Arabian Journal of Pediatric Dentistry
Vol 2 (2) :29-36

المجلة العربية لطب أسنان الاطفال
المجلد 2 العدد2 : الصفحات 29-36

Evaluation of the time taken to remove caries from immature permanent molars using Brix 3000 gel compared to the traditional rotary method (clinical study)

Malek Rajab [1] Samar Alsalameh[2] Shadi Azzawi[3]
[1] DDS, Department of Pediatric Dentistry, Faculty of dentistry, Damascus University, Syria (malek.rajab@damascusuniversity.edu.sy).
[2]DDS, MSc, PhD, Prof, Department of Basic Sciences, Faculty of dentistry, Damascus University, Syria (samar.alsalameh@damascusuniversity.edu.sy).
[3] DDS, MSc, PhD, Prof, Department of Pediatric Dentistry, Faculty of dentistry, Damascus University, Syria (shadi11azzawi@damascusuniversity.edu.sy).

Abstract:

Background: The traditional method of removing caries using rotary instruments is associated with a number of disadvantages, such as thermal effects that are harmful to the pulp tissue and excessive preparation of the dental tissue, in addition to the feeling of discomfort, fear, and anxiety that accompany it.

Aim: This study aims to evaluate the time taken to remove caries by the chemo-mechanical method using Brix 3000 compared to the traditional rotary method.

Materials and methods: The study sample consisted of 30 permanent first molars with Class I dentine caries, in 30 children between 7 and 9 years of age. The sample was divided into two equal groups according to the treatment method used (Brix 3000, traditional rotary method). Investigate the time it takes to remove the caries using a mobile phone timer, and the independent sample t test was used to analyze the results at a confidence level of 95 % and a significance level of $p \leq 0.05$

Results: The average time taken to remove caries in the caries removal group using Brix 3000 was (9.24 minutes). Conversely, the average time taken to remove caries in the caries removal group using the traditional rotary method was (2.27 minutes), and there were differences. Statistically significant when comparing the two groups ($p<0.05$).

Conclusion: The chemo-mechanical method of removing caries using Brix 3000 required a longer time compared to the traditional rotary method, and the traditional rotary method was the fastest method in removing caries.

Keywords: Chemo-Mechanical Caries Removal, Brix 3000, Papain Enzyme.

Received: 10/06/2024
Accepted:22/07/2024

تقييم الزمن المستغرق لإزالة النخر من الأرحاء الدائمة الفتية باستخدام هلام الـ Brix 3000 مقارنة مع الطريقة التقليدية الدوارة (دراسة سريرية)

محمد مالك علي رجب[1] سمر علي السلامة[2] شادي خالد عزاوي[3]

[1]طالب ماجستير في قسم طب أسنان الأطفال– كلية طب الأسنان – جامعة دمشق.

[2] أستاذة في قسم العلوم الأساسية– كلية طب الأسنان – جامعة دمشق .

[3] أستاذ في قسم طب أسنان الأطفال– كلية طب الأسنان – جامعة دمشق.

الملخص:

خلفية البحث: ترتبط الطريقة التقليدية لإزالة النخر باستخدام الأدوات الدوارة بعدد من العيوب، مثل التأثيرات الحرارية المؤذية للنسيج اللبي والتحضير الزائد للنسج السنية، بالإضافة إلى الشعور بالإنزعاج والخوف والقلق المرافق لها.

هدف البحث: تهدف هذه الدراسة إلى تقييم الزمن المستغرق لإزالة النخر بالطريقة الكيميائية الميكانيكية باستخدام مادة Brix 3000 مقارنة مع الطريقة التقليدية الدوارة.

