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CLINICAL TRIAL STUDY

The Effect of Topical Anesthetic Gel *versus* Relaxation Exercise in Controlling the Pain of Anterior Maxillary Injection

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Abstract:

Background and Aim:

Adequate intraoral anesthesia is a major prerequisite for many dental procedures. Bubble breath exercise, distraction, and play therapy technique may be used as relaxation exercises to decrease pain. This study aimed to compare the efficacy of bubble breath exercise versus topical anesthetic gel in controlling the pain of anterior maxillary infiltration.

Methods:

This crossover clinical trial was performed on 50 children aged 10-12 years. Subjects received a total of 100 maxillary injections (two per person) in the buccal mucosal area of canine teeth of both sides at intervals of 2 to 3 days. On one side, the injection was performed after applying 20% benzocaine gel. On the other side, a similar injection was performed after the bubble breath exercise. The injection solution was 1/4 of 1.8 mL cartridge of 2% lidocaine containing 1:200,000 epinephrine using a 30-gauge needle. The pain was measured immediately after anesthesia injection using a Visual Analogue Scale (VAS). Data analysis was carried out using SPSS Version 18.0 (IBM Inc., Chicago, IL, USA). Wilcoxon signed-rank tests were used to compare with the 10-mm visual analog scale (VAS) scores obtained from all participants. The level of significance was considered at 5% ($p < 0.05$). The correlation between gender and pain score (VAS) for the two methods was analyzed using the Mann-Whitney U test.

Results:

The results showed no statistically significant difference between injection pain after topical anesthetic gel application and injection pain after bubble breath exercise (p value=0.30). Also, no statistically significant difference was found between injection pain after gel application and injection pain after bubble breath exercise in boys (p value=0.59) or girls (p value=0.32). There were statistically significant differences between boys and girls in terms of injection pain after gel application (p value=0.001) and also injection pain after bubble breath exercise (p value=0.004).

Conclusion:

There is no significant difference between perceived injection pain after bubble breath exercise and after applying the topical anesthetic gel. Furthermore, future studies should explore the role of age, dental fear, and anxiety, previous painful experiences, the pain thresholds.

Keywords: Pain, Injection, Infiltration, Relaxation exercise, Gender, Pain.

Article History

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1. INTRODUCTION

Dental practitioners are professionally required to possess the necessary skills, instruments, and medicines to provide effective anesthesia during dental procedures. For many patients,

anesthetic injections are a major source of the fear during dental procedures. Meanwhile, many dental practitioners still find it challenging to provide satisfactory pain control with minimal discomfort for their pain-sensitive patients [1]. Surveys have shown that patients' choice of the preferred dental practitioner is strongly influenced by the practitioner's ability to maintain their oral health and perform painless injections [2]. Deep knowledge of pain control techniques enables a dentist to take better pain management precautions,

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exhibit more effective pain control behaviors, and utilize verbal and behavioral relaxation methods to relieve pain, all of which will help improve the treatment procedures [3]. Therefore, identifying the pain control techniques applicable in each case and attempting to reduce the injection pain as much as possible is a clinically critical requirement for dental practitioners [4]. Pain is the most common clinical experience of patients visiting dental offices, especially children [5]. Research has shown that more than 50% of American adults report the fear of pain as the main reason they avoid visiting dental offices [6]. Some studies have reported that using herbal and synthetic topical anesthetic gels [7], warming the injection agent [8, 9], and cooling the injection site will reduce the pain caused by local anesthetic injection [10]. Another approach to reducing pain and anxiety in patients is to use cognitive-behavioral techniques [11]. These techniques include desensitization, modeling, cognitive restructuring, relaxation, emotional therapy, and hypnosis [12]. Bubble blowing exercise is a play therapy technique designed as a method of relaxation through deep and controlled breathing. A study by Sridhar *et al.* demonstrated that bubble-blowing exercise significantly reduced perceived pain during maxillary buccal infiltration. Bubble-blowing exercise inhibits the initial respiratory response to painful stimuli, thereby preventing elevated pain sensation and resulting in relaxation [13]. Relaxation exercises increase vagal activity, improve the production of pain-control neurotransmitters such as serotonin, and decrease stress hormone levels [11]. This physiological response to stressful situations is known as the relaxation response [14]. This exercise is easy and inexpensive with no side effects. When the child is breathing deeply, as is the case in the bubble-blowing exercise, breathing itself can divert the child's attention away from the source of pain. This distraction may lead to a decrease in pain response [11]. In an experimental study, Busch *et al.* showed that the relaxation due to deep and slow breathing leads to modulation of sympathetic arousal and pain perception [15].

