

Assessing Anxiety and Pain During Treatment of Primary Molar Carious Lesions Using Minimal Invasive Techniques: Randomized Controlled Trial

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Abstract

Background: The routine method of removing caries is nonselective, causing a detrimental biological consequence and triggering anxiety, fear, and pain for children. As a result, this study aims to compare three minimally invasive treatments by the evaluation of an anxiety level pain assessment. **Materials and Methods:** A controlled clinical trial was conducted on a total of 45 children aged 7-8 years who had primary molar and active caries lesions. The children were divided into three groups: the 38% e-SDF (Group S), the Brix3000 (Group B), and the CeraBur (Group C). The children were presented with a facial image scale to evaluate their level of anxiousness. Chi-square, Kruskal-Wallis, and post-hoc pairwise tests were used to analyze the data, and the statistical significance (p-value) was determined to be significant at $p \leq 0.05$. **Result:** This study revealed a variation in the child's anxiety level during caries removal. There is a significant difference in anxiety scores between the three treatment methods ($P = 0.009$). Post-hoc pairwise comparisons revealed a significant difference between the S and C groups ($P = 0.002$). **Conclusion:** Silver diamine fluoride was a simple, efficient, and least invasive method for treating dental caries and eliminating the need for local anesthesia.

Key-words: Anxiety, Brix3000, Ceramic bur, Chemico-mechanical caries removal, Facial image scale, Minimal Invasive Dentistry, Silver diamine fluoride.

Introduction:

Dental caries is a highly prevalent illness that affects individuals on a global scale. The development of dental caries is a result of a multifactorial interplay between acid-producing bacteria, fermentable carbohydrates, and other host components such as teeth and saliva, which occur over a prolonged period of time. [1]

The conventional method of removing caries is excavation using traditional burs. Being nonselective, they remove both infected and sound dental tissues, causing detrimental biological consequences for dental pulp tissues. It triggers anxiety, fear, and pain and often requires a local anesthetic injection, which compromises the acceptance of dental treatment by children. To overcome these issues, advanced conservative caries removal methods have evolved [2].

In order to address this problem, minimal intervention dentistry was implemented, requiring the removal of the infected dentin and the preservation of the affected dentine, which was also essential for the future restoration [3].

In 2008, ceramic Burs were introduced. These burs were capable of distinguishing between infected and affected dentin and had the advantage of cutting fewer dentinal tubules, resulting in reduced pain sensations [4]

The papain-based chemico-mechanical caries removal agent that was recently introduced, This gel is composed of papain, and its primary objective is to minimize thermal changes, remove only the infected dentin, reduce vibration and pain, and reduce the necessity for local anesthesia[5]

In recent times, silver diamine fluoride (SDF) has attracted interest for its ability to interfere with the progression of dental caries. Additionally, it is regarded as a non-invasive, comfortable treatment option. SDF has the dual benefits of remineralization and antimicrobial activity provided by the silver and fluoride contents, which eliminate the necessity for instrument-based caries excavation. [6]

This study was conducted to compare three minimally invasive treatments through the evaluation of Anxiety level and pain perception

Materials and Methods

A controlled clinical trial was conducted at Mustansiriyah University, College of Dentistry, Department of Pedodontics, Orthodontics, and Preventive Dentistry. Ethical approval number is (MUPRU004). Before the participation of each child in this study, parents/guardians were given detailed information regarding the study's design, goals, and possible advantages. They were also given the option to quit the study at any stage by providing signed written consent. This was planned to eliminate any obstacles and to guarantee their full cooperation and focus.

Sample of the study

Children involved in this study were 45 children (23 boys, and 22 girls) aged (7-8) years who had active caries lesions on their primary molars. The participants were chosen based on particular criteria to take part in this study. These children were divided into 3 groups: e-SDF (silver diamine fluoride), Brix3000 (a papain-based Chemico-mechanical caries removal agent), and ceraBur (Ceramic Bur Group).

Selection criteria

The present investigation comprised youngsters who satisfied a specific

condition, specified by [7, 8], [9] With some alterations.

