CLINICAL DENTISTRY AND RESEARCH 2022; 46(3): 114-120 Original Research Article

DOES MALLAMPATI SCORE AFFECT THE TECHNICAL SUCCESS OF THE INFERIOR ALVEOLAR NERVE BLOCK AND POSTERIOR MANDIBULAR SURGICAL PROCEDURES?

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ABSTRACT

Background and Aim: The aim of this randomized prospective study was to assess the effect of Mallampati score on the technical success of the inferior alveolar nerve block and posterior mandibular surgical procedures.

Material and Methods: A total of 150 adult patients who required inferior alveolar nerve blocks for dental surgery in the lower posterior region were included in this study. A research fellow documented the Mallampati score, age, gender, and body mass index of patients. A resident blinded to the Mallampati scoring performed the local anaesthesia and surgical procedures and documented the technical difficulty scores during the inferior alveolar nerve block and surgical procedures, latent period of local anaesthesia, and total volume of injected anaesthetic solution. The data were statistically analyzed.

Results: There were statistically significant differences between the patients with different Mallampati scores in terms of age, technical difficulty score of inferior alveolar nerve block, and technical difficulty score of surgical procedure ($p<0.05$). Technical difficulty scores of the inferior alveolar nerve block were significantly higher in Mallampati class III and IV patients than in class I patients. Technical difficulty scores of the surgical procedure were significantly higher in Mallampati class II, III, and IV patients than in class I patients.

Conclusions: The knowledge and/or clinical assessment regarding Mallampati classification in the field of dentistry is scarce and should be improved. Dental clinicians should be aware of the possible relationship between high Mallampati score and unsuccessful inferior alveolar nerve block or technical difficulty of a posterior mandibular surgical procedure.

Clin Dent Res 2022; 46(3): 114-120

Keywords: Inferior Alveolar Nerve Block, Local Anaesthesia, Mallampati Classification, Mallampati Score, Prospective Study

Submitted for Publication: 11.02.2022
Accepted for Publication : 12.19.2022

INTRODUCTION

The inferior alveolar nerve block (IANB) has widespread applications in all fields of dentistry and is the most frequently used intraoral regional injection technique. Considering that it is a single injection, IANB provides anaesthesia for a wide area and is useful for quadrant dentistry. On the other hand, even when properly administered, it is a frustrating technique, recording the highest percentage of clinical failures (approximately 15% to 20%).[1,2]

Several techniques are used to achieve anaesthesia of the inferior alveolar nerve. In the most commonly used conventional technique, the inferior alveolar nerve before it enters the mandibular foramen is the target area.[1,2] The nerve is approached from the opposite side of the mouth, with the syringe positioned at the level of the contralateral lower premolars. The needle insertion point is one-quarter of the distance from the deepest point of the pterygomandibular raphe to the coronoid notch. After inserting the needle into the mucous membrane with a 45° angle to the occlusal plane and 1 cm above the mandibular molars, the syringe is advanced parallel to the width of the ramus to a depth of 20–25 mm until contacting the bone. After achieving bone contact with the medial surface of the ramus, the needle is withdrawn 1 mm, aspiration is performed to avoid intravascular injection, and the anaesthetic solution is deposited.[1,2]

The most common complications related to IANB that may result from inaccurate needle placement are haematoma that occurs by damage to blood vessels, trismus that develops due to tearing of mucosa during insertion or withdrawal of the needle, transient facial paralysis produced by the deposition of local anaesthetic solution in the body of the parotid gland, and failed anaesthesia.[1,2]

In anaesthesiology, the Mallampati test (also known as Mallampati classification) is a simple, reproducible, reliable, and frequently used clinical preanaesthetic airway evaluation test for assessment of endotracheal intubation difficulty.[3,4,5,6] It is determined by looking at the anatomy of the oral cavity, and it is particularly based on the visibility of the base of the uvula, plica glossoepiglottica lateralis, plica glossoepiglottica medialis, and soft palate.

A possible reason for the relatively high rates of clinical failure and complications of IANB is the visibility and manipulation difficulties of the injection area due to the relatively large tongue volume. The effect of Mallampati score on the success of IANB and surgical manipulation difficulty in the mandibular posterior region has not been studied.

