Anesth Prog 41:35–39 1994

Efficacy of a Topical Anesthetic on Pain and Unpleasantness During Scaling of Gingival Pockets

Peter Svensson, DDS, PhD,* Jens Kølsen Petersen, DDS, MS,† and Helle Svensson‡

*Department of Prosthetic Dentistry and Stomatognathic Physiology, †Department of Oral and Maxillofacial Surgery, and ‡Dental Auxiliary Division, Royal Dental College, Aarhus University, Denmark

The efficacy of a topical anesthetic on pain and unpleasantness provoked by scaling of gingival pockets was investigated in 20 patients with mild chronic periodontitis. A eutectic mixture of local anesthetics (EMLA) and a placebo cream, both occluded by Orahesive Oral Bandages, were applied in a balanced, randomized, double-blind, split-mouth design, which enabled within-subject comparison of the anesthetic and the placebo in the upper and the lower jaw. Pretreatment interviews showed that approximately two-thirds of the patients considered gingival scaling to be associated with some degree of pain and unpleasantness. Pain intensity and unpleasantness were evaluated on 100-mm visual analog scales (VAS). Application of EMLA reduced both pain intensity and unpleasantness significantly compared to placebo cream. Median reductions in VAS pain intensity in the upper and lower jaw were 58.9% and 61.9%, and corresponding reductions in VAS unpleasantness were 31.9% and 25.6%, respectively. Generally, the patients accepted the anesthetic procedure well. The residual perception of pain and unpleasantness following topical anesthesia may be dependent on activation of nonanesthetized nociceptive fibers in the tooth pulp. However, the present study clearly demonstrates the efficacy of a topical anesthetic in a clinical situation, which may be recommended as a simple pharmacologic strategy to reduce pain and unpleasantness during scaling procedures.

Control of pain constitutes an important aspect of dental treatment.[1] Several means exist, including pharmacologic and psychologic strategies, to reduce pain and unpleasantness.[2] In spite of the documented efficacy of local injections with anesthetics,[3,4] fear of pain and the needle are still common reasons for avoidance of dental treatment in odontophobics.[5,6] Application of topical anesthetics has been another well-described procedure to reduce pain,[7] although its efficacy on needle pain has been challenged.[8,9] An effective topical anesthetic would have obvious advantages compared to multiple injections of local anesthetics, as may be required for periodontal treatment. Periodontal diseases are seldomly associated with significant pain from the gingiva except in certain manifestations, such as acute necrotizing gingivitis or periodontal abscess. Therefore, the dentist or dental hygienist may face a problem when periodontal treatment is needed in that the treatment may evoke considerably more unpleasantness and pain than the disease. Furthermore, Danish dental hygienists are not allowed to perform injections, and an effective topical anesthetic procedure would, therefore, be a great help.

The choice of the topical anesthetic procedure is also important. It has recently been demonstrated that a eutectic mixture of local anesthetics (EMLA) is more efficient than a lidocaine gel[10] and that occlusion of the topical anesthetic may help to control the application.[11] In a clinical study using EMLA before removal of arch bars, it was shown that the anesthetic is significantly more effective in reducing pain than is placebo.[12] Thus EMLA seems to be a powerful topical anesthetic in the oral cavity.

The aim of the present study was to evaluate the efficacy of EMLA cream on pain and unpleasantness provoked during scaling of gingival pockets.

METHODS

Subjects

Twenty patients (11 females and nine males), 44 ± 14 yr in age (mean ± standard deviation) and with mild chronic periodontitis (pocket depths ≤5 mm and even

Received August 19, 1993; accepted for publication May 30, 1994.

Address correspondence to Dr. Peter Svensson, Department of Prosthetic Dentistry and Stomatognathic Physiology, Royal Dental College, Aarhus University, Vennelyst Blvd., DK-8000 Aarhus C, Denmark.