1. The children included in the study are healthy and do not have any oral or systemic illnesses.
2. Each child participating in the study should have primary molars with carious lesions. These lesions should be present either on the occlusal surface or proximal surface and should not involve the pulp. To ensure consistency and standardization, the cavities should have a depth ranging from 40 to 99 that indicates dentin lesions only, measured using LASER fluorescence technology of the DIAGNOdent 2190 (KaVo, Biberach, Germany).
3. The cavities were easily accessible using appropriately sized hand tools, suitable for a small excavator.
4. There is no clinical evidence of pulp or periapical infections in the vital primary molars, and the patients are asymptomatic.
5. The selected teeth have a normal morphology.
6. The children's behavior was assessed using Wright's clinical classification [10] to

determine their level of cooperativeness, as type 1 (adequate cooperative) was selected, excluding both type 2 (lacking cooperative ability) and type 3 (potential cooperative).

Study groups

Study Groups: Separated into two sub-groups (S & B).

I: Group S: The lesions in the S group will be treated using 38% Silver Diamine Fluoride (e-SDF, Kids-e-dental LLP, India)

II: Group B: Caries eradication in this group was performed using a chemico-mechanical agent papain-based gel (BRIX3000® Ormaled Global LTD, Argentina)

Control group (Group C): In this group, caries removal was performed using the usual technique of drilling with a ceramic bur (CeraBur K1SM – Komet, Germany).

Each participant was randomly allocated one of three treatment procedures for a specific tooth.

Methods for examination and assessment

The child received an oral examination while positioned in the dentist's chair, with the assistance of the operation light. Dental caries was detected using a combination of visual and tactile methods, employing a dental mirror and probe.

Clinical procedure

The clinical procedure was performed following the manufacturer's instructions for each material used. [4, 11-13]

1. Cotton rolls and a saliva ejector were used to isolate the tooth.

2. Brushing the occlusal surface to eliminate debris and plaque.

3. Just before commencing caries treatment therapy, the depth of the carious lesion was assessed using DIAGNOdent, and the results were recorded in the patient's medical record.

4. The lesions of group B were performed according to the following criteria:

The manufacturer's instructions involved applying the Brix 3000 (a gel featuring Papain-based CMCR) to the cavity using a tiny brush and allowing it to function for around 2-3 minutes.

Next, the dissolved infected dentin was excavated with a spoon excavator without force.

If the cavity still contains infected dentin, a further layer may be necessary.

Once the vitreous portion of the cavity is reached, it indicates that all decaying tissue has been entirely removed.

5. Lesions of the (S) group were treated as following steps:

Petroleum jelly was applied to protect the skin and gums of the face from getting stained. (38% SDF Kids-E) will be applied directly twice on the accused tooth surface using a micro brush, and any excess material will be removed using cotton pellets.

According to the producers' instructions, it is recommended to allow 2 minutes for each application. Subsequently, the affected dentin would change in colour.

6. Group (C) lesion, involved the method of caries elimination with a low-speed handpiece and the use of ceramic burs (CeraBur, K1SM, Komet Brasseler; Lemgo, Germany) designed exclusively for the treatment of occlusal caries. The carious tissue was excavated from the center of the cavity to its border using circular motions, without the need for a water cooler.

7. The prepared surface was cleaned using wet cotton wool pellets.

8. The glass ionomer material was made following the directions provided by the manufacturer for cavity restoration.

Anxiety and Pain Assessment

During and after their therapy, the children were presented with a facial image scale to assess their level of anxiety and pain as shown in Figure (1). Each child was instructed to indicate the facial expression that most accurately conveyed their current emotional state, categorized as either very happy, happy, neutral, unhappy, or very unhappy^[14, 15]

The Results

The child anxiety during caries removal.

Shows a significant difference in anxiety scores among the three treatment methods ($P = 0.009$), as shown in Table (1) and Figure (2). Post-hoc pairwise comparisons indicated a significant difference between e-SDF and CeraBur groups ($P = 0.002$). As in Table (2)

Discussion

It has been found that the impact of anxiety persists from childhood to adulthood, potentially resulting in dental avoidance and subsequently, compromised oral health.^[14]

The group treated with SDF experienced significantly more comfort and the least pain

reaction compared to the Brix3000 and CeraBur groups, as SDF does not require any pressure on the dentin during the procedure, this result was also confirmed by Mahajan et al.,^[12]

In a study comparing the use of CMCR gel and CeraBur Group for caries removal, it was found that patients treated with CMCR gel reported higher satisfaction levels. This gel contains a percentage of essential oils derived from plants, which act as anti-inflammatory, analgesic, and mild anesthetic properties. These properties help reduce pain perception during the operative procedure^[16]. However, the difference in satisfaction levels between the CMCR group and the CeraBur group was not statistically significant. This result is consistent with the findings reported by Elfeel et al. and Mahajan et al.^[4, 12] On the other hand Ismail & Al Haidar^[17] conducted a study comparing Brix 3000 with conventional drilling procedures using CeraBur. Their findings showed that Brix 3000 provided

References

1. Hassan, R.H. and M.J. Abaas, *Prevalence of dental caries in children attended pedodontic dental clinic Al Mustansiria Collage of Dentistry*. Mustansiria Dental Journal, 2011. **8**(3): p. 276-280.

significantly better pain control compared to the conventional drilling.

