

The efficacy of eutectic mixture of local anesthetics as a topical anesthetic agent used for dental procedures: A brief review

[Alireza Daneshkazemi](#), [Seyyed Mohammad Abrisham](#),¹ [Pedram Daneshkazemi](#),² and [Amin Davoudi](#)³

Department of Operative Dentistry, Social Determinant of Oral Health Research Center, School of Dentistry, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

¹Department of Prosthodontics, Yazd Dental School, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

²School of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran

³Dental Students Research Center, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran

Corresponding author: Dr. Seyyed Mohammad Abrisham, Daheye Fajr St, Dental School, Shahid Sadoughi University of Medical Sciences, Yazd, Iran. E-mail: abrisham.m@gmail.com

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Abstract

Dental pain management is one of the most critical aspects of modern dentistry which might affect patient's quality of life. Several methods are suggested to provide a painless situation for patients. Desensitization of the oral site using topical anesthetics is one of those methods. The improvements of topical anesthetic agents are probably one of the most important advances in dental science in the past 100 years. Most of them are safe and can be applied on oral mucosa with minimal irritation and allergic reactions. At present, these agents are various with different potent and indications. Eutectic mixture of local anesthetics (EMLA) (lidocaine + prilocaine) is a commercial anesthetic agent which has got acceptance among dental clinicians. This article provides a brief review about the efficacy of EMLA as a topical anesthetic agent when used during dental procedures.

Keywords: Anesthesia, dental, eutectic mixture of local anesthetics, oral, topical anesthesia

INTRODUCTION

The anesthetic agents are available in different kinds such as: Gels, lotions, lozenges, patches, and solutions.[1] Generally, there are 13 types of topical analgesic and anesthetic with different bases which can be applied on mucosal tissues for the pain associated treatments.

A number of analgesic and anesthetic combination are available in different brands such as:

Benzocaine + butamben + tetracaine (Cetacaine[®]), lidocaine + prilocaine (EMLA[®], Oraqix[®]), lidocaine + tetracaine (Synera[®]), and methyl salicylate + menthol (BenGay[®]; Icy Hot[®]).[2]

These formulations represent various anesthetic potent that are administered for different indications.[2]

These formulas are approved by the United States Food and Drug Administration Society as topical anesthetic agents. In general, the topical anesthetics are minimally absorbed and have few systemic adverse reactions or drug interactions. Nevertheless, much care must be taken during prescribing of these agents, because they can be toxic in nonstandard doses.[3]

Eutectic mixture of local anesthetics (EMLA) is a eutectic combination of 2.5% lidocaine and 2.5% prilocaine which has gained aficionados for dental procedures, lately. It consists of a mixture of two crystalline powders (2.5% lidocaine and 2.5% prilocaine), which has a melting point below room temperature which turn into a liquid oil. In this way, it would be able to penetrate intact skin or mucosa into

a depth of 5 mm. EMLA provides sufficient local anesthesia in a variety of painful superficial procedures including superficial surgery, laser surgery, epilation, cautery of condylomata, debridement of leg ulcers, and venipuncture.[4,5] EMLA represented a very favorable tolerability profile with transient and mild skin blanching. The erythema is reported as the most frequent adverse side effect of EMLA application on the skin, but it can be overlooked.[5]

Originally, EMLA is not indicated for the oral mucosa but several authors have reported it as the most effective topical agent in dentistry.[6,7] Effective results have been found in children for controlling of the pain induced by venipuncture and has also been used for other minor procedures such as sinus puncture, biopsies, and rubber dam clamp.[8,9,10] Furthermore, Al-Asfour *et al.* observed that EMLA does not interfere with wound healing.[11]

The oral mucosa is thinner than dermal tissue and has a more underlying blood supply that facilitates rapid absorption of lipophilic drugs. In a study, Vickers *et al.* observed whether the plasma concentration of EMLA, which was applied on oral mucosa, is below standard level of toxicity or not. They indicated that 30 min application EMLA on oral mucosa produces safe plasma concentration for prilocaine (223 ng/ml) and lidocaine (418 ng/ml) which was considerably below the known toxic level of both prilocaine (4.4 µg/ml) and lidocaine (6.0 µg/ml).[12] A meticulous search reveals that EMLA has been used for reducing pain during dental injection,[7] minor gingival surgeries, and pocket scaling[13,14] restorative procedures.[12]

EMLA is available at the range dosage of 2.5–5%. Effective duration for 5% EMLA has been reported to be of 2[15] and 10 min,[16] which is as effective as longer intraoral application times.