The aim of this study was to evaluate the effect of Mallampati score on both the technical success of the IANB and the difficulty of the posterior mandibular surgical procedure.

MATERIAL AND METHODS

This study was approved by the Baskent University Institutional Review Board (Project no: KA 11/234). Prior to the data collection process, a statistical power analysis was implemented using G*Power software at the $p<0.05$ significance level. Based on the data from the study by Mashour and Sandberg (2006),[7] the correlation analysis result between Mallampati score and Cormack–Lehane grade was considered, and the effect size was d=0.567. According to the power analysis, a sample size of 150 patients was chosen, with a high power of 0.999.

A total of 150 (85 female/65 male) ASA 1 or 2 adult patients with a median age of 32 years were included in this prospective study. Patients with restricted mouth opening for any reason (congenital craniofacial abnormalities, diffuse intraoral infections, TMJ disorders, etc.), a history of soft palate surgery, and ASA 3 or 4 patients were excluded from the study. Written informed consent was obtained from all participating patients.

A research fellow documented the Mallampati score, sex, age, and body mass index (BMI) for all patients at the beginning of their appointments. BMI was defined as normal between 18.5 and 25 kg/m^2, overweight between 25 and 30 kg/m^2, and obese above 30 kg/m^2.[6] Mallampati score was determined in the sitting position, with the patient's head in the neutral position, mouth opened fully, tongue protruded maximally without phonation, and the examiner eye-to-eye with the patient in a "mirror" fashion.[5,7]

In this study, Samsoon and Young's Mallampati classification system (Modified Mallampati classification) as follows was used:5,8 Class I: Soft palate, uvula, fauces, and tonsillar pillars are visualized (Figure 1A). Class II: Soft palate, uvula, and fauces seen; tonsillar pillars not visualized (Figure 1B). Class III: Soft palate and base of uvula visualized (Figure 2A). Class IV: Soft palate not visible at all (later added by Samsoon and Young) (Figure 2B).

A resident blinded to Mallampati scoring performed the IANB injections and surgical procedures. The same resident noted the viewing and manipulation difficulty during the IANB technique, manipulation difficulty during the surgical

Figure 1. A. Mallampati class I patient with full visibility of the hard palate, soft palate, tonsils, and uvula. B. Mallampati class II patient with visibility of the hard palate, soft palate, upper portion of tonsils, and uvula.

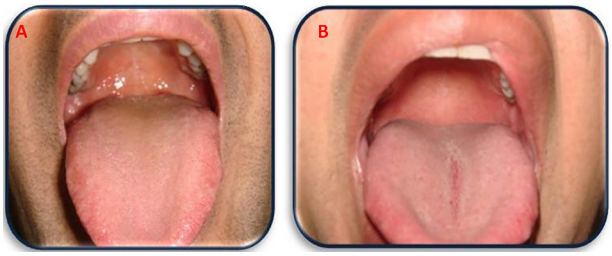

Figure 2. A. Mallampati class III patient with visibility of the hard palate, soft palate and base of the uvula. B. Mallampati class IV patient with visibility of only the hard palate.

procedure, latent period of local anaesthesia, and total volume of injected local anaesthetic solution.

4% articaine with 1:100.000 epinephrine was used as the local anaesthetic agent in all patients. The patients were asked to state the onset of their lower lip numbness to determine the latent period of local anaesthesia. Mandibular surgical procedures were performed as follows: 106 patients had removal of their third molars, 26 had removal of other molars or premolars, 16 had implant surgery, 1 had an apicoectomy, and 1 had a mandibular distraction.

A Visual Analogue Scale (VAS) between 0 and 10 ("0" representing "no difficulty" and "10" representing "highest difficulty") was used to evaluate the viewing and technical difficulties experienced by the clinician during the administration of local anaesthesia by the IANB technique and the performance of the surgical procedure.

Statistical analysis

The normality of the quantitative variables was evaluated by implementing the Shapiro–Wilk test. Descriptive statistics were also given based on the normality results. The normal data were presented with the mean and standard deviation. The non-normal data were reported with median and interquartile ranges. While reporting the descriptive statistics, the variability values (i.e. standard deviation and interquartile range) were given inside parentheses.

