Clinical Effectiveness of Lidocaine and Benzocaine for Topical Anesthesia

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The effectiveness of lidocaine and benzocaine in reducing pain produced by needle insertion into the palate was evaluated in a double-blind and placebo-controlled study using a more suitable method. Twenty subjects, 10 men and 10 women, submitted to 4 sessions in which they were randomly treated with 5% lidocaine, a placebo that tasted like lidocaine, 20% benzocaine, and a placebo that tasted like benzocaine. At each session, a 27-gauge needle was inserted into the palate twice, once before (baseline) and once after drug application for 1 minute. Immediately after each insertion, subjects indicated on a visual analog scale the pain intensity perceived. Lidocaine and benzocaine were equally efficient, and both were better than placebo in reducing pain caused by insertion of needles into the palate.

Key Words: Topical anesthetic; Lidocaine; Benzocaine; Pain; Injections.

Because patients' opinions of their dentists are almost entirely based on the quality of the anesthesia that they can provide, good anesthesia contributes more to the success of a procedure than the actual skill of the dental surgeon. Conservative estimates show that more than 6 million cartridges are administered every week in the United States,[1] making the injection of local anesthetic by far the most frequently performed procedure in dentistry.

Although the purpose of anesthesia is to eliminate pain in a particular area, the actual method of giving the anesthetic is painful because of stimulation produced by the needle during insertion and the injection of the anesthetic solution. The mechanisms by which the injection of the anesthetic solution causes pain have not yet been clearly identified,[2] but some factors involved are certain properties of the injected solution, how the injection is given, and the tissue sensitivity of the injection site.[3]

Needle insertion produces mechanical trauma of the tissues, and the intensity of pain is related to the area of injection[4] and to the design of the needle bevel, which affects penetration. Needles that have secondary bevels cause the least pain.[5] On the other hand, the needle's diameter, within dental standards, does not interfere in the intensity of the pain caused by needle insertion.[6,7]

Application of topical anesthetics has been used to minimize the pain caused by needle insertion. A number of clinical studies have been conducted regarding the effectiveness of such drugs, some showing the advantages of topical anesthetics and others showing that they are no more effective than placebo.[8–11] However, analysis of these studies shows that both those with favorable results and those with unfavorable results presented methodological problems, such as the use of low-sensitivity pain scales, the injection of a local anesthetic that could mask the effect of the topical anesthetic, a long period of application, or application of anesthetic on areas with little pain sensitivity. Hence, in the case of the more frequently used topical anesthetics, there is still doubt about their clinical effectiveness. New methods such as electronic anesthesia, new formulas such as the eutectic mixture of local anesthetics, or modifications in the concentrations and time of application of available drugs have been tested with controversial results.[4,12–15]

Svensson and Petersen[16] compared the effectiveness of the eutectic mixture of local anesthetics using the palate, where the injection causes intense pain[4] and there-

Received May 11, 1999; accepted January 24, 2000.

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Anesth Prog 46:97–99 1999

ISSN 0003-3006/99/$9.50
SSDI 0003-3006(99)

fore is the most suitable region for evaluating the effectiveness of topical anesthetics. The pain was assessed before and after a double-blind application of anesthetic or placebo using a 100-mm visual analoge scale (VAS), which is an efficient and sensitive method for measuring pain.[17] To our knowledge, none of more frequently used topical anesthetic (eg, lidocaine and benzocaine) have been evaluated using this method.

Using the method used by Svensson and Petersen,[16] the aim of this study was to assess the effectiveness of topical application of 5% lidocaine and 20% benzocaine in reducing pain caused by needle insertion into the palatine mucosa.

MATERIALS AND METHODS

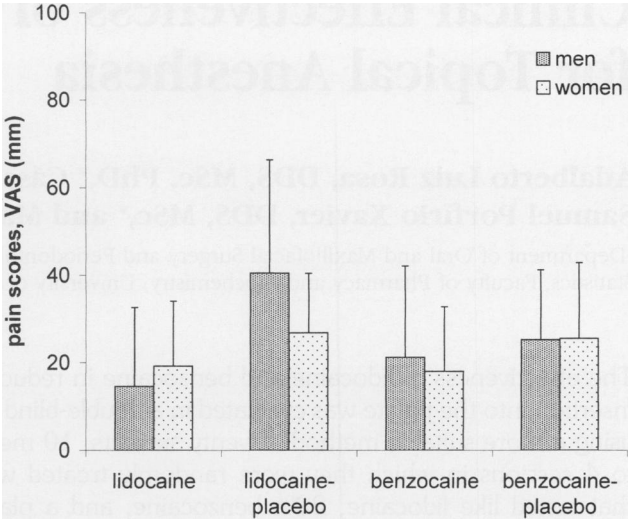
Twenty subjects, 10 men and 10 women aged 17 to 26 years, took part voluntarily in this study. They had a negative medical history, were not using any medication, and gave their written consent before participating. They were informed that they would be given drugs and placebo on a double-blind basis. The drugs used were a tasteless paste of 5% lidocaine, a tasteless paste of placebo (lidocaine placebo), a mint-flavored paste of 20% benzocaine, and a mint-flavored paste of placebo (benzocaine placebo).

