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Original Article

Comparison Between Gow-Gates Mandibular Nerve Block Versus Inferior Alveolar Nerve Block in Extraction of Mandibular Third Molars

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ABSTRACT

Because of the intricacy of the process and the possibility of severe patient suffering, a successful extraction of mandibular third molars, or wisdom teeth, depends on an effective anesthetic. **Objective:** To compare the efficacy of Gow-Gates Mandibular Nerve Block (GGNB) versus Inferior Alveolar Nerve Block (IANB) in the extraction of mandibular third molars. **Methods:** This comparative cross-sectional study involved patients aged 20 to 45 years, of both genders, with impacted mandibular third molars. Using non-probability consecutive sampling, 160 patients were allocated to two groups: Group A (IANB) and Group B (GGNB), each with 80 patients. Outcomes such as pain, onset of anesthesia, and post-operation recovery time were measured. Efficacy between the groups was compared using Chi-square and independent t-tests. **Results:** The mean age was 30.29 ± 6.96 years. The mean pain in IANB (1.43 ± 1.19) was lower than in Gow-Gate (1.59 ± 2.02) statistically ($p = 0.041$). For anesthetizing the buccal, inferior alveolar nerve, and lingual nerve shows that only the buccal nerve the GGNB (100%) was more effective than IANB (81.5%) statistically ($p<0.001$). The onset of anesthesia was quicker in GGNB than in IANB for all three nerves ($p<0.001$). Post-operative recovery time between IANB and GGNB techniques was not statistically different ($p=0.227$). **Conclusions:** The research concluded that IANB resulted in significantly lower pain compared to GGNB. GGNB demonstrated greater effectiveness in anesthetizing the buccal nerve compared to IANB. The onset of anesthesia was statistically quicker in GGNB than in IANB for all three nerves.

INTRODUCTION

In oral surgery, local anesthesia is essential for pain management by inhibiting nerve action potentials. Lidocaine 2% with a vasoconstrictor like adrenaline is commonly used to enhance effects and reduce toxicity. Effective anesthesia is influenced by the operator's technique and patient-specific factors [1, 2]. Achieving effective pulpal anesthesia in adult mandibular cases is challenging due to the high density of cortical alveolar bone, which impedes anesthetic penetration [3]. The success of the inferior alveolar nerve block (IANB) depends on various factors, including patient anxiety, injection issues, anatomical variations, infections, intravascular injection risks, dense bone structure, bifid mandibular nerve, accessory mental foramen, expired solutions, and injection technique errors [4, 5]. Mandibular local anesthesia primarily employs three techniques: IANB, Gow-Gates, and Vazirani-Akinosi. IANB, the most commonly used, involves injecting near the inferior alveolar nerve, providing comprehensive anesthesia to the lower teeth and surrounding tissues on one side of the jaw [6, 7].

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While effective, the IANB does not affect other branches like the lingual, buccal, and mylohyoid nerves, requiring supplementary injections. Anatomical variations and accessory nerve supply can affect success rates, which range from 65 to 79 percent [8]. Gow-Gates Mandibular Block technique involves a single intraoral injection at the lateral aspect of the mandibular condyle, targeting the mandibular nerve's main division at the foramen ovale. It achieves comprehensive anesthesia of the entire mandibular nerve, a significant branch of the trigeminal nerve [9, 10]. The GGMB technique has a higher success rate and lower incidence of positive aspiration (2% vs. 10-15%) compared to the Inferior Alveolar Nerve Block (IANB), effectively addressing accessory sensory innervation issues [11, 12]. This research explores the influence of anesthesia techniques, particularly by comparing the inferior alveolar nerve block and Gow-Gates nerve block. The focus is on assessing pain levels and success rates during the extraction of impacted teeth, aiming to identify alternatives that can provide effective anesthesia, particularly in situations where the conventional inferior alveolar nerve block might be less successful. Proficiency in both techniques enhances the probability of attaining pain-free dental procedures for all patients, underscoring the significance of broadening anesthesia approaches in oral surgery.

This study aimed to compare the effectiveness of the Gow-Gates mandibular nerve block with the inferior alveolar nerve block in the extraction of mandibular third molars.

