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).

<table>
<thead>
<tr>
<th>Region</th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incisors</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Premolars</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Molars</td>
<td>11</td>
<td>55</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Regular</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>Not Regular</td>
<td>12</td>
<td>60</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Subjective Criterion of the Patient</th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Painless Treatment</td>
<td>14</td>
<td>70</td>
</tr>
<tr>
<td>Mild Pain</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Severe Pain</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

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 4. Duration of cavity preparation in the experimental group

<table>
<thead>
<tr>
<th>Class</th>
<th>Mean Srednja vrednost</th>
<th>SD</th>
<th>Standard error Standardna greška</th>
<th>Min</th>
<th>Max Maks.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I klasa</td>
<td>11.6</td>
<td>1.05</td>
<td>0.43</td>
<td>5.0</td>
<td>20.0</td>
</tr>
<tr>
<td>II klasa</td>
<td>12.85</td>
<td>2.76</td>
<td>0.77</td>
<td>10.0</td>
<td>18.0</td>
</tr>
<tr>
<td>III klasa</td>
<td>8.0</td>
<td>4.24</td>
<td>3.0</td>
<td>5.0</td>
<td>11.0</td>
</tr>
<tr>
<td>V klasa</td>
<td>8.33</td>
<td>2.58</td>
<td>1.05</td>
<td>5.0</td>
<td>12.0</td>
</tr>
</tbody>
</table>

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 6. Efficacy of caries removal treatment

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Completely Removed Caries</td>
<td>17</td>
<td>85</td>
</tr>
<tr>
<td>Partially Removed Caries</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

Fisher exact, two-tailed p = 0.11

DISCUSSION

The development of systems for chemo-mechanical caries removal has come from the desire of patients for 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.

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


Uporedna studija upotrebe gela BRIX 3000 i klasične mehaničke metode za uklanjanje karijesnih lezija

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KRATAK SADRŽAJ

Uvod U stomatološkoj ordinaciji, uprkos stalnom usavršavanju stomatološke opreme i materijala, problem sa rotirajućim instrumentima za uklanjanje karijesa još uvakve nije na zadovoljavajući način rešen. Terapija karijesa konstantno nudi brojne alternative za zamenu rotirajućih mašina, a jedna od njih je i hemomehanička metoda za eliminaciju karijesa. Cilj ovog rada je da se ispita efikasnost hemomehaničke metode uklanjanja karijesa pomoću gela BRIX 3000, upoređujući je sa klasičnom metodom eliminacije karijesa.

Materijal i metod U studiji je korišćen BRIX 3000, materijal namenjen atraumatskom lečenju karijesa. Klinička ispitivanja efikasnosti obe metode eliminacije karijesa obavljena su kod 40 pacijenata sa evidentnim karijesnim lezijama, od kojih je 20 podvrgnuto atraumatnom tretmanu u cilju uklanjanja karijesnog tkiva, a kod preostalih 20 karijesne lezije su uklanjane rotirajućim instrumentima. Rezultati Naša studija je pokazala efikasnost gela BRIX 3000 u uklanjanju karijesa. Podaci ukazuju na značajno smanjenje upotrebe lokalnih anestetika. Pacijenti nisu osećali nelagodnost ili bol tokom korišćenja BRIX 3000, ali je trajanje procesa eliminacije karijesa atraumatnom metodom bilo značajno duže nego klasičnom metodom.

Prema istraživanjima, može se zaključiti da je atraumatski metod uklanjanja karijesa adekvatna alternativa konvencionalnim terapijskim procedurama za uklanjanje karijesa, i on nalazi mesto u domenu savremene stomatologije i minimalne invazije.

Ključne reči: BRIX 3000; eliminacija karijesa; atraumatska metoda

UVOD

Zubni karijes je bakterijsko oboljenje koje dovodi do progresivne demineralizacije neorganog dela zuba i pručeno je enzimskom dezintegracijom organskih komponenti zubnog tkiva. Već godinama najčešće korišćeni i još uvakve najkompleksniji alat uklanjanja karijesa je upotreba visokoturažnih i niskoturažnih rotirajućih turbina i kolenjaka. Inaktivnost ovih instrumenta je uzrok mnogih nelagodnih efekata na zubna tkiva, kao što su termičko oštećenje pulpe, prekomerno uklanjanje zdrave strukture, njeno očuvanje i njeno stimulisanje procesa remineralizacije.

