Undergraduate Performance in Dental Anesthesia

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***Abstract*— Mandibular block is frequent in the dental practice for performing painless procedures, since it anesthetizes one quadrant with a single injection. The class of anesthesia at School of Dentistry of the National Autonomous University of Mexico, (UNAM,) gives students the necessary skills and clinical teachings to successful performance in mandibular anesthesia. *Purpose:* To determine the undergraduate performance in regional mandibular anesthesia, in patients under extraction order of erupted permanent tooth. *Material and methods:* An observational study was performed between March 2007 and February 2008 in five clinics of the School of Dentistry UNAM, including 131 fifth year students, who applied the regional mandibular technique and who agreed to participate in the study. Student, patient, and procedure variables, they were recorded; input and processed in SPSS 15.0. *Results:* Female students predominated (75%), mean age was 23.4±1.4 years, GPA 7.9±3.9. 63% of the patients were female, with average grade of 46.9±17.4. Teeth most frequently extracted were posterior (87%). 50% of the mandibular blocks were successful. *Conclusions:* a) Successful performance in mandibular block was 50% b) It is necessary to research the application characteristics of the failed mandibular anesthesia to improve the performance of undergraduate students.**

***Index Terms*— anesthesia performance, dental extraction, jaw anesthesia, undergraduate.**

I. Introduction

The effectiveness of anesthesia techniques is based on the knowledge of anatomical and physiological matters to attain loss of sensitivity in the area where it is applied.

Students of the School of Dentistry (SD) of the National Autonomous University (UNAM) of Mexico, study anesthesia in their fourth semester [1], and apply the different techniques in their clinical activities while they are studying.

The objective of dental anesthesia is to attain the temporary inhibition of pain sensitivity, through therapeutic means (by administering a drug) [2], without inducing loss of consciousness [3]. Mostly it is used to perform dental procedures without causing pain to the patient [4].

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Local Anesthesia and Regional Anesthesia in Dentistry

The difference between these two concepts is basically the extension of the anesthetized area: in regional anesthesia the anesthetized area corresponds to the innervation area of a nerve, a collateral nerve branch or one of its terminals. In local anesthesia the drug acts at completely peripheral levels, on receivers or smaller terminal branches [5].

Regional anesthesia is indicated when it is necessary, or desirable, that the patient remains aware but with insensitive teeth and their adjacent structures [5].

Local anesthetics

Local anesthetics are compounds that cause a reversible block of nerve conduction in any part of the nervous system where they are applied [6], [7]. They cause a depression in the nerve fibers action potential propagation by blocking the Na^+ passage through the membrane in response to nerve depolarization [6].

This conduction depression along the nerves is known as conduction anesthesia, block or nerve block. This means: a decrease in pain perception resulting from the application of an agent along the nerve fiber of its terminals [7].

Mandibular Anesthesia

The regional mandibular anesthesia technique is the most common method of mandibular anesthesia in dentistry, it has many applications in dental treatment, including dental surgery, endodontic, periodontal, prostheses, etc., and its success has been evaluated mainly in graduates or undergraduates of maxillofacial surgeons. Successful performance is estimated at about 80 to 85% [8]–[13].

This is the dentistry trunk block by excellence: inferior alveolar, buccal, and lingual. This technique was originally developed by Fisher, and was later modified by different authors [11]. To apply this technique, the dentist must be familiar with the anatomical details accessible by palpation, allowing him to locate the mandibular foramen. The structures are the masseter muscle and the pterygomandibular ligament, the internal and external oblique lines, the mandible posterior ridge and the plane formed by the lower molar occlusive faces [5].

One must take into account the variations in position and dimension of the mandibular branch, measures from the first molar distal face, which depends on the changes experienced by a growing mandible [5]. Several authors have contributed to improve the anesthesia of the inferior alveolar nerve, refining and creating new techniques and devices in order to enhance the success rate of these procedures. [14]-[17].

II. Procedure

Sample**:** We include 131 fifth year students, who were coursing in 5 peripheral clinics of the UNAM School of Dentistry and agreed to participate in the study while treating patients, free from systemic disease, under extraction order of mandibular permanent erupted tooth without acute infection. Each student and each patient were registered once.

Method**:** Students demographics and school-related information (grade point average (GPA), repeated courses, extra-curricular experience in nerve blocks) were recorded.

Regarding the patients, variables recorded included demographics, periodontal conditions, and periapical lesion X-rays of the tooth to be extracted. Regarding the anesthetic procedure, the technique used was recorded, all procedures used 1.8 milliliters of 2% lidocaine with 1:100,000 epinephrine once time. A block was deemed successful when a single application was enough to extract the tooth with score zero, assessed using the Verbal Rating Scale (VRS), this is no pain for the patient.

A single evaluator, previously trained with Kappa=0.876, performed all measurements.

Ethical considerations. This study complied with the 1975 Declaration of Helsinki for human research and the Mexican General Regulations of Health Research, paragraph 17, and the study was considered low risk [18].

III. Results

From March 2007 to February 2008, 131 students were enrolled from peripheral clinics: Aragon, Azcapotzalco, Milpa Alta, Vallejo, and Xochimilco, and each treated one patient, for extraction of a single permanent mandibular tooth.

According to student **demographics** characteristics**,** they were mostly women (75%); mean age was 23.4±1.4 years, with an interval of 21 to 28 years old; **GPA** was minimum 6.80 and maximum 8.60, with a mean of 7.9±0.39; as for **repeated courses,** 48.9% of the students reported to have repeated at least one clinical class.

