Efficacy of Anesthetic Agents to Delay Pain Onset After Periodontal Surgery

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The aim of this study was to evaluate the influence of 2 anesthetic agents on patients' postoperative pain perception after periodontal surgery. For this parallel-group, double-blinded, randomized clinical trial, 36 open flap debridement surgeries were performed on patients who presented with periodontal disease with clinical signs of inflammation after nonsurgical treatment on at least 1 quadrant. Patients were allocated to 1 of the following groups: group 1, 2% lidocaine with 1 : 100,000 epinephrine; group 2, 2% mepivacaine with 1 : 100,000 norepinephrine. Pain intensity was assessed using the visual analog scale during the first 8 hours after surgery. All patients received 750-mg acetaminophen tablets, which they were instructed to take as a rescue medication if necessary. The results demonstrated that postoperative pain intensity was statistically lower in group 2 than in group 1 at the 1-, 2-, and 3-hour periods after surgery, although the pain intensity for all groups could be considered mild. In conclusion, patients in both groups reported similar mild pain after periodontal surgery.

Key Words: Anesthetic solution; Pain, postoperative; Lidocaine; Mepivacaine.

Pain after periodontal therapy occurs frequently. Scaling and root planing (SRP) is one of the most common procedures in clinical practice and may cause pain.¹ Seventy-seven to ninety percent of the patients experience some degree of pain following SRP, and the average duration of moderate to severe pain is 6.1 hours.^{1,2} Periodontal surgery may also cause pain and discomfort greater than SRP alone.³ Open flap debridement surgeries cause pain in 79% of patients, whereas 89% complain of pain after gingivectomy and 93% after flap surgery with osseous resection. Postoperative pain perception may be influenced by age, procedure modality, duration, location, extension, and degree of anxiety.^{2,3}

Local anesthesia is used to prevent pain during surgical procedures. This approach seeks to prevent potential propagation so that sensation cannot be transmitted from the injury site to the brain. Local anesthetics

block sodium's entrance to its channels and therefore prevent the transitory raised permeability of the nerve membrane to sodium, which is otherwise necessary for the action potential occurrence.⁴

Lidocaine was introduced in 1948, and because of its excellent efficacy and safety, it quickly became the local anesthetic of choice in the United States. In addition to its efficacy, lidocaine can claim an outstandingly low incidence of allergenicity: there have been fewer than 20 case reports in the literature during the past 50 years. Because of the routine use of local anesthesia in dental practice, the rare incidence of allergic reactions is considered an important clinical advantage. Lidocaine can be found in the market associated with vasoconstrictors, such as epinephrine and norepinephrine. Two percent lidocaine with 1 : 100,000 epinephrine is considered a standard for comparisons with new agents.⁵

Mepivacaine is considered an important anesthetic agent for its minimal vasodilating properties and being capable of promoting profound local anesthesia. On the other hand, mepivacaine without vasoconstrictor produces a short period soft tissue anesthesia.⁵ For

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this reason, mepivacaine can be found associated with norepinephrine, an adrenergic vasoconstrictor that presents 25% of epinephrine potency, is more stable in solution, and requires less preservatives.⁶ The purpose of this double-blind, randomized clinical trial was to compare the clinical efficacy of 2% lidocaine with 1 : 100,000 epinephrine and 2% mepivacaine with 1 : 100,000 norepinephrine in delaying pain onset after periodontal surgery.

METHODS

Study Design

Forty patients between the ages of 18 and 60 were selected at the Department of Periodontology, Ponta Grossa State University, from September 2008 to August 2009, to take part in this double-blind, parallel-group randomized clinical trial. All patients presented with moderate or severe chronic periodontitis with clinical signs of inflammation (bleeding on probing and/or suppuration) after nonsurgical periodontal therapy in at least 1 quadrant and were therefore scheduled for open flap debridement surgery. Excluded from the study were patients with a history of systemic disease such as diabetes mellitus, uncontrolled hypertension, or gastric ulcer; pregnant or lactating women; patients allergic to any of the formulations used in the study; and patients using analgesics and/or anti-inflammatory drugs, or at risk for infective endocarditis. The nature of the study was explained to each patient, who then signed an informed consent approved by the University Institutional Ethical Committee on Human Research.