When the data were not normally distributed, the Kruskal–Wallis test was used. If the normality was valid, the analysis of variance (ANOVA) method was applied. In the presence of significance, post-hoc tests were carried out. Dunn's test via Bonferroni correction was applied if the Kruskal–Wallis test produced a significant result. All statistical findings were obtained using IBM SPSS Statistics (version 26) software, and the error level was set at 5%.

RESULTS

Table 1 shows the univariate Shapiro–Wilk normality test results for the quantitative variables. The test results revealed that none of the quantitative variables were normal ($p<0.05$). Table 2 shows the descriptive statistics of the Mallampati class variable, as well as the quantitative measurements. The frequency analysis findings for the Mallampati classes and the median–interquartile range for the research variables are presented. Of the 150 patients included in this study, 39 (26.0%) were in Mallampati class I, 38 (25.3%) were in class II, 46 (30.7%) were in class III, and 27 (18.0%) were in class IV. The median BMI was 24.50, median technical difficulty score of IANB was 1, median volume of total injected local anaesthetic solution was 2 cc, median latent period of local anaesthesia was 60 seconds, and median technical difficulty score of surgical procedure was 1.

Table 3 shows the Shapiro -Wilk normality test results for the quantitative variables across the Mallampati classes. BMI was normally distributed across the patients with all Mallampati classes ($p>0.05$). The distribution of age, VAS score of technical difficulty of IANB, volume of total anaesthetic solution injected, latent period of local anaesthesia, and VAS score of technical difficulty of surgical procedure were not normal ($p<0.05$).

There were significant differences among Mallampati classes in terms of age, technical difficulty score of IANB, and technical difficulty score of surgical procedure ($p<0.05$). The average age of the patients with Mallampati class IV was significantly higher than that of the patients with Mallampati class I. In terms of the technical difficulty scores of the IANB, the average scores of the patients with Mallampati class III and IV were significantly higher than those with Mallampati class I. (Table 4)

Table 1. Univariate normality test results

Variable	Shapiro-Wilk test		
	Statistic	df	p
Age (years)	0.933	149	<0.001
BMI (kg/m²)	0.975	149	<0.001
Technical difficulty score of IANB (VAS)	0.815	149	<0.001
Volume of total anaesthetic solution injected (cc)	0.484	149	<0.001
Latent period of local anaesthesia (seconds)	0.844	149	<0.001
Technical difficulty score of surgical procedure (VAS)	0.821	149	<0.001

df: degrees of freedom.

Table 2. Descriptive statistics of the research variables

Variable	Descriptive statistics
Mallampati class I	39 (26%)
Mallampati class II	38 (25.3%)
Mallampati class III	46 (30.7%)
Mallampati class IV	27 (18%)
Age (years)	32 (25)
BMI (kg/m²)	24.50 (5.91)
Technical difficulty score of IANB (VAS)	1 (3)
Volume of total anaesthetic solution injected (cc)	2 (0)
Latent period of local anaesthesia (seconds)	60 (60)
Technical difficulty score of surgical procedure (VAS)	1 (3)

DISCUSSION

The Mallampati scoring system is a standard airway assessment method used to identify patients at risk of difficult tracheal intubation. The anatomic basis of this examination is the relationship of the tongue to the oral cavity; in other words, relative position of the palate and base of tongue.[7,8] The original Mallampati classification consists of three classes (Class 1: faucial pillars, soft palate, and uvula could be visualized; Class 2: faucial pillars and soft palate could be visualized, but the uvula was masked by the base of tongue; Class 3: only soft palate could be visualized).[5,7]

Samsoon and Young modified the original Mallampati classification system by adding a fourth class; this is usually the scoring system in current use[5,7] and was used in this study.

Mallampati scoring should be performed in a sitting position,[9] with the patient's head in the neutral position, mouth opened fully, tongue maximally protruded, and without phonation.