The subjects submitted to 4 sessions at intervals of at least 7 days. They were topically treated with one of the above drugs in random order. A cotton swab was inserted into the paste and rotated clockwise 3 times to standardize the amount of drug applied. At each session, a 27-gauge needle was inserted into the palate next to the greater palatine foramens twice, once before (baseline) and the other after (test) drug application for 1 minute. Immediately after each insertion, subjects indicated on a VAS the pain intensity perceived. No anesthetic solution was injected, nor was any other type of procedure carried out.

A repeated-measures 2-way analysis of covariance with fixed effects was used to analyze the data. The treatment (drugs and placebos) and the patients' sex were the independent variables. Baseline pain score was the changing covariate and test pain score the dependent variable. Three predefined contrasts were used to detect if there were significant differences between drugs and placebos, the 2 drugs, and the 2 placebos. Differences were considered significant at the 5% level.

RESULTS

The average pain scores after topical application of anesthetics and placebos are shown in the Figure. The mean pain score after lidocaine treatment was 16.90 (14.6 for men and 19.2 for women), and after benzocaine it was 19.60 (21.2 for men and 18.0 for women). After lidocaine placebo, the mean test pain score was 33.65 (40.5 for men and 26.8 for women), and for benzocaine placebo it was 25.35 (25.2 for men and 25.5 for women).



Pain scores after topical application of anesthetics and placebos. Data are shown as means; bars are standard deviations.

Analysis of covariance showed that the effect of at least 2 treatments were different ($P = .001$); however, there were no differences related to sex ($P = .116$) or for gender vs treatment interaction ($P = .978$). The comparisons detected significant differences between drug and placebo ($P = .001$) but not between lidocaine and benzocaine ($P = .829$) or between the 2 placebos ($P = .289$).

DISCUSSION

The results of this study showed that lidocaine and benzocaine were equally efficient in reducing pain caused by insertion of needles into the palate, and both were better than placebo. The clinical effectiveness of lidocaine and benzocaine was clearly proved by the fact that the pain intensity was considerably reduced when they were applied. These results do not agree with those obtained by Gill and Orr[8] and Kincheloe et al,[9] which showed that there was no difference between various topical anesthetics and placebos. This discrepancy may be due to differences in the methodologies used. Gill and Orr[8] may not have noted a difference between anesthetics and the placebo because they used a 5-point descriptive scale for pain assessment. This is not an accurate method because this scale is not sensitive.[17] This

may have occurred for the study by Kincheloe et al[9] because they injected 1.8 mL of anesthetic solution in 30 seconds. Because the injection of a solution, even slowly, results in more pain than only needle insertion, it is likely that this may have masked the topical anesthetic effect.

Although other authors have shown the effectiveness of topical anesthetics in comparison to a placebo, in general the needle was inserted in the mucovestibular fold,[10,11] an area in which a noxious stimulus produces low-intensity pain. Furthermore, Rosivack et al[11] applied topical anesthetics and placebo to the same individuals, although not in a double-blind manner, which may have influenced the subjects to indicate higher pain scores when they were given a placebo. The present results offer an extension of earlier studies because they show that these anesthetics are also effective in the palatine region, where injection is more painful.[4] In addition, sex does not influence either pain intensity or drug effect evaluation; thus, there is no need to select equal numbers of men and women in similar studies.

We used topical anesthetics and placebos with different flavors, and there was no difference between tasteless and mint-flavored pastes, which suggests that flavor does not influence the efficacy of topical anesthetic. In our clinical experience, some patients complain about flavored topical anesthetic.

In addition, these results indicate that dental surgeons should continue to apply topical anesthetics before injections because this results in significant pain reduction. On the other hand, the pain level perceived by patients was still high even after the use of topical anesthetics, which emphasizes the need for more effective ways of controlling pain, because pain may well contribute to avoidance of routine dental care.

ACKNOWLEDGMENTS

This work was supported by Fundação de Amparo à Pesquisa do Estado de São Paulo (grant 94/4288-6).

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