

Comparison of Efficacy of Gow-Gates Mandibular Nerve Block and Inferior Alveolar Nerve Block for The Extraction of Mandibular Molars

Ayesha Maqsood¹, Muhammad Adil Asim², Fouzia Aslam³, Rushna Khalid⁴, Omer Khalid⁵

Abstract

Objective: The purpose of this study is to compare the efficacy of two local anaesthesia techniques i.e. inferior alveolar nerve block and Gow-Gates nerve block technique in terms of their success rate to anaesthetize tissues, time of onset of action, pain levels during administration and amount of drug used to achieve adequate anaesthesia.

Methods: This randomised control trial was carried out in department of Oral & Maxillofacial Surgery at Rawal Institute of Health Sciences, Islamabad from September 2017 to May 2018. A total of 138 patients were selected and randomly allocated to receive Gow-Gates (GG) nerve block or inferior alveolar nerve block (IANB) for extraction of mandibular molars. Onset of anaesthesia and success rate was noted for individual nerves. Pain during administration of anaesthesia was compared between IANB group and GG group by verbal response scale. Status of blood aspiration during injection and volume of local anaesthesia solution used to achieve adequate anaesthesia for extraction of lower molar tooth was also noted at the end of procedure.

Results: Comparison of success to achieve anaesthesia did not show significant difference between IANB and GG groups except the buccal soft tissue. Onset of action of anaesthesia of all nerves (IAN, lingual and buccal) was achieved much earlier in IANB. While results of pain and total amount of drug used were significantly better in favor of GG group as shown by p-value of 0.015 and 0.002 respectively.

Conclusion: We conclude that GG nerve block is a good alternative technique to conventional IANB technique for extraction of mandibular molars.

Keywords: Nerve block, anaesthesia, molar.

IRB: Approved by Research Ethics Committee of Rawal Institute of Health Sciences. Ref# RIHS-REC/022/16.

Citation: Maqsood A, Asim MA, Aslam F, Khalid R, Khalid O. Comparison of Efficacy of Gow Gates Mandibular Nerve Block and Inferior Alveolar Nerve Block for The Extraction of Mandibular Molars [Online]. *Annals ASH KM&DC* 2018;.

(ASH & KMDC 23(4):177;2018)

Introduction

In Oral Surgery, local anaesthesia is a key component in pain management¹. Local anaesthesia or L.A. blocks the painful stimulus by reversibly blocking the generation of action potential in a nerve. This is achieved with the help of a local anaesthetic agent, most commonly used of which is

¹⁻⁵ Department of Oral and Maxillofacial Surgery, Rawal Institute of Health Sciences, Islamabad

Correspondence: Muhammad Adil Asim
Department of Oral and Maxillofacial Surgery,
Rawal Institute of Health Sciences, Islamabad
Email: adil_asim@yahoo.com

Date of Submission: 25th September 2018

Date of Acceptance: 17th January 2019

lidocaine 2%, to which is added a vasoconstrictor such as adrenaline to reduce toxicity of drug by decreasing its vascular absorption, providing a clear field for surgery and enhancing the effect of the local anaesthetic agent. In dental surgery achieving optimal anaesthesia is very important. Operator (choice of anaesthetic technique) and patient (anatomical, pathological or psychological) are known as the main factors in anaesthetic success or failure rates. Lopez et al. explained failure to achieve anaesthesia by stating that if after 10-15 minutes following administration of a local anaesthetic solution, the symptoms of anaesthesia are not identified it will be considered a failed anaesthesia².

Maxillary anaesthesia is mostly successful except for the cases with anatomical variations or pathologic conditions. This is observed because the maxillary teeth apexes are not surrounded by dense bone and easy penetration of anaesthetic agent through local infiltration techniques achieves the desired result. But the situation in adult mandibular anaesthesia is quite different in which success rate in pulpal anaesthesia is low and much more difficult because higher density of cortical alveolar bone prevents easy penetration of the anaesthetic agent³. There are many factors which affect the success of inferior alveolar nerve block in the mandible, these include: patients fear of receiving the anaesthetic drug, systemic and local complication of intraoral injection, biologic diversity responsible to the drugs, anatomical variations, infections and inflammations, intravascular injections and needle deflection, dense bone, bifid mandibular nerve, accessory mental foramen, anastomoses, expired solution and incorrect method of injection⁴.