U studiji smo koristili materijal BRIX 3000 za hemomehaničku eliminaciju karijesa, čiji je glavni sastojak papain (30.000 U/mg 10 g), kao enzim koji katalizuje demineralizaciju neorganskog dela zuba i praćeno je enzim-fosfat, monokalijum-fosfat, toluidin plavo, destilovano ulje (q.s. 100 ml).

MATERIJAL I METOD

U studiji smo koristili materijal BRIX 3000 za hemomehaničku eliminaciju karijesa. Klinička ispitivanja efikasnosti obe metode eliminacije karijesa obavljena su kod 40 pacijenata sa evidentnim karijesnim lezijama, od kojih je 20 podvrgnuto atraumatnom tretmanu u cilju uklanjanja karijesnog tkiva, a kod preostalih 20 karijesne lezije su uklanjane rotirajućim instrumentima. Pacijenti su imali prethodno iskustvo kod stomatologa, a svi su konvencionalnom metodom imali tretman sličnih karijesnih lezija.

U studiji može se zaključiti da je atraumatski metod uklanjanja karijesa adekvatna alternativa konvencionalnim terapijskim procedurama za uklanjanje karijesa, i on nalazi mesto u domenu savremene stomatologije i minimalne invazije.

Ključne reči: BRIX 3000; eliminacija karijesa; atraumatska metoda
– Ispitanci u ličnoj 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 karijesnih zuba), gde je karijes bio uklonjen pomoću gela BRIX 3000 i kontrolnu grupu (20 karijesnih zuba), gde je primenjena klasična metoda uklanjanja karijesa turbinama i kolenjacima. Početak pripreme u obe grupe ispitanika sproveden je kao korišćenjem turbine kako bi se formirala preparacija.

**Hemomehanička metoda uklanjanja karijesa**

Postupak za uklanjanje karijesa sproveden hemomehaničkim putem uraden je nanošenjem gela BRIX 3000 u kavitet, gde je gel stalio oko 30 sekundi u cilju omekšavanja karijesnog tkiva. Omekšali karijes je uklonjen ručnim instrumentima – ekskavatorima (Slika 2), bez većeg pritiska, primenom rotacijskih pokreta i grebanjem omekšanog dentina. Ostaci gela i karijesnog tkiva uklonjeni su pusterenom, početak je ponavljan odmah dok izmenjeni dentin nije bio potpuno uklonjen. Nakon sušenja kavite sledili su inspekcija, sondiranje i procena efikasnosti uklanjanja karijesa primenom detektora karijesa.

**Konvencionalna metoda uklanjanja karijesa**

U kontrolnoj grupi karijesno tkivo je uklonjeno mašinskim 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 glasjonemornog 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 oba metoda utvrđivana je pod veštakim osvetljenjem, pregledom sondom, a zatim na odgovarajući način evidentirana u upitniku. Nakon rehabilitacije pacijentima su postavljana pitanja vezana za dotađašnja iskustva kod stomatologa, uspešnost i kvalitet pripreme i uklanjanja, odnosno pripreme uklanjanja karijesa.

Rezultati

Ispitanci iz obe grupe su se bezobalu razlikovali (p > 0,05) u pogledu redovnosti poseta stomatologu ( jednom u 12 meseci). Tako osam (40%) pacijenata tretirani sistemom BRIX 3000 i četiri (20%) tretirana konvencionalnom metodom, jedan put odgovor na to je da u većini njih (60% eksperimentalne i 80% kontrolne grupe) imalo je navika nižeg kontrole karijesa.

Subjektna percepcija lečenja je određena kao bezbolno lečenje, blagi bol i jaki bol. U eksperimentalnoj grupi 17 (70%) ispitanika smatrao je da je lečenje bezbolno, njih četvero (20%) imalo je blage bolove tokom lečenja, a samo dve (10%) opisalo je bol kao jak. 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 kriteriju 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, odstupanje od njih, kao i najkraće i najduže trajanje preparacije. U okviru eksperimentalne grupe, kaviteti III i IV klase imaju najnižu prosečnu vreme preparacije, od 8 ± 4,2 minuta. Sa druge strane, najduže vreme, od 12,8 ± 2,8 minuta, bio je rezervisan za grupu kavite II klase.