ISSN 0003-3006/94/$7.00

horizontal loss of supporting tissues not exceeding one-third of the length of the root),[13] were taken from the waiting list at the Royal Dental College in Aarhus and included in the study. The patients had previously been examined and were scheduled to receive conservative therapy, including information, instruction in self-performed plaque control methods, and scaling of gingival pockets. At least five teeth in each quadrant were required, and the number of teeth in the opposite quadrant was not allowed to differ by more than one tooth.

The subjects gave informed consent, and the study was conducted according to the guidelines from the Second Helsinki Declaration, which means that the local ethics committee in Aarhus County had reviewed and approved the study.

Evaluation Parameters

Before the treatment was started, the patients were asked to indicate the pain intensity and unpleasantness evoked during previous scaling on simple verbal rating scales (0 = none, 1 = mild, 2 = slightly moderate, 3 = moderate, 4 = strong). After scaling of a quadrant, the pain intensity and unpleasantness were separately scored on 100-mm visual analog scales (VAS) and on the verbal rating scale described above. The left end-point on the unpleasantness VAS was "no unpleasantness at all" and the right end-point was "worst imaginable unpleasantness." The left end-point on the pain intensity VAS was "no pain at all" and the right end-point was "worst imaginable pain." No interim descriptors were used. Patients were also asked to rate their general impression of the anesthetic procedure (bad, acceptable, or good) and the taste of the anesthetic agent (bad, acceptable, or good). Finally, they were asked whether the applied anesthetic in the quadrant had had an effect (yes, no, some effect). The data from each quadrant were kept on separate records.

Anesthetic Procedure

A balanced, randomized, double-blind, placebo-controlled, split-mouth design was used. In a randomized manner, half the subjects first received the active cream in the first quadrant and the other half first received the placebo cream. Thus an effect of sequence should be neutralized, and the data enabled a within-subject comparison in the upper and the lower jaw.

The active anesthetic was a 5% eutectic mixture of local anesthetics (EMLA, Astra AB, Södertälje, Sweden) consisting of 2.5% lidocaine and 2.5% prilocaine. The placebo cream was similar in appearance and viscosity to the EMLA cream but without the active anesthetic compounds.

The principle of occluded anesthesia[11,14] was used in the present study to improve control and absorption of the applied anesthetic. Orahesive Oral Bandages (ConvaTec, Princeton, NJ) were fitted to the gingival margin and covered 2 to 3 mm of the facial and lingual aspects of the teeth. Five milliliters of test cream were applied by syringe on the gingival margin along the gingival pocket on the facial and lingual aspect, and the bandages were positioned and adapted. After 5 min, the bandage covering two to three teeth in the quadrant was removed, and scaling was started. Scaling with use of conventional hand instruments (curettes and sickles) varied between 2 and 5 min per tooth, depending on the amount of subgingival calculus and the pocket depth. The bandages were removed successively in the mesial direction until the quadrant had been finished. The patient was then asked to evaluate this part of the treatment before scaling of the next quadrant. The whole session lasted about 2 to 2.5 hr.

Statistics

The data were evaluated using nonparametric statistics, as a relative small number of patients were included and a Gaussian distribution of the data was not verified. Wilcoxon's signed rank test for paired values and the sign test were used for within-subject comparisons of VAS scores and verbal ratings. The Kruskal-Wallis one-way analysis of ranks was calculated between ratings of previous pain and unpleasantness experiences and VAS scores. Significance was accepted at P value of 0.05.

RESULTS

Approximately two-thirds of the patients found that scaling of gingival pockets on previous occasions had been associated with pain and unpleasantness. Four female patients considered the scaling procedure a major problem, rating the pain from moderate to strong (Table 1).

There was a significant effect of the topical anesthetic on pain intensity and unpleasantness provoked by scaling of gingival pockets in the present study. The VAS pain intensity and unpleasantness scores were significantly lower following application of EMLA in both the upper and the lower jaw (Figure 1). However, the VAS pain intensity was significantly more reduced in the lower jaw compared to the VAS unpleasantness (Table 2).