المواد والطرائق: تألفت عينة الدراسة من 30 رحى أولى دائمة مصابة بآفة نخرية عاجية من الصنف الأول، وذلك لدى 30 طفلاً تراوحت أعمارهم بين 7 و9 سنوات، وقسمت العينة إلى مجموعتين متساويتين وفقاً لطريقة المعالجة المتبعة (مادة Brix 3000، الطريقة التقليدية الدوارة)، واستقصي عن الزمن المستغرق لإزالة النخر باستخدام المؤقت الزمني للهاتف المحمول، كما استخدم اختبار Independent sample T test لتحليل النتائج عند مستوى الثقة 95 % ومستوى الدلالة $p \leq 0.05$.

النتائج: كان متوسط الزمن المستغرق لإزالة النخر في مجموعة إزالة النخر باستخدام مادة Brix 3000 (9.24 دقيقة)، وبالمقابل فقد كان متوسط الزمن المستغرق لإزالة النخر في مجموعة إزالة النخر بالطريقة التقليدية باستخدام السنابل الدوارة (2.27 دقيقة)، وكانت هناك فروقات ذات دلالة إحصائية عند المقارنة بين المجموعتين ($p<0.05$).

الاستنتاج: تطلبت الطريقة الكيميائية الميكانيكية لإزالة النخر باستخدام مادة Brix 3000 زمناً أطول مقارنة مع الطريقة التق

ليدية الدوارة، وكانت الطريقة التقليدية الدوارة هي الطريقة الأسرع في إزالة النخر.

الكلمات المفتاحية: الطريقة الكيميائية الميكانيكية لإزالة النخر، Brix 3000، أنزيم البابايين.

تاريخ الايداع: 2024/06/10

تاريخ القبول: 2024/07/22

Introduction:

The traditional method of removing caries using rotary instruments is one of the most common methods of caries removal and its effectiveness has been proven over the years. However, it has many disadvantages, such as harmful thermal effects on the pulp tissue and excessive preparation of dental tissues, in addition to discomfort, anxiety and fear due to the sound and vibration that accompany it [1, 2].

In an attempt to overcome these defects, several alternative methods have been developed, such as the use of lasers, air abrasion, smart burs, and the chemical-mechanical method to remove caries [3].

Interest in chemical-mechanical caries removal methods has increased in recent years, and the trend is towards non-traumatic treatments to reduce pain and anxiety, especially in children [4].

The chemo-mechanical method of caries removal chemically softens the affected dentin and makes it soft so that it can be easily removed with hand instruments[5]. Chemo-mechanical caries removal agents are divided according to their composition into agents based on sodium hypochlorite (NaOCL) and agents based on enzymes [6]. Although Carisolv Gel is one of the most widely used chemical and mechanical caries removal agents and has been proven effective in numerous studies [7, 8], However, its short shelf life, the need for special storage conditions, and its unpleasant taste and smell were limitations on its use [9, 10].

Recently, in 2016, Brix Srl Argentina launched the Brix 3000 product, which was an enzymatic product free of sodium hypochlorite and composed of the papain enzyme derived from green papaya fruits at a high concentration of 3000U/mg in order to ensure a higher efficiency of proteolysis of collagen fibers in necrotic tissues. It has low solubility in the oral cavity fluids, and according to dermatology organizations, if the product comes into contact with the tissues of the oral cavity, the skin, the eye, or the pulp tissues, it does not cause any type of reaction. It is biologically acceptable, antibacterial and antifungal properties, selective removal of carious tissue and preservation of healthy dental tissue [11, 12]. It has a long shelf life of up to 4 years and does not need to be stored even in inappropriate conditions as it does not need to be placed in the regenerator [13].

Due to the lack of studies on the clinical performance of Brix 3000 on permanent molars in children, the material was chosen in this study to compare it with the traditional method of removing caries using rotary drills.

1.1 Objectives:

This study aims to evaluate the time taken to remove caries by the chemo-mechanical method using Brix 3000 compared to the traditional rotary method.

2. Materials and methods:

2.1 Study design

A comparative clinical study to evaluate the time taken to remove caries for both the chemical-mechanical method using Brix 3000, and the traditional method using low-speed rotating bars, on lower permanent first molars affected by Class I dentinal caries, in children aged 7 to 9 years.