While pain control is not an easy task for many adult patients, it is even more challenging in clinical pediatric dentistry. Common pain control techniques are focused on one aspect of pain control, namely the drug effect, and neglect the psychological component of this discussion. This is especially true for children, a population in which the fear of needles is a barrier to quality dental care [16].

The most widely advocated methods used to minimize the pain caused by needle insertion is the use of Benzocaine gel. However, it has a prolonged effect, bad taste, side effects, and toxicity due to its ingredient [17].

Bubble breath exercise, distraction, and play therapy technique can be used as a relaxation procedure to decrease pain during short procedures like vaccination and cryotherapy of dermal warts. It is found on the gate-control mechanism of pain. The mechanism suggests that ascending signals of pain can be affected by descending signals due to emotions, thoughts, and attention [13, 18, 19].

Hence, this study aimed to evaluate the efficacy of bubble breath exercise on dental pain intensity during anesthetic injection in the infiltration of the anterior maxilla.

2. MATERIALS AND METHODS

A triple-blind crossover clinical trial was performed on 50 patients, 10 to 12 years, of age who received treatment in the dental clinic of Kermanshah University of Medical Sciences and required 2-session local anesthesia on both sides of the maxillary anterior tooth for dental treatments. Sampling was performed using the convenience method from among volunteers. For all participants, consent was obtained before any procedure. This study was approved by the Ethics Committee of Kermanshah University of Medical Sciences, with the registry ID of IR.KUMS.REC.1398.760. The inclusion criteria were: those without systemic disease, no allergy to the anesthetic agent and no prior intake of medications that affected the pain intensity. All subjects received conventional local infiltration anesthesia with topical anesthetic agent in one session and the bubble breath exercise method in the second session by random fashion. All injections was performed using 1/4 of a cartridge, 1.8 mL of 2% Lidocaine containing 1:200,000 epinephrine during 60 seconds using a short 30-gauge needle.

In the first session, before anterior maxillary anesthesia infiltration, the mucosa of the injection site was dried with sterile cotton, and then benzocaine 20% topical gel was applied to this site for two minutes using a sterile cotton applicator impregnated with this gel.

The injection was performed adjunct to the maxillary canine root into the depth of 2-3 mm. The syringe was positioned along the longitudinal axis of the tooth with the bevel facing the bone at the height of the mucobuccal fold above the canine. After the injection, patients were asked to rate perceived pain in each session on a Visual Analogue Scale (VAS) with scores ranging from 1 to 10. All infiltrations were performed by a senior student of the dentist. The gel was applied to the mucosa with light pressure. During injection, the needle was kept out of the child's direct vision. The needle was pushed into the tissue very gently, and injection was done at a slow rate to minimize pain. To standardize the amount of gel applied, the cotton applicator was rolled three times in the gel container.

At the end of the first session, patients were taught the bubble-blowing exercise. This training was done by a psychologist-trained researcher. In this training, patients were first taught how to draw in a deep breath causing the abdomen to move out, and then slowly exhale it. They were then given a bubble-blowing toy and asked to inhale as they were taught and then exhale slowly to blow a large bubble. Patients were encouraged to blow larger bubbles to make them exhale slowly. They were asked to repeat this game 10 times and practice it 4 times a day until the next appointment (2-3 days later). Parents were asked to encourage their children to do the exercise at home and ensure that it is done correctly.