Deskriptivni parametri koji opisuju trajanje preparacija svih pet klasa kaviteta iz kontrolne grupe prikazani su u Tabeli 4 i Grafikonu 4. Procena efikasnosti uklanjanja karijesa iz eksperimentalne grupe, kaviteti III klase, sa vrednošću od 3,3 ± 1,5 minuta, i kavitete V klase, sa vrednošću od 3,6 ± 1,1 minut, 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 i delimično uklanjanje karijesa, kompletan uklanjanje karijesa postignuto je kod 17 (85%) pacijenata tretirani sistemom BRIX 3000, a kod svih 20 pacijenata tretiranih konvencionalnom metodom. Ova razlika u raspoldeni pacijenata sa potpuno i delimično saniranim karijesnim lezijama u zavisnosti od vrste primenjene metode je nedovoljna da bi 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 upotrebe mašina i sa manje neprijatnih senzacija tokom rada [6]. Ovo je možda najčešći razlog odlaganja poseta stomatologu. Pacijenti koji su dobili od pacijenata u vezi sa njihovom frekvencijom posete stomatologu ukazuju na to da većina njih (60% eksperimentalne i 80% kontrolne grupe) nema naviku redovnih godišnjih kontrola, a kao najčešće razlog za posetu stomatologu navode veće ili manje neprijatne senzacije u predelu zuba ili desni (Tabela 1 i Grafikon 1).

Saznanje da je ovo nova i bezbolna metoda, čijom primenom se izbegava upotreba mašinskih rotirajućih instrumenta i lokalna anestezija, povoljno je uticalo na većinu pacijenata, tako da je 85% ispitanika izrazilo zadovoljstvo primenjenim tretmanom. Pacijenti koji su davali prednost konvencionalnom metodu često su kažu da razlog odlaganja tretmanu. Uvećana kliničkih studija izveštava o sličnim rezultatima [7–10].

Mogućnost bezbolnog uklanjanja karijesa bez prethodne primene lokalne anestezije je velika prednost hemomehaničkih metoda. To je posledica selektivnog delovanja gela BRIX 3000 na karijesno izmenjenom dentinu, odsustva toplotne stimulacije, procene efikasnosti uklanjanja različitih vrsta primenjene metode. Ova razlika u raspoldeni pacijenata sa potpuno i delimično saniranim karijesnim lezijama u zavisnosti od vrste primenjene metode je nedovoljna da bi bila potvrđena statistički (p > 0,05) (Tabela 5 i Grafikon 5).
su prethodno iskustvo sa mehaničkim uklanjanjem karijesa, što im je omogućilo da direktno uporede dve tehnikе uklanjanja karijesa. Saznanje da 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 izrazilо zadovoljstvo primenjenom tretmanom. Pacijenti koji su davali prednost konvencionalnu metodu često su naznačili dužinu tretmana kao razlog (Tabela 2 i Grafikon 2). Većina kliničkih studija izvestava o sličnim rezultatima [8, 12, 13].

Pregled literature ukazuje na zanimljivu činjenicу o zapažanju pacijenata o trajanju tretmana: značajan procenat ispitanika imao je utisak da uklanjanje karijesa hemomehaničkom metodom traje kraće ili možda isto što je uklanjanje karijesa klasičном metodom. To je verovatno posledica utiska da je tretman prijatniji zbog odsustva zvukova, vibracija i bolova tokom uklanjanja karijesa, što pacijente čini opuštenijim [14]. Prosečno trajanje preparacije pojedinačnih klasa kaviteta u okviru eksperimentalне grupe kretalo se od osam minuta 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 a 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 se kaviteti V klase pristupačniji za obradu, što je u skladu sa studijom koju su objavili Alkhouli i saradnici [8].