- There is no malformation or hypomineralization of the teeth.

2.4 Exclusion criteria

- Children with physical or mental illnesses.
- Caries extending to the pulp.
- Molars with pulp symptoms.

2.5 Procedure

After ensuring that the inclusion conditions were met, the rubber dam was applied to the molars without anesthesia, Then, the caries was removed according to the following:

2.2 Study groups

The study sample was randomized using the website www.randomaizor.com into two groups:

Group A: 15 carious molars treated with Brix 3000.

Group B: 15 carious molars treated with the traditional rotary method.

2.3 Inclusion criteria

- The child must have a Class I cavitied dentin carious lesion on the lower permanent first molar that does not exceed two-thirds of the thickness of the dentin radiographically.
- The child must be cooperative.

Group A: Brix 3000 was applied to the caries for two minutes to initiate the chemical action of the gel according to the manufacturer's instructions, then the softened carious tissue was excavated using non-cutting edges excavators (carisolv excavators) and the gel application was repeated until the color of the gel became clear and caries removal verified with a caries detector (caries marker, voco) (figure 1).

Group B: The caries were removed with a low-speed handpiece using round tungsten carbide burs, and the process was repeated until the surface became hard when using the probe so that it did not give a

Tug Back feeling when passed over the dentin, then the caries detector (caries marker, voco) was applied were present, it was reapplied until it was confirmed that all caries had been removed (figure 2).
After ensuring that all caries have been removed, calculate the time taken to remove the caries in each
.

for 10 seconds and then washed for 5 seconds, to identify the areas of residual caries, and if caries group using the timer of the mobile phone (Xiaomi Note 10 Pro) as follows:
- Group A (Brix 3000 gel): from the beginning of applying the gel until the caries are removed.

Figure(1): caries excavation with brix 3000
(a) before excavation (b) gel application (c) after excavation (d) restoration with composite.

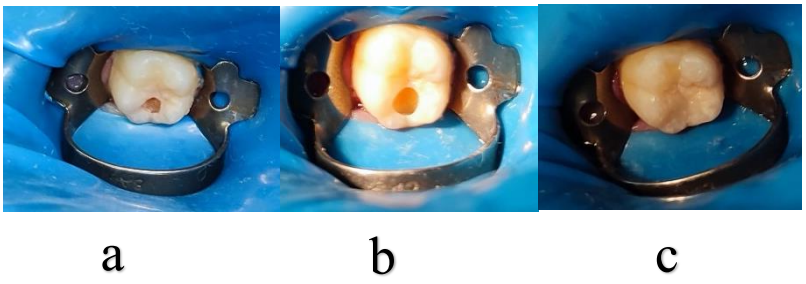

Figure (2): caries excavation with traditional rotary method
(a) before excavation (b) after excavation (c) restoration with composite.

2.6 Data analysis
Data analysis was performed using IBM SPSS Statistics for Windows, version 23.0. The difference in mean time taken to remove caries between the two study groups was analyzed using the Independent Sample T test. P-value of 0.05 was considered the level of significance.

3. Results:

The research sample included 30 permanent first molars with Class I dentin caries, in 30 children aged between 7 and 9 years. The permanent first molars in the research sample were distributed into two equal groups according to the treatment method used (Brix 3000, traditional rotary method), as shown in Table (1).
The results showed that the mean time taken to remove caries with Brix 3000 was (9.24 minutes), mean time taken to remove caries between the Brix 3000 group and the traditional method group as shown in Table (3).

while the mean time taken to remove caries with the traditional method using rotary burs was (2.27 minutes), as shown in Table (2).
Independent sample T test was conducted using SPSS 23.0 to study the differences between the The results in Table (3) show that the significance level value (p=0.000) indicates that there are statistically significant differences in the time taken to remove caries between Brix 3000 and the traditional rotary method, as the time taken when applying Brix 3000 was greater than the time taken when applying the traditional method using rotary burs.