The predictive value of the Mallampati classification is dependent on the standardized examination conditions, especially the position of the head in relation to the cervical spine. If the position of the head changes, Mallampati

Table 3. Normality test results across Mallampati classes

Variable	Mallampati class	Shapiro-Wilk test		
		Statistic	df	p
Age (years)	I	0.860	39	<0.001
	II	0.944	38	0.055
	III	0.910	45	0.002
	IV	0.951	27	0.222
BMI (kg/m²)	I	0.963	39	0.230
	II	0.974	38	0.526
	III	0.971	45	0.304
	IV	0.977	27	0.793
Technical difficulty score of IANB (VAS)	I	0.754	39	<0.001
	II	0.822	38	<0.001
	III	0.865	45	<0.001
	IV	0.895	27	0.010
Volume of total anaesthetic solution injected (cc)	I	0.484	39	<0.001
	II	0.521	38	<0.001
	III	0.473	45	<0.001
	IV	0.368	27	<0.001
Latent period of local anaesthesia (seconds)	I	0.821	39	<0.001
	II	0.831	38	<0.001
	III	0.846	45	<0.001
	IV	0.831	27	<0.001
Technical difficulty score of surgical procedure (VAS)	I	0.628	39	<0.001
	II	0.837	38	<0.001
	III	0.885	45	<0.001
	IV	0.895	27	0.010

df: degrees of freedom.

scoring would be less reliable because of the alteration of the craniocervical distance.[7] Singhal et al. reported that turning the patient from the sitting position to the supine position caused a change in mouth opening, causing the Mallampati grades to change toward a higher grade.[9]

Causes of the relatively high failure rate of conventional IANB include anatomical differences of the inferior alveolar nerve, as well as pathological, pharmacological, or psychological factors; however, the most common cause is poor technique.[10] The accuracy and efficiency of the blockage technique is closely associated with the manipulation and visibility difficulties of the clinician when performing the

Table 4. Results of the mean comparison test among Mallampati classes

Variable	Mallampati class				Statistic	p
	I	II	III	IV		
Age (years)	28[b] (17)	33[ab] (16)	34[ab] (23)	49[a] (28)	15.993	<0.001[K]
BMI (kg/m²)	23.62 (4.05)	24.72 (3.96)	25.31 (4.41)	26.28 (5.20)	2.168	0.094[F]
Technical difficulty score of IANB (VAS)	0[b] (1)	1.50[ab] (3)	2[a] (4)	2[a] (5)	5.607	<0.001[K]
Volume of total anaesthetic solution injected (cc)	2 (0)	2 (0)	2 (0)	2 (0)	18.151	0.990[K]
Latent period of local anaesthesia (seconds)	60 (60)	60 (50)	60 (85)	60 (60)	2.793	0.425[K]
Technical difficulty score of surgical procedure (VAS)	0[b] (1)	1[a] (3)	2[a] (4)	2[a] (3)	26.444	<0.001[K]

F: ANOVA test, K: Kruskal–Wallis test. Statistic: The appropriate test statistic is shown. The different letters indicate significant differences.

IANB. When the volume of the tongue increases relative to the volume of the oral cavity, the Mallampati score also increases.

The Mallampati scoring system may be a predictor for not only difficult endotracheal intubation but also for difficult IANB techniques and mandibular posterior surgical procedures in dentistry. In patients with a high Mallampati score, even if the mouth is opened maximally due to the close relationship between the tongue and the soft palate, the visibility of the pterygomandibular raphe during IANB administration and the surgeon's view during surgical procedures in the mandibular posterior region are reduced. Moreover, as the results of our study indicate, the IANB technique tends to be less successful because of this anatomical factor.

Recording the Mallampati score in the patient's chart allows other clinicians to plan the treatment while being aware that they may experience technical difficulties when performing IANB, mandibular posterior surgical procedure, root scaling, endodontic treatment, conservative treatment, or taking periapical radiographs. Surgeons should be aware of the possible need for assistance while performing local anaesthesia injections or surgical procedures in patients with high Mallampati scores, and local anaesthesia practice training should not be started in these patients.

CONCLUSION

Higher Mallampati scores were associated with higher rates of technical difficulties in IANB administration and mandibular posterior surgery. A dental clinician should be aware of possible relationships between a high Mallampati score and failure of IANB, need for reinjection, difficulty during posterior mandibular procedure, need for four-hand dentistry, or prolonged procedure time.

Funding: This research was carried out without funding.

Conflict of Interest: The authors declare that they have no conflicts of interest related to the study.

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