Comparative study of caries removal using BRIX 3000 and classic mechanical method

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SUMMARY

Introduction In dental practice, despite the constant improvement of dental equipment and materials, caries removal using rotational instruments is still not a satisfactory way. The caries removal treatment constantly offers numerous alternatives in order to replace machine tools, and one of them is the chemo-mechanical method. The aim of this paper is to examine the effectiveness of the chemo-mechanical method of caries removal using BRIX 3000 and classic method.

Material and Method We used BRIX 3000; a material intended for atraumatic caries removal. Both caries elimination methods were performed in 40 patients with evident carious lesions. Twenty patients underwent atraumatic caries removal while in the other twenty carious tissue was removed using rotating instruments.

Results BRIX 3000 was effective in caries removal. A significant reduction in the use of local anesthetics was noticed. Patients did not experience discomfort or pain during treatment with BRIX 3000, but the duration of caries removal using this atraumatic method was significantly longer than with the classic method.

Conclusion Atraumatic method of caries removal is an adequate alternative to conventional therapeutic procedures for caries removal, which finds a place in the domain of modern minimally invasive dentistry.

Keywords: BRIX 3000; caries elimination; atraumatic method

INTRODUCTION

Dental caries is bacterial disease that leads to progressive demineralization of the inorganic part of the tooth followed by enzymatic disintegration of organic component. For years, the most common way to remove caries and prepare teeth for fillings has been the use of handpieces and burs. The invasiveness of this preparative method is the cause of many side effects such as thermal damage to the pulp, excessive removal of healthy dentin as well as patient discomfort.

Enamel prisms may break during the use of burs and handpieces, not only along the edges of the cavities, but also deeper in the enamel. These cracks can potentially harbor bacteria, causing further penetration into the dentin and growth of caries lesion. When carious tooth structure is removed using burs, some of the healthy part is also removed which weakens the cavity walls and increases the possibility of tooth fracture. With the use of modern materials and adhesive systems, the need for large retention cavities has been eliminated [1].

Taking into account the negative consequences that can occur using rotary preparation techniques, and in order to preserve and protect healthy tissues, in the recent years there has been a huge development of minimally invasive methods of caries removal - air abrasion, lasers, sono-abrasion, chemo-mechanical methods (CMCR) etc. [2, 3]. CMRC involves the use of gels that selectively remove softened and infected dentin which further facilitates manual excavation of caries dentin. That way painful and unpleasant sensations are reduced to minimum while there is high efficiency and the treatment is comfortable for patients [4].

BRIX 3000 is a gel containing papain (3,000 U / mg in a concentration of 10%) which was produced in 2012 by Brix Medical Science in Argentina. The unique features of this product are due to the high concentration of papain, which is bio-encapsulated using the exclusive EBE technology (Encapsulating Buffer Emulsion). It provides an ideal pH for the gel, that immobilizes enzymes and releases them during collagen proteolysis. The mechanism of action is exclusively on the necrotic dental tissue by dissolving partially degraded collagen fibers, while healthy dentin, solid and stable structure is not disturbed, as collagen fibers are not demineralized nor exposed.

Numerous scientific papers present data on the effectiveness of chemo-mechanical method of caries removal using BRIX 3000, pointing to it as an alternative to rotary handpieces. The results show complete removal of caries and clean cavity after several gel applications. These studies also include answers about patients’ acceptability. Most of the respondents accepted the treatment well and they perceived it as more pleasant and less painful than the classic method of caries removal [5]. However, there are small number of studies that evaluate the effectiveness of CMRC in the adult population.

Therefore, in an attempt to bridge this gap, our study was conducted to evaluate the effectiveness of caries re-
moval methods, in order to find the best option that will be routinely used in clinical practice. The main goal was to find method that will be successful in caries lesions removal without damaging the surrounding tooth structure, distinguishing infected dentin from healthy, reducing healthy structure removal, preserving it and stimulating the remineralization process.

The aim of this study was to compare the efficacy of two caries removal techniques, atraumatic caries removal using BRIX 3000 and classic method using rotary handpieces. Treatment duration, effectiveness in caries removal, presence/absence of pain during treatment, and patient’s perception of treatment were evaluated.

MATERIAL AND METHOD

The study used the material BRIX 3000 for chemo-mechanical removal of caries with papain as its main ingredient (30,000 U/mg 10%). Papain is an endoprotein, similar to pepsin present in gastric fluid, which has bactericidal, bacteriostatic and anti-inflammatory action. 100 ml of BRIX3000 gel contains the following components: Papain 30,000 U / mg 10 g, Propylene Glycol, Citric Pectin, Triethanolamine, Sorbitan Monolaurate, Disodium Phosphate, Monopotasic Phosphate, Toluidine Blue, distilled water q.s. 100 ml.