There are three main techniques used to administer local anaesthesia in the mandible, Inferior alveolar nerve block, Gow-gates technique and Vazirani Akinosi. Inferior alveolar nerve block (IANB) is the most routinely employed technique for achieving local anaesthesia in mandible⁵. Inferior alveolar nerve block technique involves deposition of local anesthesia solution in the pterygomandibular space, close to the inferior alveolar nerve. Other branches of mandibular nerve, including lingual, buccal, and nerve to mylohyoid are not anesthetised by this technique. So supplemental injections may be required to anaesthetise these nerves. However due to anatomical variations and accessory nerve supply this may not always result in successful pulpal anaesthesia³.

In 1973 Gow-Gates used extra-oral landmarks for achieving mandibular anaesthesia. To administer Gow-Gates Mandibular Block (GGMB), firstly the tissue targeted for needle insertion is dried with sterile gauze and topical anaesthetic gel is applied. The extra-oral and intraoral landmarks are carefully identified in the following manner: (1) extra-oral

landmarks include lower border of the tragus or the intertragic notch and the corner of the mouth; and (2) intraoral landmarks include the mesio-palatal cusp of the maxillary second molar just below which the needle tip is placed and is moved further to a point just distal to the molar. After completion of the localization of landmarks, the syringe is advanced, and gentle needle insertion is done, and then slowly progressive forward until the bone of the anterior condyle is contacted. The needle is withdrawn 1mm so that direct nerve impingement is avoided. If bone contact is not achieved, the needle is slightly withdrawn and redirected. No local anaesthesia must be deposited if the bone is not contacted. Once you have encountered the target area aspiration is performed to avoid intravenous injection. The patient is asked to keep his/her mouth open for 1-2 minutes after injection⁶. In this technique single intraoral injection is given at the lateral aspect of mandibular condyle, just below the insertion of lateral pterygoid muscle, targeting the main mandibular nerve division as it comes out of the foramen ovale, thus anesthetizing the whole of the mandibular nerve, a branch of trigeminal nerve⁷. Considerable advantages of the Gow-Gates technique over IANB, include its higher success rate, its lower incidence of positive aspiration (approximately 2% vs. 10% to 15% with the IANB) and the absence of problems with accessory sensory innervation to the mandibular teeth^{3,8}.

Some studies have shown higher success rates with the GG technique (95-96%) versus the conventional IAN (65-79%) during surgery⁹. In some studies it was found that the success rate of lip numbness was similar in both techniques^{8,10}. Whereas no regional and local studies have been done in which comparison of efficacy of Gow-Gates mandibular nerve block and inferior alveolar nerve block for the extraction of mandibular molars has been done.

The purpose of this study is to compare the two administration techniques inferior alveolar nerve block and Gow-gates nerve block technique, their onset of action, pain levels during administration and success rates for extraction of mandibular molars.

Subjects and Methods

This randomized control trial was carried out in department of oral & maxillofacial surgery at Rawal Institute of Health Sciences, Islamabad from September 2017 to May 2018. The inclusion criterion was patients reporting for extraction of mandibular molars to the OMFS department, falling in 18 to 60 years age groups without any serious co-morbid. Exclusion criteria was patients with mental illness and learning disability, acute facial space infections, patients with trismus, pregnant patients and patients with serious medical co-morbid conditions. A verbal informed consent was taken from the patients who were included in the study.

Sample size of 138 patients was calculated by consecutive non probability sampling technique, by taking level of significance 95%, study power of 80%, anticipated success of anaesthesia in Gow-Gates group 96%, and anticipated success of anaesthesia in IANB group of 80.8%^{5,4}. The patients were randomly divided in two equal groups (69 patients each) i.e. group receiving conventional inferior alveolar nerve block (IANB) and group receiving mandibular nerve block through Gow-Gates (GG) technique, by using lottery method after taking the verbal consent from patient.