As EMLA is going to turn into a common topical anesthetic agent among dental clinicians, the aim of this review was to observe clinical properties of this agent in published literature from 2000 to 2015 which has not been studied as an independent agent previously.

MATERIALS AND METHODS

A data search was performed using PubMed's electronic database of dental reports based on the following search terms in simple or multiple conjunctions: “EMLA,” “oral,” “dental anesthesia,” and “topical anesthesia.” The search was set up from 2000 to 2015 and review articles and references from different studies were used to identify relevant studies.

To select the studies all obtained reports were reviewed, so titles and abstracts were screened for relevance. The full text of relevant abstracts was obtained and selected using the following inclusion and exclusion criteria.

Inclusion criteria

- Dental procedures in which EMLA was administered as an anesthetic agent
- Clinical research of at least 5 adult patients (>18 years)
- Maintaining the standard guidelines of anesthesiology.

Exclusion criteria

- Case reports
- Studies with missing data
- Repeatedly published studies; the last version was included
- Studies in languages other than English
- The initial literature search yielded 40 articles. After the first screening based on the title and abstract, 9 studies were found eligible. Full-texts of all articles were reachable for initiating the reviewing process.

RESULTS

From the gathered articles, 9 of them met the inclusion criteria in which 4 of them[14,17,18,19] used

EMLA for periodontal treatments, such as scaling and root planning (SRP), and 5 of them[7,20,21,22,23,24] used EMLA as a topical anesthetic agent prior to local anesthesia injection. The important information of each study is summarized in Tables 1 and 2.

DISCUSSION

Eutectic mixture of local anesthetics for periodontal treatments

Administration of local anesthesia is recommended for SRP procedures and injection of local anesthesia is strongly supported by some researches.[25,26] Fear and anxiety of needle injection is inevitable during local anesthesia administration.[27] Thus, some patients prefer to tolerate the pain of SRP rather than withstand with their fear and anxiety of injection.[28]

EMLA demonstrated lesser pain and discomforts during treatment for mild chronic periodontitis in comparison to a placebo and is similar to lidocaine patches.[17,18] Antoniazzi *et al.* compared the effects of EMLA 25 mg/g, injectable 2% lidocaine, topical 2% benzocaine, and a placebo substance on reducing pain during SRP. They concluded that EMLA provided similar effectiveness to injectable lidocaine and better than the other two groups.[17] In that study, 70% of the patients preferred the topical anesthesia because of lesser pain, discomfort, and numbness periods. Furthermore, 50% of placebo group, 25% of benzocaine group, and 6.2% of EMLA group reported pain intolerance.[18]

It has been claimed that provoked pain during SRP is related to the pocket depth. In a valuable research, Derman *et al.*, evaluated the effectiveness of the intra-pocket application of EMLA on 638 patients who referred for SRP. Their result indicated that 72% of participant preferred using EMLA for SRP, which reflects its efficacy even in deep periodontal pockets.[14] In another study, the effectiveness of EMLA, 20% lignocaine patch, electronic dental anesthesia was evaluated during SRP on 25 patients with 5 mm periodontal pocket depth. The results suggested that among the tested agents, 5% EMLA and 20% lignocaine patch, were more effective specifically in comparison to electronic dental anesthesia.[19]

Chung *et al.*, conducted a study to evaluate the efficacy of EMLA on pain perception during SRP. Furthermore, they compared the intensities of provoked pain by hand and ultrasonic instruments.[18] They stated that application of EMLA alongside using ultrasonic instruments significantly results in patient's comfort.

Eutectic mixture of local anesthetics as a topical agent before needle injection

Needle injection during local anesthesia infiltration might induce a provoked pain, especially in the palatal mucosa with a thick, keratinized layer which resists to the effects of topical anesthetics (particularly the anterior region) rather than other intraoral sites.[29,30] The pain of palatal injection is mainly associated with the mucoperiosteum dislocation than with the puncture.[20] As the palatal mucosa is one of the most painful sites for needle penetration, it has become a special test for evaluating the efficacy of any kinds of topical anesthetic agents.[21]