The clinical part of the examination took place at the Clinic for Restorative Dentistry and Endodontics at the Faculty of Dentistry in Skopje. The study group consisted of patients aged 18 to 70 years of both genders, who after the examination were found to meet the criteria for the inclusion in the study:
- At least one carious lesion was found in each patient.
- The treated teeth were vital.
- Patients had previous experience at the dentist, where they were treated with similar carious lesions using a conventional method.
- The respondents in the personal history did not have data on possible allergy or hypersensitivity to drugs or other medical devices.

This study included 40 patients who were divided into two groups - experimental (20 carious teeth), where caries lesions were removed with BRIX3000 and control group (20 carious teeth), where the classic method of caries removal with handpieces and burs was used. The beginning of the preparation in both groups of respondents was conducted by using a high-speed handpiece, in order to start the preparation of the cavity.

Chemo-Mechanical Method of Caries Removal

Chemo-mechanical method of caries removal was performed by applying the BRIX 3000 gel in the cavity, where the gel was applied for about 30 seconds in order to soften the carious dentin. Then, it was removed by hand instruments – excavators (Figure 2),
without excessive pressure, by applying rotational movements and scratching the softened dentin. The remnants of the gel and carious tissue were removed using air. The procedure was repeated until the altered dentin was completely removed. Drying the cavity was followed by inspection, using explorer and evaluation of caries removal was done by applying the caries detector.

Conventional Method of Caries Removal

In the control group, the carious tissue was removed by machine rotating instruments and carbide borers of different shapes and sizes. The efficacy of caries removal in this group was assessed based on inspection, using explorer and application of caries detector.

In the final phase, cleaned cavities were filled with glass ionomer cements, composites or amalgam, depending on the therapist’s assessment. The time required for caries removal using both methods was measured and recorded for each patient individually. The efficiency of caries removal after the application of both methods was determined under artificial lighting, by inspection, using explorer and then appropriately recorded in the questionnaire. After the completion, the patients were asked questions related to previous experiences at the dentist, perception of the treatment and comparison with the conventional method, as well as the presence and intensity of pain during caries removal. All data were recorded and separately analyzed in a previously prepared questionnaire.

RESULTS

There was no significant difference between respondents from both groups (p > 0.05) in terms of regularity of visits to the dentist (once in 12 months). However, 8 patients (40%) treated with the BRIX 3000 system, and 4 (20%) treated conventionally go to dentist once a year, while the majority of the respondents from both groups (60% of the experimental and 80% of the control group) still have no habit of annual visit to the dentist (Table 1 and Chart 1).

| Region | Experimental Group | Control Group |
|--------|--------------------|---------------|
|        | N                  | N             | %        | %        |
| Incisors Sekutići | 2 | 10 | 3 | 15 |
| Premolars Pretkutnjaci | 7 | 35 | 8 | 40 |
| Molars Kutnjaci | 11 | 55 | 9 | 45 |
| Total Ukupno | 20 | 100 | 20 | 100 |

Subjective perception of treatment was determined as painless treatment, mild pain and severe pain. In the experimental group, 14 respondents (70%) considered the treatment painless, 4 (20%) of them had mild pain during the treatment, and only 2 (10%) described the pain as severe. On the other hand, in the control group, only 3 respondents (15%) experienced the treatment as painless, 9 (45%) had mild pain, and 8 (40%) had severe pain. This difference between the two analyzed groups was highly statistically significant (p < 0.001). The patients treated with the chemo-mechanical method were significantly more likely to consider caries removal as a painless treatment than the patients treated using conventional method (Table 2 and Chart 2).
Table 2. Regular dental visits
Tabela 2. Reguljne posete stomatologu

|                  | Experimental Group | Control Group       |
|------------------|--------------------|---------------------|
|                  | N | %  | N | %  |
| Regular          | 8 | 40 | 4 | 20 |
| Not Regular      | 12| 60 | 16| 80 |
| Total            | 20| 100| 20| 100|

Yates corrected Chi-square = 0.71 p = 0.4

Table 3 and Chart 3 present the average durations of the preparations for the individual classes of cavities from the experimental group, as well as the shortest and the longest duration of the preparation of the cavities. Class III cavities had the lowest average preparation time of 8.0 ± 4.2 minutes, while the longest time of 12.8 ± 2.8 minutes was needed for Class II cavities.