Regarding the characteristics of treated **patients**, they were predominantly female (61%). Their mean **age** was 46.9±17.4 years old, from 13 to 88.

87% of extracted teeth were posterior, evaluated preoperatively, using the Russell Periodontal Index, and dentoalveolar x-rays for periapical diagnosis. Most showed gingivitis periodontal issues with pouches or advanced destruction, with no periapical lesion (table 1).

Table 1. Preoperative diagnosis of extracted teeth.

Teeth to be extracted	n	%	Periodontal Dx		Periapical Dx	
Anterior	29	22	**Category**	**%**	**Category**	**%**
			Healthy	0		
			Mild gingivitis	21	**With no periapical lesion**	**76**
			Gingivitis	0		
			Pouch	**14**	With periapical lesion	24
			Advanced destruction	**65**		
Posterior	**102**	**77**	**Category**	**%**	**Category**	**%**
			Healthy	13		
			Mild gingivitis	8	**With no periapical lesion**	**60**
			Gingivitis	28		
			Pouch	15	With periapical lesion	40
			Advanced destruction	36		

The anesthetic technique used for mandibular block was mostly direct (63%). 33% of the students had additional experience in the performance of anesthetic blocks outside the school.

50% of the cases were successful performance in regional mandibular blocks.

Bivariate Analysis

An analysis was made of the result variable with the students GPA, repeated courses for courses including the application of anesthetic techniques in practice, and additional experience in anesthetic blocks application, testing the hypothesis using two tail test with a 0.05 significance.
The GPA analysis of the students who performed successful blocks or failed using the t test for independent samples showed no statistically significant differences $\mathbf{t_{0.05}^{145gl}}$=0.225 with p=0.823.

Regarding repeated courses, the variable was tested using Fisher's exact test X^2 and no significant differences were observed: $X^2_{0.05}{}^{1gl}$=2.46 with p=0.139.

As for additional experience in anesthetics, Pearsons' test X^2 did not show statistically significant differences either $X^2_{0.05}{}^{1gl}$ =1.525 with p=0.225.

It was found that none had statistically significant differences.

IV. DISCUSSION

Successful performance in mandibular nerve blocks by fifth year students in peripheral clinics of the UNAM School of Dentistry was evaluated, observing that of the total blocks performed (131), 50% were successful, which means that when applying such block, success or failure is without odds.

According with the literature, studies on graduate and undergraduate maxillofacial surgeons reports a success average of 80-85% [19]. However, success rates of up to 90% [20] may be found, as reported by Martínez et. al. In their comparative study of direct mandibular block and the Akinosi technique, performed at the Complutense University of Madrid, and 100% success rate when combining two or more anesthetic techniques [21].

Kholer et. al. reports A larger volume of anesthetic solution (3.6 mL) is required to achieve a higher success rate and a faster onset of action for a dental extraction without the use of reinforcement anesthesia in posterior teeth extraction. But all procedures were performed by the senior paper author.[22].

Gallatin et. al. [23] observed lower results in a study performed at the University of Ohio, in 48 patients anesthetized for cavities in the mandibular first molars, extensive restoration works, periodontal disease and history of sensitivity. Using block of the inferior alveolar nerve only a success rate of 81% was attained, but when combined with intrabone injection, a success rate of 100% was attained.

Hannan et. al. [24], at the University of Ohio, had a 76% success rate with conventional inferior alveolar nerve block. Meanwhile, Reitz et. al., also at the University of Ohio, reports a success rate of 60-74% with inferior alveolar nerve block [17].

Waikakul et. al. [11] reports that at the Oral Surgery Clinic of the School of Dentistry, University of Mahidol, a success rate of 60% for direct mandibular block was observed in 136 applications. They report no significant differences in age and sex.

Kennedy et. al. [25] performed a study at the University of Ohio, with 64 patients divided into two groups: one anesthetized with conventional alveolar nerve block, the other with bi-directional alveolar nerve block. Both groups had a 50% success rate.

The rate of successful blocks observed in our study is 4% higher than that reported by Tzu-Ni Lai et. al. [12] they regarding the mandibular block evaluation using standardized methods, at the National University of Taiwan, and the National University Hospital of Taiwan, including 123 patients who required endodontic treatment. Patients were divided into two groups: 100 patients were anesthetized with the standardized technique described by Malamed [3], and 23 patients received inferior alveolar nerve anesthesia and lingual nerve block with additional block of the long buccal nerve.

The anesthesia success rate was 47%, finding no significant differences in the efficiency of anesthesia in relation to sex and age of the patients.

The most common reason for failure of the mandibular alveolar nerve is an operator defective technique [10], [26].

But there are other factors that influence in inferior alveolar nerve block failure which are not due to the operator, such as:

Anatomical: mylohyoid ancillary nerve, bifid mandibular nerve, variations in the position of the retromolar foramen, collateral enervation of teeth, [10], [13], [27].

Pathological: trismus, infection, inflammation, prior surgery [9], [10].

Pharmacological: use of: analgesics, antimicrobial agents, anti-inflammatory agents [3].

Psychological**:** fear, anxiety, apprehension [10].

That could partially explain the low performance in dental anesthesia, but neither of this was evaluated in this study.

V. CONCLUSIONS

1. Successful regional mandibular blocks were 50% of the cases.

2. No statistically significant differences were observed regarding the students GPA, their having repeated clinical courses, or their additional experience in administering anesthesia.

3. It is necessary to research the application characteristics of regional mandibular blocks leading to failure, in order to make modifications in the teaching and the practice of blocks, in order to improve the efficacy of their application.

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