Franz-Montan *et al.*, designated a study to compare the efficacy of EMLA, liposome-encapsulated 2% ropivacaine, and liposome-encapsulated 1% ropivacaine before palatal injection (liposomes are phospholipid vesicles which are used to carry drugs and brings better cutaneous and percutaneous penetration, alongside slow release of the local anesthetic). Their results reflected that EMLA was better pain reliever than other studied agents but with no significant statistical differences.[20] In another recent study, the topical anesthetic efficacy of following agents was evaluated prior to palatal injection: Liposome-encapsulated 5% lidocaine, liposome-encapsulated 2.5% lidocaine, 5% xylocaina, and 2.5% EMLA. Similar result to the previous study was reported in which the liposome-encapsulated 5% lidocaine and EMLA showed the best anesthetic results than other agents.[22] Again, in another clinical study, the efficacy of following topical anesthetics were evaluated when they were applied at buccal fold of maxillary canine tooth prior to local anesthesia infiltration: 20 mg of 1% ropivacaine gel, 60 mg of 1% ropivacaine gel, 20 mg of EMLA, 60 mg of EMLA, 20 mg of 20% benzocaine gel, and 60 mg of 20% benzocaine gel. The final results manifested that all of the topical anesthetics were similar in reducing the pain of needle penetration, however, EMLA 60 mg promoted longer duration of soft tissue anesthesia.[31] Al-Melh and

Andersson compared the anesthetic efficacy of 20% benzocaine gel with EMLA on the 40 participants who needed to receive palatal anesthetic infiltration. They claimed that the pain scores were significantly lower in EMLA group than other groups.[32] Also, EMLA was compared with lignocaine gel by McMillan *et al.* and better anesthetic efficacy was reported by EMLA.[7]

Limitations

There is no serious side effect or contraindication for EMLA; however, some consideration should be noticed. Edema, erythema, and transient pallor are the most reported side effect after cutaneous application of EMLA.[32] Furthermore, methemoglobinemia and seizures might happen in EMLA overdose.[32] About oral administration, one article reported for cases who demonstrated ulceration and gingival desquamation 1-day after topical application of EMLA.[33]

CONCLUSION

From the reviewed studies, it can be concluded that EMLA is an efficient anesthetic agent which can be used for oral application. It represents well anesthetic duration locally for SRP and prior to needle injection during local anesthesia infiltration.

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Conflicts of interest

There are no conflicts of interest.

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Figures and Tables

Table 1

Authors	Year	Treatment plan	Number of participants	Groups	Clinical significant
Antoniazzi <i>et al.</i> ^[17]	2015	SRP	32	EMLA 2.5% Injectable lidocaine 2% Topical benzocaine 2% Placebo	Higher effectiveness by EMLA similar to injectable lidocaine 2%
Derman <i>et al.</i> ^[14]	2014	SRP of deep pockets	638	EMLA 2.5% Placebo	Effectiveness of EMLA for SRP
Chung <i>et al.</i> ^[18]	2011	SRP with hand and ultrasonic instruments	40	EMLA 2.5% Placebo	Significant effect of EMLA than placebo
Pandit <i>et al.</i> ^[19]	2010	SRP of 5 mm pockets	25	EMLA 5% Lignocaine 20% Electric dental anesthesia	Higher anesthesia by EMLA and Lignocaine

EMLA=Eutectic mixture of local anesthetics, SRP=Scaling and root planning

Reviewed articles which used EMLA for periodontal treatments

Table 2

Authors	Year	Site of injection	Number of participants	Groups	Clinical significant
Franz-Montan <i>et al.</i> ^[23]	2015	Palatal	40	Liposome-encapsulated 5% lidocaine Liposome-encapsulated 2.5% lidocaine Xylocaina 5% EMLA 2.5%	Best results by EMLA and first group
Franz-Montan <i>et al.</i> ^[20]	2012	Palatal	40	Liposome-encapsulated 2% ropivacaine Liposome-encapsulated 1% ropivacaine EMLA 2.5% Placebo	All of them were similar
Franz-Montan <i>et al.</i> ^[23]	2007	Buccal fold	30	20 mg of 1% ropivacaine gel 60 mg of 1% ropivacaine gel 20 mg of EMLA 2.5% 60 mg of EMLA 2.5% 20 mg of 20% benzocaine gel 60 mg of 20% benzocaine gel	60 mg of EMLA promoted longer anesthesia
AL-Melh and Andersson ^[24]	2007	Palatal	40	EMLA 2.5% 20% benzocaine gel	Significant effect of EMLA than benzocaine
MCMillan <i>et al.</i> ^[7]	2000	Oral mucosa	10	EMLA 2.5% Lignocaine gel	Better efficacy by EMLA

EMLA=Eutectic mixture of local anesthetics

Reviewed article which used EMLA orally for elimination discomfort of needle penetration

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