Table 3. Subjective assessment of treatment
Tabela 3. Subjektivna procena tretmana

| Subjective Criterion of the Patient | Experimental Group | Control Group |
|-------------------------------------|--------------------|---------------|
|                                    | N | %  | N | %  |
| Painless Treatment                 | 14| 70 | 3 | 15 |
| Mild Pain                          | 4 | 20 | 9 | 45 |
| Severe Pain                         | 2 | 10 | 8 | 40 |
| Total                               | 20| 100| 20| 100|

The duration of the preparation of the 5 classes of cavities from the control group are presented in Table 4 and Chart 4. The average duration time of preparation was the shortest for Class III of 3.3 ± 1.5 minutes and Class V of 3.6 ± 1.1 minutes, while on average the preparation time for Class II was 9.9. ± 2.5 minutes.

Table 4. Duration of cavity preparation in the experimental group
Tabela 4. Trajanje preparacije kaviteta u eksperimentalnoj grupi

| Class | Mean | SD | Standard error | Min | Max |
|-------|------|----|----------------|-----|-----|
| I     | 11.6 | 1.05| 0.43           | 5.0 | 20.0|
| II    | 12.85| 2.76| 0.77           | 10.0| 18.0|
| III   | 8.0  | 4.24| 3.0            | 5.0 | 11.0|
| V     | 8.33 | 2.58| 1.05           | 5.0 | 12.0|

The evaluation of the effectiveness of the treatment in the study was analyzed through complete or partial caries removal. Complete caries removal was achieved in 17 (85%) patients treated with the BRIX 3000 system, and in all 20 patients treated with the conventional method. This difference in the distribution of patients with completely and partially cleaned carious lesions, depending on the type of method applied was statistically not significant (p > 0.05) (Table 5 and Chart 5).

Table 5. Duration of cavity preparation in the control group
Tabela 5. Trajanje preparacije kaviteta u kontrolnoj grupi

| Class | Mean | SD | Standard error | Min | Max |
|-------|------|----|----------------|-----|-----|
| I     | 6.5  | 4.93| 1.74           | 5.0 | 20.0|
| II    | 9.93 | 2.46| 0.66           | 5.0 | 14.0|
| III   | 3.33 | 1.53| 0.88           | 2.0 | 5.0 |
| IV    | 5.50 | 2.12| 1.50           | 4.0 | 7.0 |
| V     | 3.6  | 1.14| 0.51           | 2.0 | 5.0 |
The development of systems for chemo-mechanical caries removal has come from the desire of patients for a painless caries removal, without the use of drills and less unpleasant sensations [6]. These are perhaps the most common reasons for postponing dental visits, as well as regular check-ups. The data we have received from the patients regarding their consistency of visiting dentist, indicate that most of them (60% of the experimental and 80% of the control group) do not have the habit of regular annual check-ups, and the most common reasons for visiting dentist are sensitivity or painful sensations in the area of the teeth or gums (Table 1 and Chart 1).

The knowledge that this is a new and painless method that avoids the use of drills and local anesthesia, had a favorable effect on most patients and 80% of respondents expressed satisfaction with the treatment used. Patients who preferred conventional method often said the reason was the length of treatment. Most clinical studies report similar results [7–10]. The possibility of painless caries removal without prior application of local anesthesia is a great advantage of the chemo-mechanical method. This is due to the selective action of the Brix gel on carious dentin, the absence of thermal stimulation, pressure and vibrations that develop during rotary preparation. Removing caries lesions using hand instruments - excavators, additionally contributes to painless treatment, because their blades remove only carious tissue without damaging healthy dentin [11]. All patients in the experimental group had previous experience with mechanical caries removal, which enabled them to compare directly the two techniques. The knowledge that this is a new and painless method, without using drills and local anesthesia, had a favorable effect on most of them and 70% of respondents expressed satisfaction with applied treatment. Patients who preferred conventional method often indicated the length of treatment as the reason (Table 2 and Chart 2) as found similarly in other studies [8, 12, 13],

A review of the literature indicates an interesting fact about the patient’s perception of the duration of treatment: a significant percentage of respondents had the impression that the removal of caries by the chemo-mechanical method lasts shorter or perhaps the same as the removal of caries with the classical method. This is probably due to less uncomfortable feeling during chemo-mechanical method due to the absence of sounds, vibrations and pain making patients more relaxed [14]. The average duration of the preparations of the individual classes of cavities within the experimental group ranged from 8 minutes for the class III cavities to 13 minutes for the class II cavities (Table 3 and Chart 3). In the control group, the duration of the preparation of the 5 classes of cavities was much shorter and ranged from 3.3 min for class III cavities to 9.93 min for class II cavities (Table 4 and Chart 4). There was a significant difference in duration of chemo-mechanical caries removal between class I and V cavities which can be explained by the fact that class V cavities are more accessible which is in accordance with the study of Alkhouli et al. [8]. Comparing duration of cavity preparation of all classes between the two groups, we found that for the class I, II and V cavities, caries removal time with BRIX was significantly longer than the same time in the control group (Table 4, 5 and Chart 4, 5).