Table(1): Sample distribution according to treatment method.

Treatment method	Number of molars	percentage
Brix 3000	15	50%
Traditional Method	15	50%
All samples	30	100%

Table (2) : mean time taken to remove caries according to treatment method.

Treatment method	Number of molars	Highest value	Minimum value	Mean	Standard deviation
Brix 3000	15	13	6.53	9.24	1.85478
Traditional method	15	3.28	1.15	2.27	0.67018

Table (3): Results of the Independent Samples T Test to study the differences in the mean time taken to remove caries between the study groups

T	df	difference	P value
13.678823	28	6.965333	0.000

34. **Discussion**:

The traditional method of removing caries using rotary instruments has been associated with many disadvantages, such as excessive preparation of the drill and excessive removal of healthy dental tissue, in addition to generating heat and pressure, stimulating the pulp tissue and stimulating the feeling of pain, as well as producing annoying sounds and vibrations [14].

Several alternative techniques have been developed that achieve the principle of minimal intervention in dentistry, including the chemical-mechanical method for removing caries, which works to dissolve the carious tissue by applying a chemical solution, to be removed mechanically using hand instruments easily[6]. Therefore, it was necessary to use alternative techniques that preserve dental tissues, provide comfort, and reduce the feeling of pain and discomfort, especially in children.

In this study, the conventional rotary method using low-speed burs and the chemical-mechanical method of caries removal using Brix 3000 were compared on permanent first molars with Class I carious dentin caries in children aged 7 to 9 years, with caries not exceeding two-thirds of the dentin thickness radiographically. Treatments were performed under good isolation with a rubber dam.

The time taken to remove the caries was calculated for each group using a mobile phone timer, given the importance of time on children's behavior during dental treatment and its role in stimulating anxiety [15].

The results showed that the average time taken to remove caries using the Brix 3000 was (9.24 minutes), while the average time taken to remove caries using the traditional method using rotary drills was (2.27 minutes).

The results showed that the traditional rotary method was the fastest method for removing caries, followed by Brix 3000, with a statistically significant difference between the two groups.

This may be due to the long application time of Brix 3000, which takes two minutes to fully activate its chemical action, according to the manufacturer's instructions [16].

The results of the study are consistent with the results of the study by Alkhouli et al, which found that the time taken to remove caries using Brix 3000 was longer than when removing it using the traditional rotary method, with a statistically significant difference [17].

It also agrees with the results of the study by Eftimoska et al, who found that the time taken to remove caries using Brix 3000 was significantly longer than the time taken with the conventional method [16].

The results of the study also agree with the results of the study of Balachandran et al, which found that the time taken to remove caries using Brix 3000 was greater than the time taken with the conventional method [18].

The results of the study are also consistent with the study by Mahdi and Haidar, which compared Brix 3000 with the traditional method using ceramic burs, and found that the time taken to remove caries using Brix 3000 was significantly greater than the time taken to remove caries using the traditional method [19].

The results of the study are also consistent with the study of Kochhar et al, and the study of Bohari and et al, which found that the time taken to remove caries using Papacarie gel based on the papain enzyme was greater than the time taken to remove caries using the traditional method on primary molars [20, 21].

5. Conclusion:

Within the limitations of this study, we conclude that Brix 3000 took the longest time to remove caries, and the traditional rotary method was the fastest technique for removing caries. We also recommend conducting similar studies on chemo-mechanical caries removal materials, including their effect on marginal microleakage around restorations. We also recommend conducting histological studies on the effect of these materials on the dental pulp.

Acknowledgment

This research was supported by the Department of Pediatric Dentistry at Damascus University, and we would like to thank our colleagues for their help in completing this research.