METHODS

This comparative cross-sectional study was conducted at the Department of Oral and Maxillofacial Surgery, Institute of Dentistry, Liaquat University of Medical and Health Sciences, located in Jamshoro/Hyderabad from November 1, 2021 to April 30, 2022 after obtaining ethical approval (LUMHS/REC/-117) by using a non-probability consecutive sampling technique. The calculated sample size for the study was determined to be 160 participants. The sample was calculated in openepi to be 104 (52 per group) at 80%, 95% confidence level using the success of the Conventional IANB group (88.9%) and the GGNB group (64.4%) [13]. The total sample size was then divided into two groups: Group A comprised 80 participants undergoing conventional IANB, while Group B included 80 participants undergoing GGNB. Participants of both genders were included in the study, provided they fell within the age range of 20 to 45 years and exhibited impacted mandibular third molars. Exclusion criteria comprised pregnant patients, individuals with trismus and pericoronitis, those with oral submucous fibrosis, acute oral cavity infections, medically compromised conditions, and individuals engaged in alcohol consumption, smoking, or tobacco chewing. In this research conducted at the oral and maxillofacial surgery department, eligible patients who expressed a willingness to participate were enrolled after providing informed written consent. Demographic and clinical details, such as age, gender, pain, and medical history, were documented. The study undertook a comparative assessment of two groups: Group A, which received the traditional IANB, and Group B, which underwent mandibular nerve block using the GGNB technique. A specific local anesthesia solution (2% lignocaine with 1:100000 epinephrine) was administered with precise needles and techniques. The onset time was recorded, and for IANB, 1.5 ml of the solution was administered over 60-90 seconds, including an additional deposit for lingual and long buccal nerve anesthesia. In the GGNB, 1.8 ml of the solution was administered over the same time frame. Following injection, patients were instructed to maintain an open mouth posture for one minute. Demographics like age and gender were recorded. Pain was evaluated using a Visual Analog Scale (VAS) from 0 (no pain) to 10 (worst pain). The onset of anesthesia was the time from block injection to effect. Anesthesia was considered unsuccessful if patients didn't experience lip and tongue numbness or reported pain 10 minutes after administration. Onset times for the Inferior Alveolar, Buccal, and Lingual nerves were categorized. Recovery time was recorded from anesthesia onset to its subsiding [12]. The data were analyzed using SPSS version 22.0. Frequencies and percentages were computed for categorical variables. Mean and standard deviation were calculated for continuous variables such as age and pain score. A Chi-square test assessed the association between post-operative efficacy for GGNB and IANB groups. An independent t-test compared pain between the two groups. $p \leq 0.05$ was considered significant.

RESULTS

The mean age was 30.29 ± 6.96 years with a range from 20 to 45 years. The distribution of gender ($p = 0.74$), age groups ($p = 0.87$), and occupation ($p = 0.199$) among the participants in both groups (IANB and GGNB) were not statistically different (Table 1).

Table 1: Age, Gender and Occupation Distribution of the Participants in Both Groups (n=160)

Variables	Characteristics	IANB (n=80)	GGNB (n=80)	p-Value*
Age Groups (Years)	20-30	51 (63.7)	53 (66.2)	0.74
	31-45	29 (36.3)	27 (33.8)	
Gender	Male	32 (40.0)	33 (41.2)	0.872
	Female	48 (60.0)	47 (58.8)	
Occupation	House Girl	2 (2.5)	3 (3.8)	0.199
	House wife	25 (31.2)	23 (28.7)	
	Student	16 (20.0)	8 (10.0)	
	Indoor Job	22 (27.5)	20 (25.0)	
	Outdoor Job	15 (18.8)	26 (32.5)	

*Chi-square test, IANB; inferior alveolar nerve block, GGNB; Gow-Gate nerve block

The pain scores differed significantly between the groups ($p = 0.041$). The mean pain score for IANB was 1.43 ± 1.19, while for GGNB, it was 1.59 ± 2.02 (Table 2).

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Table 2: Comparison of Pain Score Between IANB and GGNB (n=160)

Pain Score	IANB (n=80)	GGNB (n=80)	p-Value*
Range	0-7	0-10	0.041
Mean	1.43 ± 1.19	1.59 ± 2.02	

*Independent T Test, IANB; Inferior Alveolar Nerve Block, GGNB; Gow-Gate Nerve Block

For the Inferior Alveolar Nerve, 77 participants (96.3%) in the IANB group and 79 participants (98.8%) in the GG group experienced successful anesthetization, while 3 participants (3.7%) in the IANB group and 1 participant (1.2%) in the GGNB group were not anesthetized. The difference in anesthetization rates was not statistically significant (p = 0.311). For Buccal Nerve, 65 participants (81.2%) in the IANB group and all 80 participants (100.0%) in the GGNB group were successfully anesthetized, whereas 15 participants (18.8%) in the IANB group were not anesthetized, with none in the GGNB group. This discrepancy in anesthetization rates was highly significant (p < 0.001). For the Lingual Nerve, 71 participants (88.8%) in the IANB group and 77 participants (96.2%) in the GGNB group were anesthetized, while 9 participants (11.2%) in the IANB group and 3 participants (3.8%) in the GGNB group were not (Table 3)