The effectiveness of caries removal was done on the basis of standard clinical parameters - inspection under artificial lighting, using explorer and application of caries detector. In 85% of cases where chemo-mechanical method was used, complete removal of the caries lesions was achieved, while in the remaining 15% the carious lesion was partially removed. Yazici et al. found residual caries lesions in the area of the enamel-dentinal border after the use of chemo-mechanical removal in 43% [15] while Goldberg et al. found it in up to 60% of samples [16]. After chemo-mechanical removal of the caries, the surface of the dentin was blurred and without gloss, which can cause difficulties in assessing the caries status of the cavity. Caries detector has been very helpful tool for detecting sound dentin.

In clinical practice, carious lesions are often not accessible, so along with the chemo-mechanical method it is necessary to use rotating machine instruments. It has also been observed that for the treatment of initial carious lesions, the chemo-mechanical removal is not the most suitable method, which is in line with the conclusions of Chaussain-Miller et al. [17]. On the other hand, due to the selective action of carious dentin, this method reduces the risk of iatrogenic pulp opening and pushing caries dentin in deep cavities.

**DISCUSSION**

**Table 6. Efficacy of caries removal treatment**

|                      | Experimental Group | Control Group |
|----------------------|--------------------|---------------|
|                      | N   | %    | N   | %    |
| Completely Removed Caries | 17  | 85   | 20  | 100  |
| Partially Removed Caries    | 3   | 15   | 0   | 0    |
| Total                   | 20  | 100  | 20  | 100  |

Fisher exact, two tailed p = 0.11

**CONCLUSIONS**

1. The chemo-mechanical method of caries removal with BRIX3000 is an effective method in clinical conditions. In some cases, it is necessary to use machine rotating instruments to provide access to the carious lesion and give a definite shape to the cavity.
Therefore, it is very important to set the correct indication for its use.

2. Chemo-mechanical treatment is usually painless, so the need for application of local anesthetics is significantly reduced. This is why it can be considered as a method of choice in anxious patients, medically handicapped patients, where local anesthesia is contraindicated, as well as in pediatric dentistry.

3. From a clinical point of view, prolonged duration of treatment is considered as a relative disadvantage of the chemo-mechanical method. But, if compared to the classical method where local anesthetics are used for pain, the overall duration of the treatment will not be very different.

REFERENCES

1. Tyas MJ, Anusavice KJ, Frencken JE, Mount GJ. Minimal intervention dentistry--a review. FDI Commission Project 1-97. Int Dent J. 2000;50(1):1–12. [DOI: 10.1111/j.1875-595x.2000.tb00540.x] [PMID: 10945174]

2. Pai VS, Nadig RR, Jagadeesh T, Usha G, Karthik J, Sridhara K. Chemical analysis of dentin surfaces after Carisolv treatment. J Conserv Dent. 2009;12(3):118–22. [DOI: 10.4103/0972-0707.57636] [PMID: 20543919]

3. Banerjee A, Watson TF, Kidd EA. Dentine caries excavation: a review of current clinical techniques. Br Dent J. 2000;188(9):476–82. [DOI: 10.1038/sj.bdj.4800515] [PMID: 10859846]

4. Ismail, Mafaz Mahdi Muhsin, Aseel Haidar MJ Al Haidar. Evaluation of the efficacy of caries removal using papain gel (Brix 3000) and smart preparation bur (in vivo comparative study). J Pharm Sci and Res. 2019;11(2):444–9.

5. Ericson D, Bornstein R. Development of a tissue-preserving agent for caries removal. In: Albrektsson TO, Bratthall D, Glantz POJ, Lindhe JT. Tissue Preservation in Caries Treatment. London: Quintessence; 2001. p. 153–66.

6. Kidd E. The Cartwright Prize. Caries removal and the pulpo-dentinal complex. Dent Update. 2000;27(10):476–82. [DOI: 10.12968/denu.2000.27.10.476] [PMID: 11218607]

7. Nadanovsky P, Cohen Carneiro F, Souza de Mello F. Removal of caries using only hand instruments: a comparison of mechanical and chemo-mechanical methods. Caries Res. 2001;35(5):384–9. [DOI: 10.1159/000047478] [PMID: 11641575]

8. Alkhouri MM, Al Nesser SF, Bshara NG, AlMidani AN, Comisi JC. 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. J Dent. 2020;93:105280. [DOI: 10.1016/j.jdent.2020.105280] [PMID: 31918164]