The effect of the EMLA cream was also demonstrated by the verbal rating scales, as the pain intensities in the

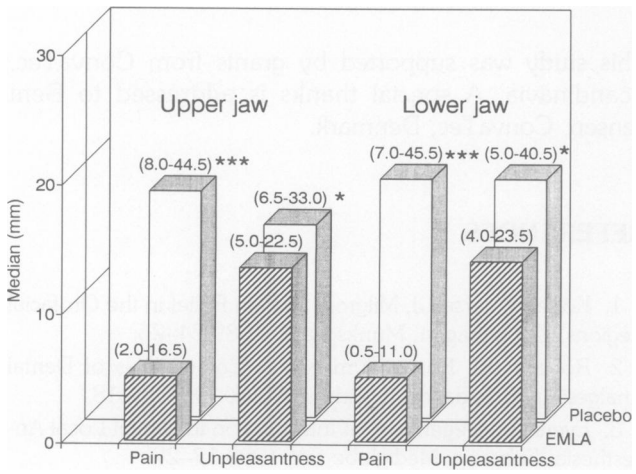
Table 1. Ratings on Pain Intensity and Unpleasantness During Previous Experiences with Scaling of Gingival Pockets in 20 Patients with Mild Chronic Periodontis

	None	*Mild*	*Slightly Moderate*	*Moderate*	*Strong*
Pain intensty	35%	25%	20%	15%	5%
Unpleasantness	25%	45%	20%	5%	5%

upper and lower jaw were rated significantly lower ($P < 0.009$ and $P < 0.013$, respectively) following administration of the active anesthetic. However, the rating of unpleasantness was not significantly different between the EMLA and the placebo cream in the upper and lower jaw ($P = 0.11$ and $P = 0.68$). Figure 2 shows the frequency distributions of the verbal ratings of the pain intensity and unpleasantness following EMLA and placebo administration in the upper and lower jaw. No correlation between previous experiences of pain and unpleasantness and the treatment response evaluated by the difference in placebo and active anesthetic VAS scores could be established in the present study, nor did the previous experience of pain and unpleasantness or age influence any of the measured VAS scores.

The placebo cream was stated by 85% of the patients not to have any effect, whereas an effect was reported by 97.5% following application of the EMLA cream. In total, 87.5% of the patients estimated the anesthetic procedure to be acceptable or good, with the best results occurring in the upper jaw. The taste of the EMLA and the placebo was considered to be at least acceptable by 57.5% and 87.5% of the patients, respectively.

Figure 1. VAS scores of pain and unpleasantness produced by scaling of gingival pockets in 20 patients. Median values are plotted with interquartile ranges shown in parentheses. Difference between EMLA and placebo: * = $P < 0.05$, *** = $P < 0.001$.



DISCUSSION

Pain is an undesired side effect of many dental treatment procedures. This is mainly due to the special psychologic impact and the complex neurophysiologic features of the orofacial region.[15] Thus a high density of nociceptors, in particular in the tooth pulp, and a very large and bilateral representation in higher levels of the somatosensory system, are important determinants for the orofacial nociception.

Management and prevention of acute pain is certainly less difficult than treatment of chronic pain. However, local injection of anesthetics, which is a highly effective method to block peripheral nociceptive afferents, is unfortunately preceded by penetration of the tissue surface by a sharp needle. Needle phobia is one of the most common reasons for postponing dental treatment in fearful patients.[5,6] Furthermore, if the dental treatment requires a relatively short working time and involves many different sites and not only a single tooth, local injections may not be the most suitable way to manage pain. Scaling of gingival pockets in patients with chronic mild periodontitis may represent a clinical situation in which topical anesthetics could be the method of choice for control of pain and unpleasantness.