In the second session, before performing anterior maxillary anesthesia injection at the opposite side, patients were asked to do the breathing exercise 4 or 5 times by inhaling deeply and then exhaling slowly as if they were blowing a bubble. The injection was performed while patients were occupied with the exercise. The collected VAS were recorded in a previously

prepared information form. Finally, the data were analyzed in the software SPSS 18 with the assistance of a statistician consultant. Wilcoxon signed-rank test was used to assess the efficacy of bubble-breath exercise for pain reduction compared to topical anesthetic gel. The level of significance was considered at 5% ($p < 0.05$). The correlation between gender and pain score for the 2 methods was analyzed using the Mann-Whitney U test.

3. RESULTS

The study was performed on 50 patients, of which 23 (46%) were boys, and 27 (54%) were girls. The mean age of participants was 11.10 ± 0.84 years. The mean and standard deviations of the VAS upon local anesthesia in maxillary infiltration with topical gel and bubble breath exercises are summarized in Table 1. The Kolmogorov-Smirnov test showed that the variables were not normally distributed. The results of the Wilcoxon test showed no statistically significant difference between injection pain after gel application and injection pain after bubble breath exercise (p value=0.30) (Table 1).

The results of the Mann-Whitney test showed a significant relationship between pain intensity after bubble breath exercise and gender. Girls had higher post-bubble breath exercise pain scores than boys. Pain intensity after gel application was also significantly higher in girls than in boys (Table 2).

4. DISCUSSION

Anesthesia injection is one of the most common pain-control procedures that dental practitioners carry out before dental treatments. Inadequate pain control can discourage patients from visiting dentists and cause anxiety during treatments [5]. It has been reported that injection elicits the most negative response among patients [20]. The type of anesthetic solution, needle size, injection speed, and use of topical anesthetics are some of the factors whose effects on perceived pain during injection have been studied [21]. Topical anesthesia helps dentists perform dental procedures without causing much pain or discomfort. Measurement of pain is a major challenge for clinicians since its internal experience is associated with large amounts of the variable. Patient's self-report is an effective and accepted method of measuring pain. In this study, pain intensity was measured using the Visual Analogue Scale (VAS), the most commonly used measure for pain assessment [22]. In a study by Fowler-Kery, the results showed that boys older than 8 years were unwilling to express their pain [23]. A study by Belinda also showed that compared to boys, girls are more perceptive of the multidimensional nature of pain [24]. The results of this study showed no significant difference between injection pain after applying topical anesthesia gel and injection pain after bubble breath exercise.

In contrast with our findings, in a study conducted by Gamze, the results showed that children who used the bubble-blowing toy during IM injection experienced less pain than the control group [25]. Inconsistent with our findings, Sridhar *et al.* [11] also reported that exercising deep and controlled breathing with the help of a bubble-blower toy significantly reduced perceived pain during maxillary buccal infiltration. In an

experimental study, Busch *et al.* showed that relaxation due to deep and slow breathing results in modulation of sympathetic arousal and pain reduction [15]. This result may have been because the above-mentioned study did not have a crossover design, which can cause bias. Another reason may be the penetration depth needle, and the amount of topical anesthesia gel and anesthetic agent injected in our study which was lower than the standard level. Shallow breathing typically coincides with stress, anxiety, and other psychological issues, often because of uncontrolled sympathetic arousal or the fight or flight response. Practicing abdominal breathing can help us control this response, causing us to become modulated by the parasympathetic nervous system [26]. Psychological understanding of pain is influenced by culture, the development of emotion, personal history, and personality [27], which is not considered in this study. It may be one of the reasons for the difference in results. The results of this study showed that bubble breath exercise was comparable to topical anesthetic gel.

Table 1. Pain intensity using a visual analog scale for maxillary infiltration anesthesia according to the use of bubble breath exercise or gel application.

-	Mean	Standard Deviation	Minimum	Maximum	Comparison between the groups (p-value: Wilcoxon Test)
Pain score with bubble breath exercise	3.24	0.94	1	6	0.30
Pain score with Topical Anesthetic Gel	3.42	0.86	2	5	

Table 2. Comparison Pain intensity after gel application and bubble breath exercise between girls and boys.