9. Klissia Romero Felizardo, Nayara Priscila de Alvarenga Barradasa, Gabriella Fernanda Cueneda, Fernanda da Conceição Antônio Ferreira, Murilo Baena Lopesb. Use of BRIX-3000 Enzymatic Gel in Mechanical Chemical Removal of Caries. Clinical Case Report. J Health Sci. 2018;20(2):87–93. [DOI: 10.17921/2447-8938.2018v20n2p87-93]

10. Schwendicke F. Retracted: modern concepts for caries tissue removal. J Esthet Restor Dent. 2016;n/a-n/a. [DOI: 10.1111/ jerd.12201]

11. Sandra Meyfarth, Karen Cassano, Flavio Warol, Marcia de Deus Santos, Angela Scarpato. A New Efficient Agent to Chemo-mechanical Caries Removal. Brazilian Journal of Dentistry. Rev Bras Odontol. 2020;77:e1946. [DOI: 10.18363/rbo.v77.2020.e1946]

12. Cardoso M, Coelho A, Lima R, Amaro I, Paula A, Marto CM, et al. Efficacy and Patient’s Acceptance of Alternative Methods for Caries Removal—A Systematic Review. J Clin Med. 2020;9(11):3407. [DOI: 10.3390/jcm9113407] [PMID: 3314249]

13. Abdul Khalek A, Elkaed MA, Abdel Aziz WE, El Tantawi M. Effect of Papacarie and Alternative Restorative Treatment on Pain Reaction during Caries Removal among Children. A Randomized Controlled Clinical Trial. J Clin Pediatr Dent. 2017;41(3):219–24. [DOI: 10.17796/1053-4628-41.3.219] [PMID: 28422591]

14. Rafique S, Fiske J, Banerjee A. Clinical trial of an air-abrasion/chemomechanical operative procedure for the restorative treatment of dental patients. Caries Res. 2003;37(5):360–4. [DOI: 10.1159/000072168] [PMID: 12925827]

15. Yazici AR, Ozgunaltay C, Dayangar B. A scanning electron microscopic study of different caries removal techniques on human dentin. Oper Dent. 2002;27(4):360–6. [DOI: 1210773]

16. Goldberg M. Effects of mild chemical treatments on sound and carious dentin surfaces. In: Albrektsson TO, Bratthall D, Glantz POJ, Lindhe JT. Tissue Preservation in Caries Treatment. London: Quintessence; 2001. p. 105–22.

17. Chaussain-Miller C, Decup F, Domejean-Oriaguete S, Gillet D, Guigand M, Kaleka R, et al. Clinical evaluation of the Carisolv chemomechanical caries removal technique according to the site/stage concept, a revised caries classification system. Clin Oral Investig. 2003;7(1):32–7. [DOI: 10.1007/s00784-003-0196-5] [PMID: 12673435]
Uporedna studija upotrebe gela BRIX 3000 i klasične mehaničke metode za uklanjanje karijesnih lezija

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KRATAK SADRŽAJ

UVOD
Zubni karijes je bakterijsko oboljenje koje dovodi do progresivne deminerализације неорганско гоела зуба и праћено је ензимском деизтеграцијом органских компонената зубног ткива. Већ годинама најчешће каријес и још увек накаталољнији нација уклањања каријеса је користи талоротацне ротације и нискотуројне ротације затирајућих турбин и коленожака. Инвазивност овој методе је узрок чићих нештовања и ефикасности зуба, као што су термици оштећење пупа, прекомерно уклањање здравог дентина, ал и нелагодност код пацијената. Гледне присме могу се смолити дојак рода овим машина, не само њивина кавитата ђе и дубље. Ове пукotine су мesta гde je могућ прољак бактерија, што изазива њиво ширеме у дентин и каријесне промене. Када се каријес одстранjuje затирајућим инструментима, осим каријеса уклања се и дела здравог зубног ткива, што слађе зидове зуба и поља оцену могућност прелима. Применом савремених материјала и адхезивних система улазн у потреба за већим ретционим кавитетима и на тај начин максимално ће срзива зубна материја [1].

Узимајући у обзир негативне последице које могу настати премењу техника машинске препарације, а у циљу оцена и заштити здравих ткива, последњих година су се више бавиле минимално инвазивне методе уклањања каријеса – вағудаша абразива, лазери, сонобразива, хемомеханичке методе за уклањање каријеса (HMUK) [2, 3]. HMUK подразумева употребу гелоа који специфично уклања омекштели, инцирани дентин, што добар одлакова руначку екскувативу. На тај начин се болне и непријатне ендоконвеције своде на минимум, подиже се степен ефи-касности, а лекење је пријатно за пацијенте [4].