The present study demonstrated that, in a sample of patients requiring conservative therapy for periodontitis, about two-thirds considered previous treatments to be associated with some degree of pain and unpleasantness. However, this experience had no influence on the treatment effect or the magnitude of the VAS scores. Thus

Table 2. Median Differences in VAS Scores Between EMLA and Placebo Expressed as the Percentage of Placebo Scores

	Upper Jaw (%)	*Lower Jaw (%)*
Pain intensity	−58.9 (−76.9 to −5.6)	−61.9 (−87.8 to −34.3)
Unpleasantness	−31.9 (−58.2 to 0)	−25.6[a] (−61.9 to 16.6)

Interquartile ranges are shown in parentheses.
[a] Significant difference ($P < 0.05$) between reductions in pain intensity versus unpleasantness.

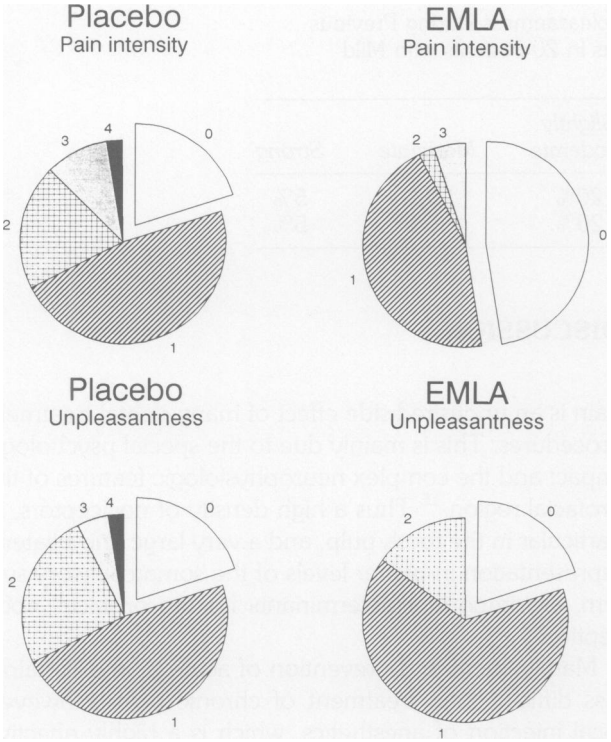


Figure 2. Frequency distribution of verbal rating scores of pain and unpleasantness after placebo and EMLA administration in 20 patients (0 = none, 1 = mild, 2 = slightly moderate, 3 = moderate, 4 = strong). Pooled results from upper and lower jaws.

patients who think that scaling is a problem showed similar reductions in both pain intensity and unpleasantness compared to patients not concerned with the scaling procedure.

The intensity of pain was more reduced following application of EMLA than was the reduction of unpleasantness. The pain intensity primarily represents sensory-discriminative aspects of pain,[16] which suggests that EMLA in fact had a blocking effect of the nociceptive afferent input from the gingival tissues. However, the smaller reduction in unpleasantness, representing affective and motivational aspects of pain,[16] could indicate that higher centers in the central nervous system were still activated during the gingival scaling. Perhaps an adequate concomitant psychologic strategy would help to reduce the unpleasantness more. Another explanation for the differences in results between pain intensity and unpleasantness could be due to loss of blinding as there was a difference in taste. However, it is unclear why this unmasking should affect only the pain intensity and not the unpleasantness. It has been shown that active treatment (eg, fentanyl) reduces the pain intensity to electrical tooth stimuli whereas the unpleasantness is not affected.[17] Furthermore, a placebo treatment (eg, administration of saline) reduces the unpleasantness of painful tooth stimuli but not the sensory-discriminative aspect.[17] This seems to strengthen the suggestion that EMLA cream predominately affected the pain intensity by blocking nociceptive afferents and to a smaller extent reduced the unpleasantness. However, active placebos that mimic the side effects of the test compound (ie, numbness, taste) should be preferred whenever possible.

The residual amount of pain is most likely due to impulses arising from the tooth pulp, as the topical anesthetic may not penetrate the cortical bone sufficiently to block nociceptive afferents at the apices of the teeth. Therefore, research should be devoted to the development of topical anesthetics with improved penetration properties.