Variable	-	Mean Rank	Mann-Whitney Test	P-value
Pain intensity with bubble breath exercise	Girls	30.57	-2.87	0.004
	Boys	19.54		
Pain intensity with Topical Anesthetic Gel	Girls	31.80	-3.516	0.000
	Boys	18.11		

CONCLUSION

This study found no significant difference between perceived injection pain after relaxation exercise and after applying the topical anesthetic gel. The effectiveness of the relaxation exercise in decreasing dental pain during maxillary buccal infiltration was not proved. Furthermore, future studies should explore the role of age, dental fear, anxiety, previous painful experiences, and the pain-thresholds of individual patients.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The Ethics Committee of Kermanshah University of Medical Sciences, Iran, approved this study (No; IR.KUMS.REC.1398.760).

HUMAN AND ANIMAL RIGHTS

No Animals were used in this research. All human research procedures were followed in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Written informed consent was obtained prior to the study.

STANDARDS OF REPORTING

CONSORT guidelines and methodology were followed.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of the article is available from corresponding author [N.O] upon reasonable request.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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REFERENCES

- [1] Saxena P, Gupta SK, Newaskar V, Chandra A. Advances in dental local anesthesia techniques and devices: An update. *Natl J Maxillofac Surg* 2013; 4(1): 19-24. [http://dx.doi.org/10.4103/0975-5950.117873] [PMID: 24163548]
- [2] Becker DE, Reed KL. Local anesthetics: review of pharmacological considerations. *Anesth Prog* 2012; 59(2): 90-101. [http://dx.doi.org/10.2344/0003-3006-59.2.90] [PMID: 22822998]
- [3] Okawa K, Ichinohe T, Kaneko Y. Anxiety may enhance pain during dental treatment. *Bull Tokyo Dent Coll* 2005; 46(3): 51-8. [http://dx.doi.org/10.2209/tdpublication.46.51] [PMID: 16598181]
- [4] Kreider KA, Stratmann RG, Milano M, Agostini FG, Munsell M. Reducing children's injection pain: Lidocaine patches versus topical benzocaine gel. *Pediatr Dent* 2001; 23(1): 19-23. [PMID: 11242725]
- [5] Aminabadi NA, Farahani RM, Oskouei SG. Site-specificity of pain sensitivity to intraoral anesthetic injections in children. *J Oral Sci* 2009; 51(2): 239-43. [http://dx.doi.org/10.2334/josnusd.51.239] [PMID: 19550092]
- [6] Hargreaves KM, Berman LH. Cohen's pathways of the pulp expert consult: Elsevier Health Sciences. 2015.
- [7] O'Brien L, Taddio A, Lyszkiewicz DA, Koren G. A critical review of the topical local anesthetic amethocaine (Ametop) for pediatric pain. *Paediatr Drugs* 2005; 7(1): 41-54. [http://dx.doi.org/10.2165/00148581-200507010-00004] [PMID: 15777110]
- [8] Touyz LZ, Lamontagne P, Smith BE. Pain and anxiety reduction using a manual stimulation distraction device when administering local analgesia oro-dental injections: A multi-center clinical investigation. *J Clin Dent* 2004; 15(3): 88-92. [PMID: 15688965]
- [9] Younis I, Bhutiani RP. Taking the 'ouch' out - effect of buffering commercial xylocaine on infiltration and procedure pain - a prospective, randomised, double-blind, controlled trial. *Ann R Coll Surg Engl* 2004; 86(3): 213-7. [http://dx.doi.org/10.1308/003588404323043382] [PMID: 15140310]
- [10] Amani R, Kariman N, Mojab F, Alavi H, Majidi S. Comparison of the effects of cold compress with gel packs and topical olive oil on episiotomy wound healing. *Majallah-i Danishgah-i Ulum-i Pizishki-i Babul* 2015; 17(11): 7-12.