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 demonstrirana je uz pomoć osnovnih kliničкиh parametara. U 85% slučajeva gde je ova metoda korишćena za uklanjanje karijesnog tkiva postignuto je potpuno uklanjanje karijesa, a u preostalih 15% karijesna leziјa je bila delimično sanirana. Yazici sa saradnicima [15] otkrio je zaostal karijes u preduel gleno-dentske granice nakon primene hemomehaničkog metoda uklanjanja karijesa kod 43% uzoraka, dok ga je Goldberg sa saradnicima našao kod 60% uzoraka [16].

S druge strane, zbog selektivnog uklanjanja karijesnog dentina ova metoda smanjuje rizik od jatrogenog otvaranja pulpe i sprečava potiskivanje karijesnih masa u slučaju dubokih kaviteta.

1. Hemomehanička metoda uklanjanja karijesa gelom BRIX 3000 je efikasna metoda u kliničkim uslovima. U nekim slučajevima neophodno je koristiti mašinsке rotirajuće instrumente, koje bi se obezbedilo pristup karijesnim lezijama i da se ostvaruje definitivan oblik kaviteta. Ova metoda uklanjanja karijesa je manje neprijatna za pacijente, zbog čega se može smatrati metodom izbora kod preplašenih pacijenata, medicinski hendikepiranih pacijenata, kao i u pedijatrijskoj stomatologiji.

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

3. U podmak view text - relating to the topic of stomatology in Serbia - the work presented is intended to be a contribution to the field of dental research. It discusses the results of a study comparing the effectiveness of a new method of caries removal with the traditional method. The study involved 70% of the participants, and the results showed that the new method was more preferable due to its decreased duration of treatment. The study also highlighted the benefits of the new method, such as less pain during treatment, which made it more acceptable to the participants. The results were compared with previous studies [8, 12, 13], and it was found that similar results were obtained. The review of literature showed an interesting fact that patients noticed the duration of treatment: a significant percentage of participants had the impression that caries removal using the new method took less time or the same, compared to the traditional method. This was likely due to the lack of noise, vibrations, and pain during caries removal, making patients feel more relaxed [14]. The average duration of preparation for individual classes of cavities in the experimental group varied from eight minutes for class III cavities to 13 minutes for class II cavities (Table 3 and Graph 3). In the control group, the duration of preparation for all five classes of cavities was much shorter and ranged from 3.3 minutes for class III cavities to 9.93 minutes for class II cavities (Table 4 and Graph 4).

A significant difference in the duration of removing caries using the new method was observed between cavities I and V class, which can be explained by the fact that cavity V class is more accessible for treatment, which is consistent with the study published by Alkhouli and co-workers [8].

Comparing the data on the duration of these two methods, it was established that in cavities I, II and V class, the time for caries removal using BRIX was significantly longer than the time required for preparation of cavities in the control group (Table 3, 4 and Graph 3, 4).

The results of the study showed that caries removal using the new method was more effective in a number of cases. In 85% of cases where this method was used, it was possible to achieve complete removal of caries, while in the remaining 15% of cases, caries lesions were partly cleaned. Yazici with co-workers [15] found caries in the zone of visible-dentine boundary after applying the hemomechanical method of caries removal in 43% of samples, while Goldberg with co-workers found it in 60% of samples [16].

After hemomechanical caries removal, the dentine surface was rough and lacked shine, which could cause difficulties in evaluating the presence of caries in a cavity. Naturally, confirmation of complete removal of caries was achieved using a caries detector.

In clinical practice, caries lesions are often inaccessible, so it is necessary to use rotating mechanical instruments together with the new method. It was noticed that for the treatment of initial caries lesions, the hemomechanical removal of caries is not the most suitable method, which is in line with the conclusions of Chaussain-Miller and co-workers [17]. On the other hand, due to its selective removal of carious dentin, this method reduces the risk of iatrogenic perforation and prevents expulsion of carious masses in the case of deep cavities.

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3. Sa kliničke tačke gledišta, produženo trajanje tretmana smatra se relativnim nedostakom hemomehaničke metode. Ali ako se uporedi sa klasičном metodom, gde se lokalna anestezija koristi za uklanjanje bola, i dalje se celokupno trajanje tretmana neće mnogo razlikovati.