In our study local anaesthesia solution containing 2% lignocaine with 1:100000 epinephrine in aspirating syringes was used with a 40mm long, 27mm gauge fine needle. The patient was comfortably seated on the dental chair. He was asked to open his mouth widely so as to make the tissues taut and visible, a dry sterile gauze was used to clean the injection site. The landmarks were palpated and identified the needle was advanced at the target area. Aspiration was done, if it was negative local anaesthetic drug was injected, if it was positive the needle was withdrawn and redirected. After injection the onset time was noted with the help of a timer.

For IANB technique, 1.5ml of the anaesthetic solutions was administered over a time period of 60-90 second and when the needle was withdrawn little

of the remaining anaesthetic solution was deposited for lingual nerve anaesthesia. For long buccal nerve anaesthesia an additional 0.5ml anaesthetic solution was deposited in the buccal sulcus of the molar region. For GG technique, 1.8ml anaesthetic solution was administered over a time period of 60-90 seconds. After the injection, the patient was instructed to keep his/her mouth wide open for 1 minute.

Success of anaesthesia was established by verbally asking the patient about lip numbness, numbness of tongue and cheek, and sharp explorer test of periodontal ligament, buccal and lingual soft tissues. Time of onset of anaesthesia of individual nerve was noted on a pro forma. Anaesthesia was considered failed in patients who did not develop numbness and were having pain on sharp explorer test even 10 min after administration of local anaesthesia¹¹. In case of failure to achieve anaesthesia after primary local anaesthesia injection, supplemental injections were given to achieve adequate anaesthesia of the specific nerve not anaesthetized.

Pain during administration of anaesthesia was compared between IANB group and GG group by verbal response scale. Pain was categorized in four categories i.e. no pain, mild, moderate, and severe pain. Status of blood aspiration during injection and volume of local anaesthesia solution used to achieve adequate anaesthesia for extraction of lower molar tooth was also noted at the end of procedure.

Two injection techniques for incidence of lip numbness, soft tissue anaesthesia incidence, incidence of pulpal anaesthesia, and anaesthetic success were analysed and compared by using SPSS version 17. Frequency and percentages were calculated for the categorical variables while mean \pm S.D was calculated for all the continuous variables. Chi square test and independent samples t test were used to compare the results of IANB group and GG group. p-value of less than 0.05 was considered significant.

Results

The total of 138 patients, 39 (28.3%) male and 99 (71.7%) female, mean age 33.93 ± 10.46 years (age range 18 to 60 years) were included in our study. In conventional IANB group 46 (70.8%) patients were female while 23 (33.3%) were male, with mean age of 34.16 ± 10.77 years whereas in Gow-Gates group 53 (76.8%) patients were female and just 16 (23.2%) were male, with mean age of 33.70 ± 10.20 years.

Comparison of success to achieve anaesthesia of inferior alveolar nerve (IAN), lingual nerve (LN) and buccal nerve (BN) was done between IANB and GG groups. It was found that buccal nerve anaesthesia was achieved in all patients of IANB group while among patients of GG group it was successful in only 51 (84.1%) cases. However, there was not much difference in success rate of inferior alveolar nerve and lingual nerve between two groups as depicted by p-value of 1.00 and 0.745 respectively (Table 1).

Mean time of onset of action was achieved much earlier in GG group as compared to IANB group as shown by value of <0.001 (Table 2). Furthermore, mean volume of local anaesthesia used to anesthetize tissues was more in IANB group than GG group. Independent samples t-test showed p-value of 0.002 (Table 3).

Comparison of intensity of pain during administration of anaesthesia between IANB and GG groups showed that almost half of the patients i.e. 35 (50.7%) cases in IANB group had moderate pain while most patients i.e. 41 (59.4%) cases in GG group had mild pain on administration of anaesthesia. Chi square test showed significant difference (p-value = 0.015) in both treatment groups (Table 4).