Because stress and dental anxiety vary from patient to patient and may influence pain perception, the State-Trait Anxiety Inventory was applied at the beginning of the study to access the correlations among pain scores and stress and anxiety reported by the patients.⁷

Each patient was randomly assigned to receive 1 of 2 preoperative local anesthetic formulations: group 1 received 2% lidocaine with 1 : 100,000 epinephrine (Alphacaine, DFL, Rio de Janeiro, Brazil), and group 2 received 2% mepivacaine with 1 : 100,000 norepinephrine (Mepinor, DFL). The anesthetic cartridges were covered with a tape and identified as A or B by another investigator (not the surgeon) in order to maintain the blinding of the study. The anesthetic agent was injected via maxillary infiltration (maxillary teeth) or inferior alveolar nerve block (mandibular teeth) until the patient reported no pain on gingival pressure with a sharpened instrument. For each pa-

tient, a mucoperiosteal flap was raised for complete SRP using Gracey curettes and ultrasonic instrumentation. The location (upper or lower and anterior or posterior teeth) and extent (number of teeth involved) of the surgery, volume of local anesthesia administered, time of day (morning or afternoon), and the duration of the surgical procedure were recorded in the patient's file.

Patients were instructed to complete a pain diary every hour for the first 8 hours after surgery. The visual analog scale (VAS), which consists of a 10-cm line anchored by 2 extremes—"no pain" and "pain as bad as it could be"—was used to assess postoperative pain. Patients were asked to make a mark on the line that represents their level of perceived pain.⁸ All participants received rescue medication (750 mg acetaminophen) and were instructed to take this medication as needed, recording in the diary each time the medication was used.

Statistical Analysis

Once the pain scores did not show normal distribution and homogeneity of variances, the Mann-Whitney nonparametric test was used to determine the difference between the groups within each hour for the VAS. The *t* test was used to compare the patients' State-Trait Anxiety Inventory, ages, extent of surgeries, procedure duration, and volume of local anesthesia administered between the groups. Data regarding the number of patients who took analgesics as rescue medication, location of the surgeries, time of day, and gender were analyzed using the Fisher exact test. For all tests, the *p* value was set at .05.

RESULTS

Thirty-six patients (19 women and 17 men) between the ages of 20 and 56 (37.5 ± 8.0 years of age) completed the study. Two patients did not fill in the pain diary accurately and their data were not considered; another 2 patients did not return and could not be located after surgery. No side effects were reported for any of the local anesthetics used.

The pain scores demonstrated that the mepivacaine was statistically superior in reducing pain compared to the lidocaine at 1-, 2-, and 3-hour periods. However, the pain intensity for all groups could be considered mild (between 1 and 30 VAS score). Table 1 represents the mean (SD) and the median for pain scores in the 2 groups at each time period. No statistically significant differences were found in the State-Trait Anxiety In-

Table 1. Mean (SD) / Median for Pain Scores for the Lidocaine and Mepivacaine Groups at Each Time Period

Time, h	Lidocaine	Mepivacaine	p Value (Mann-Whitney)
1	17.8 (22.5) / 8.5	3.3 (5.1) / 0.4	.007
2	22.0 (25.8) / 8.0	5.1 (8.0) / 1.7	.02
3	26.8 (30.9) / 10.0	8.8 (12.1) / 1.7	.02
4	14.9 (17.1) / 6.5	10.6 (16.0) / 1.9	.21*
5	13.3 (17.9) / 4.5	11.8 (17.5) / 1.4	.47*
6	10.4 (14.6) / 1.5	8.7 (15.6) / 0.9	.59*
7	10.6 (14.0) / 3.5	8.4 (14.9) / 0.4	.18*
8	9.0 (12.2) / 3.0	6.8 (13.8) / 0.4	.21*

* Not statistically significant.

ventory, age, extent, or duration of the surgeries between the groups. Perioperative reinjection of anesthetic solution was not necessary in any surgery, and the volume of local anesthetic needed to obtain anesthesia was significantly greater in the lidocaine group (Table 2). The quadrant of the surgery, time of day, and gender did not statistically alter patients' perception of pain in either group, although the number of patients who reported using rescue medication was significantly greater in the lidocaine group (Figure).