Conclusion

According to the results, silver diamine fluoride has the least pain perception in comparison to Brix3000 and CeraBur. It has been identified as a convenient, efficient, minimally invasive method that eliminates the requirement for local anesthesia, making it particularly beneficial for children who experience dental anxiety, require multiple restorations, are young, or exhibit challenging behavior.

Conflict of interest

The authors reported that they have no conflicts of interest.

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2. Sontakke, P., et al., *A comparative study of the clinical efficiency of chemomechanical caries removal using Carie-Care gel for permanent teeth of children of age group of 12-15 years with that of conventional drilling method: A randomized controlled trial*.

- Dent Res J (Isfahan), 2019. **16**(1): p. 42-46.
3. Bsereni, L. and F.V. Torresi, *Estudio de la eficacia del gel de PapainaBrix3000*. Acceso, 2017. **1**(07).
 4. Elfeel, N.M., et al., *Evaluation of the Efficacy of Minimal Invasive Methods Versus Conventional Methods for Caries Removal in Primary Molars*. Cureus, 2023. **15**(12): p. e50803.
 5. Maashi, M.S., et al., *Chemomechanical caries removal methods: A literature review*. Saudi Dent J, 2023. **35**(3): p. 233-243.
 6. Clemens, J., J. Gold, and J. Chaffin, *Effect and acceptance of silver diamine fluoride treatment on dental caries in primary teeth*. Journal of public health dentistry, 2018. **78**(1): p. 63-68.
 7. Mahdi, M. and A. Haidar, *Evaluation of the Efficacy of Caries Removal Using Papain Gel (Brix 3000) and Smart Preparation Bur(in vivo Comparative Study)*. Journal of Pharmaceutical Sciences and Research, 2019. **11**: p. 444-449.
 8. Jiang, M., et al., *A 24-month randomized controlled trial on the success rates of restoring untreated and SDF-treated dentine caries lesions in primary teeth with the ART approach*. J Dent, 2020. **100**: p. 103435.
 9. Shivasharan, P., et al., *Clinical Evaluation of Caries Removal in Primary Teeth Using Carie-care and SmartPrep Burs: An <i>In vivo</i> Study*. Indian Journal of Oral Health and Research, 2016. **2**(1): p. 27-31.
 10. Dean, J.A., et al., *McDonald and Avery's Dentistry for the Child and Adolescent*. 2021: Elsevier.
 11. Ardehana, A., et al., *Evaluation of caries excavation efficacy with ceramic bur and hand excavation in primary teeth: an experimental study*. Pediatr Dent, 2020. **3**(2): p. 60-64.
 12. Mahajan, P., et al., *Comparative Evaluation of Less Invasive Approach of caries excavation and Only Arrest And No Excavation Approach in dental caries management in primary molars-A Randomised Controlled Trial*. Journal of Advanced Medical and Dental Sciences Research, 2021. **9**(8): p. 84-92.
 13. Satyarup, D., et al., *Comparison of the effectiveness of 38% silver diamine fluoride and atraumatic restorative treatment for treating dental caries in a school setting: A randomized clinical trial*. Dent Med Probl, 2022. **59**(2): p. 217-223.
 14. Buchanan, H. and N. Niven, *Validation of a Facial Image Scale to assess child dental anxiety*. Int J Paediatr Dent, 2002. **12**(1): p. 47-52.
 15. Vollú, A.L., et al., *Efficacy of 30% silver diamine fluoride compared to atraumatic restorative treatment on dentine caries arrestment in primary molars of preschool children: A 12-months parallel randomized controlled clinical trial*. J Dent, 2019. **88**: p. 103165.
 16. Venkataraghavan, K., et al., *Chemomechanical Caries Removal: A Review & Study of an Indigenously Developed Agent (Carie Care (TM) Gel) In Children*. J Int Oral Health, 2013. **5**(4): p. 84-90.