Finally risk of aspiration was compared between two groups and it was observed that 11 patients in GG group and 5 patients in IANB group had positive aspiration during administration of anaesthesia. But the difference was not found to be statistically significant as shown by p-value of 0.182.

Discussion

The most commonly used technique for anaesthetizing the lower molars is the inferior alveolar nerve block. However, many a times this may not prove successful either due to anatomical variations, presence of bifid inferior alveolar nerves¹², or local infection at the injection site, may complicate dental anaesthesia procedures or variety of other reasons. Thus, Gow-Gate mandibular block technique which anesthetizes the whole mandibular nerve was introduced, which provides a safe anatomical alternative approach to the mandibular nerve¹³.

When comparing success rates of mandibular anaesthesia, some investigators ascribed the increased success rates of GGMB to the reliability of anatomical landmarks which lead to the precise placement of the needle close to the nerve trunk¹⁴. They believed that it is the anatomic variation in the position of the mandibular foramen and lingula which was the main reason behind the failure of anaesthesia using the IANB method, and that GGMB is a safe reliable alternative technique that by eluding these problems, proves to be a successful mandibular anaesthetic technique^{3,15}. According to some researchers use of different length and gauge of needle may also affects success rate of anaesthesia in both techniques¹⁶.

The results of our study showed no significant differences between the IANB and GG techniques in terms of onset time and success rate. Our study revealed that the success rate of lip numbness in GG technique was higher than IANB technique, but difference was not statistically significant. In literature few researchers have reported higher success of GG technique^{9,17,18} Hung et al.¹⁰ and Goldberg et al.⁸ in two separate studies showed that there was 100% lip numbness with both techniques, but in our study these percentages were 92.3% and 91.3% for GG and IANB respectively. It should be noted that in our study patients were examined only for 10 minutes, while in study by Goldberg et al. patients were examined for 21 minutes.

Table 1. Comparison of success rate between two groups

Success status of anesthesia	Technique		Total (n=69)	p-value
	IANB	Gow-Gates (n=69)		
IAN				
Successful	63(91.3%)	64 (92.3)	127 (92)	1.005
unsuccessful	6 (8.7)	5 (7.7)	11 (8)	
Lingual Nerve				
Successful	65(94.2%)	63 (91.3)	128 (92.8)	0.745
unsuccessful	4 (5.8)	6 (8.7)	10 (7.2)	
Buccal Nerve				
Successful	69(100%)	51 (84.1)	120 (87)	<0.001
unsuccessful	0	18 (15.9)	18 (13)	

Table 2. Comparison of onset time of anaesthesia between two groups

	Technique	N	Onset time Mean ± S.D (min)	p-value
IAN	IANB	63	1.73 ± 0.91	<0.001
	Gow Gates	64	3.29 ± 1.80	
Lingual Nerve	IANB	65	1.55 ± 0.78	<0.001
	Gow Gates	63	3.27 ± 2.12	
Buccal Nerve	IANB	69	0.80 ± 0.51	<0.001
	Gow Gates	51	4.47 ± 2.04	

After anesthetizing the inferior alveolar nerve with IANB, the long buccal nerve was anaesthetized separately. For Gow-Gates separate buccal nerve block was not required as indicated by Gow-Gates¹⁰. In our study there was significant difference to achieve anaesthesia of buccal soft tissues in IANB group as compared to GG group. It is because in IANB group separate buccal nerve block was administered to anaesthetise buccal gingiva which has a higher success rate. Whereas various previous studies show that in case of GG block success of buccal nerve anaesthesia varies from 20% to 89%.¹⁰ Thus, in case of failure to achieve anaesthesia of buccal soft tissue in GG group a supplementary buccal nerve block was given before extraction of molar teeth¹⁹.