BRIX 3000 je gel koji sadrži papain (3000 U/mg u koncen- traciji od 10%), koji je 2012. proizveo Brix Medical Science u Argentin. Jedinstvene карактеристике овог производа поседу са високе концентрације папаина, који је биоинкапсулиран каријесом екскулевезе концепције EBE технолошке (Eccapsultating Buffer Emulsion). Ovo пруžа идеалan pH за гел, zbog čega se enzimi imobilišu и ослобађају током протеолизе колагена. Механизам delovanja je isključen na nekretnичком зубном tkivу razdvaja- njem delimično degradiranih kolagenih vlakana, а на здравом дентину se ne narušavaju и стабилна структура, jer колагена vlakna нису деминерализована итак експонирани. Због toga, u po- kusuju да se преносом ovaj jaz, наша студија je sprovedena kako bi se procenila ефикасност метода уклањања каријесне прозре и како bi se pronašla најбоља професионална пракса у употреби. Сутине ove metode je успешно уклањање karijesних маса без оштећења окоznог зубног ткива, odvajanje inficiranog od okolnog здравog тkива, smanjenje uklanjanja zdrave struktura, njeno očuvanje и simulisanje procesa remineraldizacije.

MATERIJAL I METOD

U studiji smo koristili materijal BRIX 3000 za hemomehaničko uklanjanje karijesa, чији je glavni састојak papain (30.000 U/ mg 10%). Reč je о endoproteiniu, сличном pepсину присутном у гастрономскоj tečnosti, коjи иака бактериолошко, бактериостатично и antiinflamatorno svojstvo. Stomillitara gela BRIX 3000 sadrži следеће компоненте: papain 30.000 U/mg 10 g, propilen-glikol, limunska kiselina, trietanolamin, sorbitan-monolaurat, disodi-fosfat, monokaliум-fosfat, toluidin plavo, destilovanu vodu q.s. 100 ml.

Клиници deo pregleda odvijao se на Klinici за bolesti zuba и endodonciju Stonatomološkog fakulteta u Skoplju. Studijsku гру-pu su чinили paciente oba pola старости од 18 do 70 година, за koje je nanak pregleda utvrđeno да их испнуjavaju kriterijume за укључивање у студију:

- Kod svakog paciente je pronadena najmanje jedna karijesna lezija;
- Lečeni zubi su bili vitalni;
- Pacijenti su imali prethodno iskustvo kod stomatologa, коде су конвенционалном и методом имали tretman sličnih karijesnih lezija;

U studiji je korišćen BRIX 3000, materijal namenjen atraumatskom lečenju каријеса. Клиничка ispitivanja ефикасности ove metode je uspešno uklanjanje karijesnih масa bez ošтећења окоznог зубног ткива, odvajanje inficiranog od okolnog здравог тkива, smanjenje uklanjanja zdrave структуры, njeno оčuvanje и simulisanje procesa remineraldizacije.
– Ispitanici u širokoj anamnezi nisu imali podatke o eventualnoj alergiji ili preosetljivosti na lekove ili druga medicinska sredstva.

Ovom studijom obuhvaćeno je 40 pacijenata koji su podeljeni u dve grupe – eksperimentalnu (20 karijskih zuba), gde je karijes bio uklonjen pomoću gela BRIX 3000 i kontrolnu grupu (20 karijskih zuba), gde je primenjena klasična metoda uklanjanja karijesa turbinama i kolenjacima. Početak pripreme u obe grupe ispitnika sproveden je korišćenjem turbine kako bi se formirala preparacija.

**Hemomehanička metoda uklanjanja karijesa**

Postupak za uklanjanje karijesa sproveden hemomehaničkim putem urađen je nanošenjem gela BRIX 3000 u kavitet, gde je gel stajao oko 30 sekundi u cilju omekšavanja karijskog tkiva. Omekšali karijes je uklonjen ručnim instrumentima – ekskavatorima (Slika 2), bez većeg pritiska, primenom rotacijskih pokreta i grebanjem omekšanog dentina. Ostaci gela i karijevog tkiva uklonjeni su pusterom. Postupak je ponavljao sve dok izmjenjeni dentin nije bio potpuno uklonjen. Nakon sušenja kaviteta sledili su inspekcija, sondiranje i procena efikasnosti uklanjanja karijesa primenom detektora karijesa.

**Konvencionalna metoda uklanjanja karijesa**

U kontrolnoj grupi karijesno tkivo je uklonjeno mašinskih rotirajućim instrumentima i karbidnim svrdlama različitih oblika i veličina. Efikasnost uklanjanja karijesa u ovoj grupi je procenjena na osnovu inspekcije sondiranjem i primenom detektora karijesa.