DISCUSSION

The usual approach to minimizing postoperative pain is an effective anesthetic agent. Postoperative pain expectation after open flap debridement surgery causes pain that is of considerable magnitude and duration,¹ although comparable with that following nonsurgical periodontal therapy.^{2,3} The choice of a pain model using open flap debridement surgery was because of its frequent use in periodontal practice, ease of recruiting patients, and the strong probability of a standardized surgical procedure.⁹

The VAS is efficient and presents good sensitivity for measurement of acute pain after surgical procedures.¹⁰ It is simple to administer, reliable, and valid, and has been used in previous studies evaluating pain

arising from periodontal therapies.^{2,3} Yet there are some limitations with VAS: memory of pain is not always accurate, and it requires 2 steps: the estimate of pain by the patient as well as the clinician's measurement of the patient's line.⁸ Vasoconstrictors used in conjunction with local anesthetics improve anesthetic duration and depth, promote hemostasis, and reduce systemic toxicity of the anesthetics.^{11,12} Epinephrine, an adrenergic vasoconstrictor used in combination with lidocaine in this study, equally stimulates beta-1 adrenergic receptors (which raises cardiac rate) and beta-2 receptors (responsible for the vasodilatation of pulmonary vessels), and also stimulates alpha receptors promoting great vasoconstriction in the local peripheral circulation.^{13,14} However, norepinephrine used in conjunction with mepivacaine in this study produces only 25% of the selectivity of epinephrine for alpha receptors, high selectivity for beta-1 (85%), and very little beta-2 activity (15%), being related to a more severe increase in blood pressure.¹⁵ Although norepinephrine is more stable in solution and requires fewer preservatives,⁶ it was removed from many formulations, making it difficult for this study to be compared with others previously published. In the United States, mepivacaine is used in conjunction with 1 : 20,000 levonordefrin, a vasoconstrictor with action similar to that of norepinephrine. Levonordefrin has a lack of activity at beta-2 receptors and less alpha-1 ac-

Table 2. Mean ($\pm$ SD) for the Variables State Anxiety, Trait Anxiety, Age, Surgery Extent and Duration, and Anesthetic Volume Administered for Each Group

Variable	Lidocaine	Mepivacaine	p Value (t test)
State anxiety	36.3 $\pm$ 8.8	33.2 $\pm$ 7.6	.29†
Trait anxiety	34.2 $\pm$ 5.2	34.8 $\pm$ 9.1	.80†
Age, y	36.0 $\pm$ 6.5	39.4 $\pm$ 9.4	.21†
Extent, no. of teeth involved	3.7 $\pm$ 0.9	3.6 $\pm$ 1.0	.81†
Duration, min	60.8 $\pm$ 24.8	50.3 $\pm$ 9.9	.12†
Anesthetic volume, mL	4.6 $\pm$ 1.7	3.3 $\pm$ 0.8	.005

† Not statistically significant.

The frequency (percentage) of patients regarding tooth position, day period when surgery was performed, gender, and rescue medication intake for the lidocaine and mepivacaine groups. * indicates statistically significant.

tivity than norepinephrine.¹⁶ Pulp anesthesia using 2% lidocaine with epinephrine lasts longer than that promoted by mepivacaine alone, but the duration of soft tissue anesthesia is similar in both formulations.¹⁷ The duration of anesthesia with 2% lidocaine with 1 : 100,000 epinephrine versus 2% mepivacaine with 1 : 20,000 levonordefrin in soft tissue was demonstrated to be 170 minutes and 130 minutes for maxillary infiltration, respectively.^{4,13,15} With the inferior alveolar nerve blocking technique, soft tissue anesthesia lasts 190 minutes for lidocaine and 185 minutes for mepivacaine.⁴ These data indicate that, except for the soft tissue anesthesia in maxillary infiltration, the anesthesia durations provided by 2% lidocaine with 1 : 100,000 epinephrine and 2% mepivacaine with 1 : 20,000 levonordefrin are similar. In the present study, however, the mepivacaine VAS scores were lower than lidocaine scores after periodontal surgery at 1, 2, and 3 hours postoperatively, although pain intensity in both groups would be considered mild (between 1 and 30) according to VAS.¹⁰ Lidocaine required more anesthetic volume to obtain suitable anesthesia, but the results need to be interpreted with caution because the statistical difference could not be considered clinically relevant. Both groups during the periodontal procedure had similar quality of anesthesia. The mepivacaine group had a low percentage of patients who took rescue medication. Several factors could have influenced these results, such as surgical extension (number of teeth involved), time required to perform the surgical procedure, gingival inflammation grade, number and severity of periodontal pockets, and previous dentin hypersensitivity. These variables were not possible to control during the study. The choice of the anesthetic formula may influence postoperative pain intensity after periodontal surgery. In spite of 2 anesthetic solutions providing a statistically significant difference, clinically both anesthetic groups were similar, showing mild pain after periodontal surgery.

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