Various studies have reported equal success rate of both techniques. In one of the studies, success rates of anaesthesia were 40%, 44% and 70% for GGNB, IANB, and GGNB + IANB²⁰. In our study we also found almost similar success rate with 2 ml of lignocaine for GG and IANB groups (0.5 ml was administered for long buccal technique). How-

Table 3. Comparison of volume of LA solution used in both techniques

Technique	N	Volume Mean ± S.D	p-value
IANB	69	3.10 ± 0.73 ml	0.002
Gow Gates	69	2.67 ± 0.90 ml	

Table 4. Comparison of pain during administration of LA between two groups

Pain status	Technique		Total	p-value
	IANB	Gow-Gates		
no pain	2 (2.8%)	6 (8.7%)	8 (5.8%)	0.015
mild	27 (39.1%)	41 (59.4%)	68 (49.3%)	
moderate	35 (50.7%)	18 (26.1%)	53 (38.4%)	
severe	5 (7.2%)	4 (5.8%)	9 (6.5%)	
Total	69	69	138	

ever, in few studies investigators used different amount of lignocaine. Goldberg et al. used 3.6 ml lidocaine for both techniques, while Hung et al. used 2.7 ml for both groups^{8,10}.

When the time of onset of anaesthesia was compared between two groups, we found that onset time of lip numbness in IANB was less than the GG technique and the difference was found to be statistically significant. In our study, onset time of lip numbness for IANB of was 1.6 minutes whereas for Gow-Gates it was 3.27 minutes. Also, Waikakul and Punwutikorn reported 3 minutes onset time of lip numbness for the IANB¹⁴ and as supported by some other researchers²¹, which attributes it to the larger size of nerve fibres in this area and increased distance from the injection site⁹.

In our study we found that risk of positive aspiration was more with Gow-Gates technique as compared with IANB block, but the difference was not statistically significant. Animesh Barodiya et al²². reported positive aspiration in Gow-Gates technique and explained it to be puncturing of internal maxillary artery or middle meningeal artery. Whereas in various studies incidence of positive aspiration was more with IANB technique^{23,24}.

In our study, the incidence of pain during needle penetration was higher in the IANB group than in the GGMB group which was statistically significant. This has also been noted in another study¹⁰. Patients receiving IANB experience more pain during the phase of initial needle penetration. Likely explanation for this finding is the mucosa in this superior area of needle penetration being less sensitive and less resistant to the needle, possibly due to thinner musculofascial bands in that area. Therefore, less pain was reported as less pull by the needle was felt when it passed through the tissue⁴.

If complications associated with both techniques are compared, researchers have noted a variety of them associated with inferior alveolar nerve block, including trismus, hematoma, transitory paralysis of the facial nerve, tissue blanching due to prolonged vasoconstriction, burning sensation on direct contact with the nerve, fainting, temporary blindness of the affected eye, and ophthalmoplegia. On the contrary, fewer complications are noted with Gow-Gates technique, these include hematoma, trismus, and temporary paralysis of cranial nerves III, IV and VI¹¹. Fortunately, none of these complications occurred in our study in both the groups. We only noted increased pain on needle penetration with inferior alveolar nerve, the reason of which has already been discussed. In order to avoid complications, we should be careful and follow the recommendations as given by Gow-Gates, these include placing the needle on the lateral side of the anterior surface of the condyle, using aspirating needles carefully, and depositing the solution very slowly. If during this technique the bone is not contacted, the solution should not be administered, rather the needle should be withdrawn and redirected¹⁰.

There are some limitations to this study, which can be addressed in future research for better comparison between different local anaesthetic techniques. Duration of LA agent was not measured in both groups in our study. Furthermore, evaluation of patient satisfaction during and after the procedure can also give a better understanding regarding efficacy of Gow-Gates and IANB techniques.

Conclusion

We conclude that both IANB and GG nerve block techniques have their own benefits and drawbacks. In IANB group, we experienced earlier onset of action and higher success rate of buccal gingival tissue anaesthesia than GG technique. While patients receiving GG block experienced significantly less pain during administration of anaesthesia and less amount of LA solution was required to achieve adequate anaesthesia. Therefore, for extraction of mandibular molars, GG can be considered a good alternative anaesthetic technique to the commonly used IANB technique.

Conflict of interest

The authors declare no conflict of interest, and all authors have studied and approved the final manuscript.

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