17. Ismail, M.M.M. and A.H.M. Al Haidar, *Evaluation of the efficacy of caries removal using papain gel (Brix 3000) and smart preparation bur (in vivo comparative study)*. Journal of Pharmaceutical Sciences and Research, 2019. **11**(2): p. 444-449.

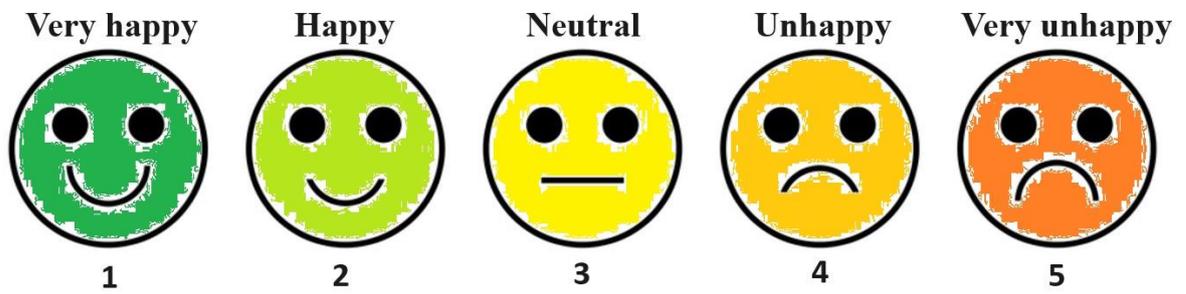


Figure (1) Anxiety and pain assessment using Facial image scale

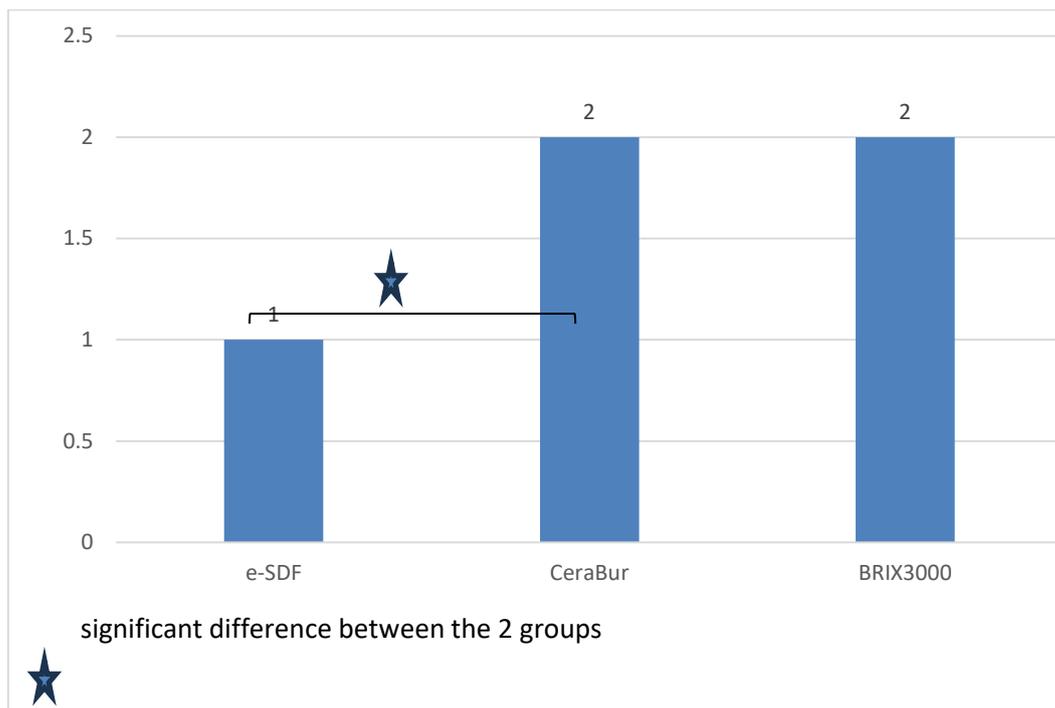


Figure (2) Anxiety and pain assessment among the three groups

Table (1) Kruskal-Wallis test

By Kruskal-Wallis Test	Groups	N	Median (IQR)	*P-value
Anxiety and pain assessment	e-SDF	15	1 (1)	0.009
	CeraBur	15	2 (1)	
	Brix3000	15	2 (2)	

Table (2) Post-hoc pairwise comparison

Pairwise comparisons	
Groups	P-value
e-SDF - CeraBur	0.002
CeraBur – Brix3000	0.08
e-SDF – Brix3000	0.1