Table 3: Comparison of Efficacy of IANB and GGNB Technique in Anesthetizing Buccal, Inferior Alveolar Nerve and Lingual Nerve

Nerve	Anesthetize	IANB (n=80)	GGNB (n=80)	p-Value*
Inferior Alveolar Nerve	Yes	77 (96.3)	79 (98.8)	0.311
	No	3 (3.7)	1 (1.2)	
Buccal Nerve	Yes	65 (81.2)	80 (100.0)	<0.001
	No	15 (18.8)	0 (0.0)	
Lingual nerve	Yes	71 (88.8)	77 (96.2)	0.072
	No	9 (11.2)	3 (3.8)	

*Chi-Square Test, IANB; Inferior Alveolar Nerve Block, GGNB; Gow-Gate Nerve Block

A thorough examination of the time of onset for the IANB and GGNB techniques is presented, detailing both frequency and percentage distributions. For the Inferior Alveolar Nerve, IANB demonstrated onset times of 1.2% within < 5 minutes, 49.4% within 5-10 minutes, and another 49.4% exceeding 10 minutes. In contrast, GGNB showed 35.4%, 53.2%, and 11.4% for the respective categories. These differences in onset times between the two techniques were highly significant (p < 0.001). For the Buccal Nerve, IANB showcased distinct onset times: 0.0% within < 5 minutes, 32.3% within 5-10 minutes, and 67.7% exceeding 10 minutes, while GG exhibited 58.8%, 41.2%, and 0.0% for the corresponding intervals. The dissimilarities in onset times were once again highly significant (p < 0.001). Similarly, the Lingual Nerve, IANB, and GGNB displayed variations in onset times across the three categories, and these differences were highly significant (p < 0.001) (Table 4).

Table 4: Comparison of Time of Onset of IANB and GGNB Technique in Anesthetizing Buccal, Inferior Alveolar Nerve and Lingual Nerve

Variable	Time of Onset (Minutes)	IANB (n=80)	GGNB (n=80)	p-Value*
IANB	< 5	1 (1.2)38	28 (35.4)	<0.001
	5-10	(49.4)	42 (53.2)	
	> 10	38 (49.4)	9 (11.4)	
Buccal	< 5	0 (0.0)	47 (58.8)	<0.001
	5-10	21 (32.3)	33 (41.2)	
	> 10	44 (67.7)	0 (0.0)	
Lingual Nerve	< 5	0 (0.0)	17 (22.1)	<0.001
	5-10	30 (42.3)	45 (58.4)	
	> 10	41 (57.7)	15 (19.5)	

*Chi-Square Test, IANB; Inferior Alveolar Nerve Block, GGNB; Gow-Gate Nerve Block

A comprehensive comparison of post-operative recovery times between the IANB and GGNB techniques, involving a total of 160 participants. The frequency and percentage distributions of recovery times are detailed for both groups. For recovery times less than 30 minutes, 6 (7.5) of participants in the IANB group and 2 (2.5) in the GGNB group were observed, with no statistically significant difference (p = 0.227). In the 30-45 minutes 1 (1.2) category, of participants in the IANB group and 3 (3.7) in the GGNB group were noted. Additionally, for the 45-60 minutes category, 3 (3.8) of IANB participants and 8 (10.0) of GGNB participants fell within this range. In the 60-90 minutes category, 13 (16.2) of IANB participants and 15 (18.8) of GGNB participants were observed. For recovery times exceeding 90 minutes, a substantial proportion was found, with 57 (71.3) in the IANB group and 52 (65.0) in the GGNB group. The statistical analysis, conducted through the chi-square test, did not reveal a significant difference in post-operative recovery times between the IANB and GGNB techniques (Table 5).