The use of Orahesive Oral Bandages enabled a controlled application, as the cream was protected from contamination with saliva and distortion due to movements. Evidence suggests that the absorption may be enhanced by occlusion, with improved analgesic profiles as a consequence.[14] The timing of the anesthetic procedure could easily be planned in this study. Although the effective application time at different sites may vary within the quadrant, it has been shown that pain thresholds to laser stimuli applied to the gingival mucosa treated with EMLA cream for 5 or 15 min were similar for a 30-min period.[10] Thus the critical parameter may be an application time of at least 5 min.

In general, the patients accepted the application of the EMLA cream and the Orahesive Oral Bandages well. The bad taste of EMLA may be controlled by rinsing and suction. The described procedure seems to be a step towards better control of pain and unpleasantness. However, further research should improve the efficacy and the taste of topical anesthetics, and the methods for optimal application still need to be elaborated.

ACKNOWLEDGMENTS

This study was supported by grants from ConvaTec, Scandinavia. A special thanks is addressed to Bent Jensen, ConvaTec, Denmark.

REFERENCES

1. Kølsen Petersen J, Milgrom P: Pain Relief in the Orofacial Regions. Copenhagen, Munksgaard, 1989:24–26.

2. Roberts GJ, Rosenbaum NL: A Colour Atlas of Dental Analgesia and Sedation. London, Wolfe, 1992:11–18.

3. Evers H, Haegerstam G: Introduction to Dental Local Anaesthesia. Fribourg, Mediglobe SA, 1990:17–27.

4. Roberts DH, Sowray JH: Local Analgesia in Dentistry, 3rd ed. Bristol, Wright, 1987:12–18.

5. Smith T, Getz T, Milgrom P, Weinstein P: Evaluation of treatment at a dental fears research clinic. Spec Care Dent 1987;3:130–134.

6. Moore RA, Brødsgaard I, Birn H: Manifestations, acquisition and diagnostic categories of dental fear in a self-referred population. Behav Res Ther 1991;29:51–59.

7. Howe GL, Whitehead FIH: Local Anaesthesia in Dentistry, 3rd ed. London, Butterworth, 1990:54–56.

8. Gill CJ, Orr DL: A double-blind crossover comparison of topical anesthetics. J Am Dent Assoc 1979;98:213–214.

9. Kincheloe JE, Mealiea WL, Mattison GD, Seib K: Psychophysical measurement on pain perception after administration of a topical anesthetic. Quintessence Int 1991;22:311–315.

10. Svensson P, Bjerring P, Arendt-Nielsen L, Kaaber S: Hypoalgesic effect of EMLA and lidocaine gel applied on human oral mucosa: quantitative evaluation by sensory and pain thresholds to argon laser stimulation. Anesth Prog 1992;39: 4–8.

11. Svensson P, Kølsen Petersen J: Anesthetic effect of EMLA occluded with Orahesive Oral Bandages on oral mucosa. A placebo-controlled study. Anesth Prog 1992;39:79–82.

12. Pere P, Iizuka T, Rosenberg PH, Lindquist C: Topical application of 5% eutectic mixture of lignocaine and prilocaine (EMLA^R) before removal of arch bars. Br J Oral Maxillofac Surg 1992;39:153–156.

13. Nyman S, Lindhe J: Examination of patients with periodontal disease. In: Lindhe J, ed: Textbook of Clinical Periodontology. Copenhagen, Munksgaard, 1985:298–308.

14. Svensson P, Arendt-Nielsen L, Bjerring P, Kaaber S: Oral mucosal analgesia quantitatively assessed by argon laser-induced thresholds and single-evoked vertex potentials. Anesth Pain Control Dent 1993;2:154–161.

15. Sessle BJ: The neurobiology of facial and dental pain: present knowledge, future directions. J Dent Res 1987;66:962–981.

16. Price DD. Psychological and Neural Mechanisms of Pain. New York, Raven Press, 1988:18–75.

17. Gracely RH, McGrath P, Dubner R: Narcotic analgesia: fentanyl reduces the intensity but not the unpleasantness of painful tooth pulp sensations. Science 1979;203:1261–1263.