U završnoj fazi svim pacijentima su ispunjeni kaviteti korišćenjem glasjonomernog cementa, kompozita ili amalgama, u zavisnosti od procene terapeuta. Vreme potrebno za uklanjanje karijesa obema metodama je mereno i evidentirano za svakog pacijenta pojedinačno.

Efikasnost uklanjanja karijesa nakon primene obe metode utvrđivana je pod veštakom osvetljenjem, pregledom sondom, a zatim na odgovarajući način evidentirana u upitniku. Nakon rehabilitacije pacijentima su postavljana pitanja vezana za dotačna iskustva kod stomatologa, utiske o tretmanu i poređenje sa konvencionalnom metodom, kao i prisustvo i intenzitet bola tokom uklanjanja karijesa. Svi podaci su evidentirani i posebno analizirani u prethodno pripremljenom upitniku.

**REZULTATI**

Ispitanici iz obe grupe su se beznačajno razlikovali (p > 0,05) u pogledu redovnosti poseta stomatologu (odnosno u 12 meseci). Tako osam (40%) pacijent u tretiranih sistemom BRIX 3000 i četiri (20%) tretirana konvencionalnom metodom jedanput godišnje posete stomatologu (Tabela 1 i Grafikon 1).

Subjektivna percepcija lečenja je određena kao bezbolno lečenje, blagi bol i jaki bol. U eksperimentalnoj grupi 14 (70%) ispitnika smatralo je da je lečenje bezbolno, njih ćetvoro (20%) imalo je blage bolove tokom lečenja, a samo dveo (10%) opisalo je bol kao jak. S druge strane, u kontrolnoj grupi su samo tri (15%) ispitanika doživela lečenje kao bezbolno, devet (45%) ispitanika je imalo blage bolove, a osam (40%) jake bolove. Posmatrana razlika u subjektivnom kriterijumu tretmana između ispitanika iz obe analizirane grupe je veoma statistički značajna (p < 0,001). Pacijenti tretirani hemomehaničkom metodom znatno češće smatraju uklanjanje karijesa bezbolnim tretmanom, suprotno od pacijenata koji su tretirani konvencionalnom metodom (Tabela 2 i Grafikon 2).

Tabela 3 i Grafikon 3 predstavljaju prosečno trajanje preparacije pojedinih klasa kaviteta iz eksperimentalne grupe, odstupač na njih, kao i najkraće i najduže trajanje preparacije. U okviru eksperimentalne grupe, kaviteti III klase imaju najnižu prosečno vreme preparacije, od 8 ± 4,2 minuta. Sa druge strane, najduže vreme, od 12,8 ± 2,8 minuta, bio je rezervisan za grupu kaviteta II klase.

Diskretni parametri koji opisuju trajanje preparacija svih pet klasa kaviteta iz kontrolne grupe prikazani su u Tabeli 4 i Grafikonu 4. Prosečno trajanje vremena preparacije je bilo najkraće za grupu kaviteta III klase, sa vrednošću od 3,3 ± 1,5 minuta, i kavitete V klase, sa vrednošću od 3,6 ± 1,1 min, dok je u proseku priprema trajala najduže u grupi kaviteta II klase, 9,9 ± 2,5 minuta.

Procena efikasnosti tretmana u studiji analizirana je kroz kompletno ili delimično uklanjanje karijesa. Kompletan uklanjanje karijesa postignuto je kod 17 (85%) pacijenata tretiranih sistemom BRIX 3000, a kod svih 20 pacijenata tretiranih konvencionalnom metodom. Ova razlika u raspodeli pacijenata sa potpuno i delimično saniranim karijeskim lezijama u zavisnosti od vrste primenjene metode je nedovoljna da bila potvrđena statistički (p > 0,05) (Tabela 5 i Grafikon 5).

**DISKUSIJA**

Razvoj sistema za hemomehaničko uklanjanje karijesa proistekao je iz želje pacijenata za bezbolnim uklanjanjem karijesa, bez potrebe mašina i sa manje neprijatnih senzacij na tokom radu [6]. Ovo je možda najčešći razlog odlaganja poseta stomatologu. Podaci koje smo dobili od pacijenata u vezi sa njihovom osećanjem posete stomatologu ukazuju na to da većina njih (60% eksperimentalne i 80% kontrolne grupe) imaju manje neprijatnih senzacija tokom radu.

Saznanje da je ovo nova i bezbolna metoda, čijom primenom se izbegava uticaj na mašinskih rotirajućih instrumentima, kod južnog kliničkih prostorija, podsticaj na većinu pacijenata, tako da je 80% ispitanika izrazilo zadovoljstvo primenjencima tretmanom.