Table 5: Comparison of Postoperative Recovery Time Between IANB and GGNB Techniques (n=160)

Recovery Time (minutes)	IANB (n=80)	GGNB (n=80)	p-Value*
< 30	6 (7.5)	2 (2.5)	0.227
30-45	1 (1.2)	3 (3.7)	
45-60	3 (3.8)	8 (10.0)	
60-90	13 (16.2)	15 (18.8)	
> 90	57 (71.3)	52 (65.0)	

DISCUSSION

Our findings showed that pain was significantly lower with IANB compared to GGNB. Gow-Gates was more effective in anesthetizing the buccal nerve, and its onset of anesthesia was statistically quicker for all three nerves: inferior alveolar, lingual nerve, and buccal nerve. In this study, male patients with impacted mandibular third molar were 32 (40.0%) and 33 (41.2%) and female patients were 48 (60.0%) and 47 (58.8%) in Group A (Conventional IANB) and Group B

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(GGNB) respectively. A study by Maqsood *et al.*, reports that 33.3% and 23.2% of male patients and 70.8% and 76.8% of female patients in Conventional IANB and GGNB respectively [14]. Whereas a study by Usama *et al.*, reports that 55.5% and 60.0% of male patients and 44.4% and 40.0% of female patients in Conventional IANB and GGNB groups respectively [15]. All of these studies indicate that impacted mandibular third molars affect both male and female patients with no sexual dimorphism. In this study, the mean age of patients with impacted mandibular third molars was 30.29 ± 6.96 (20-45) years in Group A (Conventional inferior alveolar nerve block) and 28.84 ± 5.25 (20-42) years in Group B (Gow-Gates mandibular nerve block). The majority of patients, 63.7% in group A and 66.2% in group B, fell into the age group of 20-30 years. In group A, 36.3% were in the age group of 31-45 years, while in group B, 33.8% were in the same age range. Maqsood *et al.*, reported mean ages of 34.16 ± 10.77 years and 33.70 ± 10.20 years in the Conventional IANB group and Gow-Gates mandibular nerve block group, respectively [14]. Usama *et al.*, documented mean ages of 41.11 ± 9.23 years and 43.31 ± 8.56 years in the Conventional IANB group and Gow-Gates mandibular nerve block group, respectively [15]. Jamalpour and Tamilkhani reported an overall mean age of 25.6 years for groups [16], Conventional IANB and GGNB. In this study, the effectiveness of anesthesia was evaluated for both the conventional IANB technique (group A) and the GGNB technique (group B). The results revealed that successful anesthesia rates were notably high for both groups, with 96.3% of patients in group A and 98.8% in group B achieving successful anesthesia of the inferior alveolar nerve. For the buccal nerve, success rates were 81.2% in group A and 100.0% in group B, and for the lingual nerve, success rates were 88.8% in group A and 96.2% in group B. The onset of anesthesia and found that it was significantly faster in GGNB compared to conventional IANB for all three nerves: inferior alveolar nerve ($p < 0.001$), buccal nerve ($p < 0.001$), and lingual nerve ($p < 0.001$). This suggests that the GGNB offers a quicker onset of anesthesia, enhancing its efficiency in achieving effective local anesthesia during oral surgery procedures. According to Maqsood *et al.*, successful anesthesia rates for the Conventional IANB group were 91.3% for the inferior alveolar nerve, 100.0% for the buccal nerve, and 94.2% for the lingual nerve and in the GGNB group, the rates were 92.3%, 84.1%, and 91.3% for the respective nerves [14]. It was reported an overall success rate of 59.1% with a single injection in the Conventional IANB group and a higher success rate of 77.3% in the GGNB group [16]. An overall success rate of 90.6% in the Conventional IANB group, and a slightly higher success rate of 96.9% in the GGNB group [17]. Usama *et al.*, documented an overall success rate of anesthesia, revealing a significant difference ($P = 0.006$) between the Conventional IANB group (88.9%) and the GGNB group (64.4%) [15]. The study by Aggarwal *et al.*, showed the impact of VAS score on both the techniques and concluded a success rate of 88% in the GGNB technique and only 61.5% success rate in the IANB technique [18]. When comparing the effectiveness of GGNB and IANB for the extraction of mandibular molars or premolars, Ghoddusi *et al.*, found that GGNB was more successful in 88.89% of instances whereas IANB was effective in 64.44% of cases [19]. In his research, Sabari *et al.*, similarly concluded that GGNB is better than IANB for mandibular anesthesia after surgical removal of an impacted mandibular third molar [20]. The study was associated with limitations like a single center, small sample, and non-randomized. Future studies using large sample sizes and randomized nature can better address the research question.

CONCLUSIONS

Pain experienced with IANB was significantly lower than with GG. Additionally, Gow-Gate showed a statistically quicker onset of anesthesia. There was no significant difference in post-operative recovery time between the two techniques.

Authors Contribution

Conceptualization: SUR, KAC
Methodology: SUR, AAK
Formal analysis: FJ, AB
Writing-review and editing: WM,

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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