- [11] Sridhar S, Suprabha BS, Shenoy R, Shwetha KT, Rao A. Effect of a relaxation training exercise on behaviour, anxiety, and pain during buccal infiltration anaesthesia in children: Randomized clinical trial. *Int J Paediatr Dent* 2019; 29(5): 596-602. [http://dx.doi.org/10.1111/ipd.12497] [PMID: 30887592]
- [12] Milgrom P. Behavioral methods and research issues in the management of the adult dental patient. *Anesth Prog* 1986; 33(1): 5-9. [PMID: 3458391]
- [13] Jacobs A, Price HN, Popenhagen MP. Blowing away the pain: A technique for pediatric pain management. *Pediatr Dermatol* 2014; 31(6): 757-8. [http://dx.doi.org/10.1111/pde.12418] [PMID: 25424218]
- [14] Jacobs GD. The physiology of mind-body interactions: The stress response and the relaxation response. *J Altern Complement Med* 2001; 7(1)(Suppl. 1): S83-92. [http://dx.doi.org/10.1089/107555301753393841] [PMID: 11822639]
- [15] Busch V, Magerl W, Kern U, Haas J, Hajak G, Eichhammer P. The effect of deep and slow breathing on pain perception, autonomic activity, and mood processing--an experimental study. *Pain Med* 2012; 13(2): 215-28. [http://dx.doi.org/10.1111/j.1526-4637.2011.01243.x] [PMID: 21939499]
- [16] Lathwal G, Pandit IK, Gugnani N, Gupta M. Efficacy of different precooling agents and topical anesthetics on the pain perception during intraoral injection: A comparative clinical study. *Int J Clin Pediatr Dent* 2015; 8(2): 119-22. [http://dx.doi.org/10.5005/jp-journals-10005-1296] [PMID: 26379379]
- [17] Meechan JG. Effective topical anesthetic agents and techniques. *Dent Clin North Am* 2002; 46(4): 759-66. [http://dx.doi.org/10.1016/S0011-8532(02)00035-6] [PMID: 12436830]
- [18] Peretz B, Gluck GM. Assessing an active distracting technique for local anesthetic injection in pediatric dental patients: Repeated deep breathing and blowing out air. *J Clin Pediatr Dent* 1999; 24(1): 5-8. [PMID: 10709535]
- [19] French GM, Painter EC, Coury DL. Blowing away shot pain: A technique for pain management during immunization. *Pediatrics* 1994; 93(3): 384-8. [PMID: 8115196]
- [20] Nakanishi O, Haas D, Ishikawa T, Kameyama S, Nishi M. Efficacy of mandibular topical anesthesia varies with the site of administration. *Anesth Prog* 1996; 43(1): 14-9. [PMID: 10323120]
- [21] McDonald R, Avery D. Local anesthesia for the child and adolescent Dentistry for the Child and Adolescent. 6th ed. St Louis, Mo: CV Mosby Co. 2000; pp. 294-306.
- [22] Fillingim RB, Maixner W, Eds. Gender differences in the responses to noxious stimuli Pain forum. Elsevier 1995.
- [23] Fowler-Kerry S, Lander J. Assessment of sex differences in children's and adolescents' self-reported pain from venipuncture. *J Pediatr Psychol* 1991; 16(6): 783-93. [http://dx.doi.org/10.1093/jpepsy/16.6.783] [PMID: 1798014]

- [24] Goodenough B, Thomas W, Champion GD, *et al.* Unravelling age effects and sex differences in needle pain: ratings of sensory intensity and unpleasantness of venipuncture pain by children and their parents. *Pain* 1999; 80(1-2): 179-90. [http://dx.doi.org/10.1016/S0304-3959(98)00201-2] [PMID: 10204730]
- [25] Yilmaz G, Alemdar DK. Using buzzy, shotblocker, and bubble blowing in a pediatric emergency department to reduce the pain and fear caused by intramuscular injection: A randomized controlled trial. *J Emerg Nurs* 2019; 45(5): 502-11. [http://dx.doi.org/10.1016/j.jen.2019.04.003] [PMID: 31257044]
- [26] Shilagh A. Diaphragmatic breathing to assist with self-Management of pain. *Clinical Tool* 2016; 2(1)
- [27] McGrath PA. Psychological aspects of pain perception. *Arch Oral Biol* 1994; 39(Suppl.): 55S-62S. [http://dx.doi.org/10.1016/0003-9969(94)90189-9] [PMID: 7702468]

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