] stated that the small percentage of positive aspiration associated with the Gow-Gates technique can be attributed to the position of the nerve which lies against the lateral side of the mandibular neck and to reach this position the needle should pass lateral to the usual position of maxillary inferior alveolar artery, middle meningeal artery and inferior to the masseteric artery[16].

Concerning the onset of anesthesia, it was found to be 3.3 minutes (range 2-5), 4-8 minutes (range 3-7) and 5.9 minutes (range 4-8) for classical, Akinosi and Gow -Gates technique respectively. The study by Donkor P et al[9] using the Akinosi technique supports the result of our study in which the onset of anesthesia with the Classical technique was faster than Akinosi technique[9]. The studies by Todorovic L et al[8] and Akinosi JO[3] demonstrated a faster onset of anesthesia with the Akinosi technique which was 3 minutes and 1 ½ minute respectively. The time of onset of anesthesia with the Gow-Gates techniques in our study was 5.9 minutes which highlights the slower onset and is supported by Malamed SF [13], Bennet CR [17], Todorovic L et al.[8]

Malamed SF gave a possible explanation for the slower onset of anesthesia with the Gow-Gates technique, as the greater diameter of the nerve trunk at the site of injection and the distance (approximately 10mm) of the nerve from the site of deposition of the solution[13]. Also, De Jong suggested that the nerve fibers supplying distal structures occupy the position in the central core of the nerve bundle whereas proximal areas are supplied by nerve fibers that are positioned peripherally. Therefore the distal nerve would be last to anesthetize.[1]
The duration of anesthesia in our study was found to be 232 min in Classical technique, 205 minutes in Akinosi, 245 mins in Gow Gates. In the study of Todorovic L et al, the mean duration of anesthesia was found to be 180 mins in Classical technique and 160 mins in Akinosi and Gow- Gates respectively[8].

The results concerning pain experienced during injection are almost identical for all the techniques investigated. Although it is reasonable to accept the view that it is more convenient for the patient not to open his mouth fully and that injection is less painful if the needle penetrates in the relaxed tissues as in the Akinosi techniques, it appears that the experience of pain is unpredictable. Perhaps a valid judgment concerning the differences among the various techniques in terms of pain experience can only be made with the application of different techniques in the same person[8] In the study by Jacobs et al[6], there was no difference in pain associated with the injection among the three techniques. Yamada A, Jastak JT reported that the Gow-Gates technique was less painful than the Standard block techniques[18].

CONCLUSION

Both the Gow-Gates and Akinosi techniques do not require separate injections to anesthetize the long Buccal nerve which is of considerable advantage. The Akinosi technique is advantageous in patients who have limited mouth opening.

Even though the classical technique requires additional buccal nerve anesthesia, with this study we conclude that the classical technique is effective in inducing profound mandibular anesthesia, it produces anesthesia at a faster rate and also has a reasonable duration of action.
A decision to select one of these techniques should be based on the ability to determine the techniques respective to the anatomical landmarks, the presence of accessory innervation, the need to anesthetize the buccal nerve, trismus or a marked gag reflex.

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