Pacijenti koji su davali prednost konvencionalnom metodu često su kao razlog odlaganja dobili da u većinu pacijenata, tako da je 80% ispitanika izrazilo zadovoljstvo primenjenim tretmanom.

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su prethodno iskustvo sa mehaničkim uklanjanjem karijesa, što im je omogućilo da direktno uporedile dve tehničke metode uklanjanja karijesa. Saznaje zao je ovo nova i bezbolna metoda, kod koje se izbegavaju rotirajući mašinski instrumenti i lokalna anestezija, povoljno je uticalo na većinu njih, tako da je 70% ispitanika izrazilo zadovoljstvo uklanjanjem karijesa hemomehaničkom metodom. Znajali su prethodno iskustvo sa mehaničkim uklanjanjem karijesa, što im je omogućilo da direktno upoređile dve tehnike uklanjanja karijesa. Saznaje zao je ovo nova i bezbolna metoda, kod koje se izbegavaju rotirajući mašinski instrumenti i lokalna anestezija, povoljno je uticalo na većinu njih, tako da je 70% ispitanika izrazilo zadovoljstvo uklanjanjem karijesa hemomehaničkom metodom.

Pregled literature ukazuje na zanimljivu činjenicu o zapažanju pacijenata o trajanju tretmana: značajan procenat ispitanika imao je utisak da uklanjanje karijesa hemomehaničkom metodom traje kraće od klasičnog metoda i možda isto kao uklanjanje karijesa klasičnom metodom. To je verovatno posledica utiska da je tretman prijatniji zbog odsustva zvukova, vibracije i bolova tokom uklanjanja karijesa, što pacijente čini opuštenijima. Prosečno trajanje preparacije pojedinačnih klasa kaviteta u okviru eksperimentalne grupe kretalo se od 8minuta za kavitete III klase do 13 minuta za kavitete II klase (Tabela 3 i Grafikon 3). U kontrolnoj grupi trajanje preparacije svih pet klasa kaviteta bilo je mnogo kraće i kretalo se od 3,3 minuta za kavitete III klase do 9,93 minuta za kavitete II klase (Tabela 4 i Grafikon 4).

Postojala je značajna razlika u trajanju uklanjanja karijesa hemomehaničkom metodom između kaviteta I i V klase, što se može objasniti činjenicom da su kaviteti V klase pristupačniji za obradu i da su na njih doveli Alkhouli i saradnici [8].

Uporedjujući podatke o trajanju ove dve metode, u svakoj od klasa posebno, ustanovili smo da u kavitetima I i V klase vreme uklanjanja karijesa sa BRIX-om traje znatno duže od vremena potrebnog za preparaciju kaviteta u kontrolnoj grupi (Tabela 3, 4 i Grafikon 3, 4).

U našoj studiji delotvornost uklanjanja karijesa procenjena je na osnovu standardnih kliničkih parametara – inspekcije pod veštačkim osvetljenjem, sondiranjem, kao i primenom detektora karijesa. Efikasnost hemomehaničke metode uklanjanja karijesa pomoću sistema BRIX demonstrisana je uz pomoć osnovnih kliničkih parametara. U 85% slučajeva gde je ova metoda korisćena za uklanjanje karijesnog tkiva postignuto je potpuno uklanjanje karijesa, a u preostalih 15% karijesna lezija je bila delimično sanirana. Yazici sa saradnicima [15] otkrio je zaostaliji karijes u preduel predel gledno-dentinske granice nakon primene hemomehaničkog metoda uklanjanja karijesa kod 43% uzoraka, dok ga je Goldberg sa saradnicima našao kod 60% uzoraka [16].

ZAKLJUČAK

1. Hemomehanička metoda uklanjanja karijesa gelom BRIX 3000 je efikasna metoda u kliničkim uslovima. U nekim slučajevima neophodno je koristiti rotirajuće mašinske instrumente. Primene su te metode uklanjanja karijesa kod 43% uzoraka, dok ga je Goldberg sa saradnicima našao kod 60% uzoraka [16].

2. Hemomehanički tretman je obično bezbolan, zbog čega je potreba za primenom lokalne anestezije zaostala. Ova metoda uklanjanja karijesa je manje neprijatna za pacijente, zbog čega se može smatrati metodom izbora kod preplašenih pacijenata, medicinski hendikepiranih pacijenata, gde je lokalna anestezija kontraindikovana, kao i u pedijatrijskoj stomatologiji.

3. Sa kliničke tačke gledišta, produženo trajanje tretmana smatra se relativnom nedostatkom hemomehaničke metode. Ali ako se uporedi sa klasičnom metodom, gde se lokalna anestezija koristi za uklanjanje boli, i dalje se celokupno trajanje tretmana neće mnogo razlikovati.