References:

1. Cardoso, M., et al., Efficacy and patient's acceptance of alternative methods for caries removal—a systematic review. Journal of clinical medicine, 2020. 9(11): p. 3407.
2. Asal, M.A., A.M. Abdellatif, and H.E. Hammouda, Clinical and microbiological assessment of carisolv and polymer bur for selective caries removal in primary molars. International Journal of Clinical Pediatric Dentistry, 2021. 14(3): p. 357.
3. Showkat, N., et al., Minimal Invasive Dentistry: Literature Review. Journal of Current Medical Research and Opinion, 2020. 3(09): p. 631-636.
4. Bratu, D.C., et al., A Bibliometric Analysis (2010–2020) of the Dental Scientific Literature on Chemo-Mechanical Methods of Caries Removal Using Carisolv and BRIX3000. Medicina, 2022. 58(6): p. 788.
5. Hamama, H., C. Yiu, and M. Burrow, Current update of chemomechanical caries removal methods. Australian dental journal, 2014. 59(4): p. 446-456.
6. Abdelaziz, E., A. Badran, and G. Allam, Chemomechanical caries removal agents and their applications in pediatric dentistry. Advanced Dental Journal, 2022. 4(1): p. 11-18.
7. Soni, H., A. Sharma, and P. Sood, A comparative clinical study of various methods of caries removal in children. European Archives of Paediatric Dentistry, 2015. 16: p. 19-26.
8. Ammari, M.M., et al., Efficacy of chemomechanical caries removal in reducing cariogenic microbiota: a randomized clinical trial. Brazilian oral research, 2014. 28: p. 1-6.
9. Dhamija, N. and P. Pundir, A Review on Agents for Chemo-mechanical Caries Removal. Sch J Dent Sci J Dent Sci, 2016. 3(9): p. 264-268.
10. Lai, G., et al., Comparison of Carisolv system vs traditional rotating instruments for caries removal in the primary dentition: A systematic review and meta-analysis. Acta Odontologica Scandinavica, 2015. 73(8): p. 569-580.
11. Felizardo, K.R., et al., Use of BRIX-3000 enzymatic gel in mechanical chemical removal of caries: clinical case report. Journal of Health Sciences, 2018. 20(2): p. 87-93.
12. Torresi, F. and L. Bsereni, Eficácia do método de remoção químicomecânica da cárie dentária como papaína em adultos. Rev Assoc Paul Cir Dent, 2017. 71(3): p. 266-9.
13. Inamdar, M.S., et al., Comparative evaluation of BRIX3000, CARIE CARE, and SMART BURS in caries excavation: An in vivo study. J Conserv Dent, 2020. 23(2): p. 163-168.
14. Krishnan, P., D. Ganapathy, and M. Ranjan, Chemomechanical caries removal-A review. Drug Invention Today, 2020. 14(7).
15. Jamali, Z., et al., Does the length of dental procedure influence children's behavior during and after treatment? A systematic review and critical appraisal. Journal of dental research, dental clinics, dental prospects, 2018. 12(1): p. 68.
16. Eftimoska, M., et al., Comparative study of caries removal using BRIX 3000 and classic mechanical method. Stomatološki glasnik Srbije, 2022. 69(2): p. 57-65.
17. Alkhouli, M.M., et al., Comparing the efficacies of two chemo-mechanical caries removal agents (2.25% sodium hypochlorite gel and brix 3000), in caries removal and patient cooperation: A randomized controlled clinical trial. Journal of dentistry, 2020. 93: p. 103280.
18. Balachandran, J., et al., Evaluation of efficacy of chemo-mechanical method of caries removal using Brix-3000 compared to conventional excavation with burs-A randomized controlled trial. JIDA: Journal of Indian Dental Association, 2020. 14(6).
19. 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.
20. Kochhar, G.K., et al., An evaluation of different caries removal techniques in primary teeth: a comparitive clinical study. Journal of Clinical Pediatric Dentistry, 2011. 36(1): p. 5-10.
21. Bohari, M.R., Y.K. Chunawalla, and B. Ahmed, Clinical evaluation of caries removal in primary teeth using conventional, chemomechanical and laser technique: an in vivo study. J Contemp Dent Pract, 2012. 13(1): p. 40-47.