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Brix-3000 as a Preventive Measure in Aerosol Production against Covid-19: Case Report

Utilização do gel Enzimático Brix-3000 Como Medida Preventiva na Produção de Aerossóis Frente à Covid-19: Relato de Caso

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Abstract

In 2020, the World Health Organization declared a pandemic due to a new virus, known as SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2). Faced with exposure to cross-contamination due to the use of aerosols from rotary instruments, saliva, and nasopharyngeal secretions, health professionals had to explore alternative methods for removing decayed tissue, such as BRIX-3000, a papain-based enzymatic gel used for the chemical-mechanical removal of infected decayed tissue using manual instruments, with the aim of reducing the risk of contamination for the dental team. Thus, this paper aims to report a clinical case, using the BRIX-3000 in the removal of carious tissue. An 8 year-old patient complained of sensitivity in teeth 55 and 65, and was proposed removal of decayed tissue by means of chemical-mechanical removal. The procedure was performed without anesthesia, under relative isolation. The enzymatic gel was taken to the cavity following the manufacturer's directions, and after 1 minute the infected tissue was removed by curettage. Then the cavity was prepared, using cotton for washing and drying, avoiding the triple syringe and the formation of aerosols. Glass ionomer was used as a provisional material. It can be concluded that the papain-based enzymatic gel had great efficacy in removing decayed tissue, besides reducing aerosolization and, thus, contamination, making clinical care safer against the spread of infectious and contagious diseases, before the Covid-19 pandemic.

Keywords: Dental Caries. Papain. Covid-19. Dentistry. Pandemics.

Resumo

Em 2020, a Organização Mundial da Saúde declarou uma pandemia devido a um novo vírus, conhecido como SARS-CoV-2 (Síndrome Respiratória Aguda Grave Coronavírus 2). Frente à exposição de uma contaminação cruzada, devido à utilização de aerossóis advindos dos instrumentos rotatórios, salivas e secreções da nasofaringe, os profissionais da saúde precisaram explorar métodos alternativos para remoção do tecido cariado, como no caso o BRIX-3000, um gel enzimático a base de papaína, utilizado na remoção químico-mecânica do tecido cariado infectado, por meio de instrumentos manuais, com o objetivo de diminuir o risco de contaminação da equipe odontológica. Posto isto, esse trabalho visa relatar um caso clínico, utilizando o BRIX-3000 na remoção do tecido cariado. Paciente, 8 anos, procurou atendimento queixando-se de sensibilidade nos elementos dentais 55 e 65. Foi proposto a remoção do tecido cariado por meio da remoção químico-mecânica. O procedimento foi realizado sem anestesia, sob isolamento relativo. O gel enzimático foi levado a cavidade seguindo as orientações do fabricante, decorridos 1 minuto iniciou-se a remoção do tecido infectado por meio de curetagem. Em seguida a cavidade foi preparada, utilizando algodão para lavagem e secagem, evitando a seringa tríplice e a formação de aerossóis. Como material provisório utilizou-se o ionômero de vidro. Diante do caso, pode-se concluir-se que o gel enzimático a base de papaína teve grande eficácia na retirada do tecido cariado, além de reduzir a aerossolização e, assim, a contaminação, tornando o atendimento clínico mais seguro contra a disseminação de doenças infectocontagiosas, frente a pandemia da Covid-19.

Palavras-chaves*: Cárie Dentária. Papaína. COVID-19. Odontologia. Pandemias.*

1 Introduction

At the end of December 2019, in the city of Wuhan located in China, the first case of Covid-19 (*coronavirus disease*), originated from a new type of virus, known as SARS-COV-2 (Severe Acute Respiratory Syndrome Coronavirus 2), which rapidly spread throughout the world, occurred. Leading the World Health Organization (WHO) to decree pandemic status on March 11st, 2020[1].

This virus belongs to the Coronaviridae family and is divided into four groups (alpha, beta, gamma and delta). The alpha and beta types affect the respiratory, gastrointestinal and central nervous function of mammals and humans, whereas the gamma and delta types have as their main target birds[2]. It is not yet known how the virus originated, but it has been reported that it binds to a receptor called ACE-2 of human cells[2]. ACE-2 receptors are present in the respiratory tract, especially in type II alveolar cells of the lung, heart, kidney and/or gastrointestinal tract, among others. Inside the oral cavity it is present in tongue epithelial cells, in the salivary glands ducts and other oral and gingival tissues[3].

It has high transmissibility, and can infect people through sneezing and coughing or secretions of the airways, blood and saliva. Since the tongue has a higher transmission expressiveness, it makes the oral cavity a high risk route of

infection[3,4], thus impacting the health area, which has led to changes in forms of care, including the surgeon-dentist, since dental procedures involve exposure to saliva and nasopharynx secretions, besides the production of aerosols and droplets through high-rotation pens, ultrasonic apparatus and triple syringe[3-5].

Restorative dentistry, traditionally, is used in rotational instruments in cavitary preparations for removal of dental caries. However, this technique presents production of a large quantity of aerosols impregnated with bacteria, fungi and viruses that are suspended in the air leading to the risk of contamination of the dental team. Thus, in addition to the biosafety care already adopted in clinical practice by the dental surgeon and those recommended by WHO against the coronavirus, there is a need for discussion about new approaches in restorative clinical intervention in order to reduce or eliminate the production of aerosols, in order to minimize the risk of cross-contamination of Covid-19[5-9].

In view of this discussion, Removal of Partial Caries (RPC) is an ideal non-invasive alternative for the pandemic moment, since it minimizes aerosol and prevents the spread of the virus in the environment, since it does not use rotational instruments[6-9]. This minimal intervention consists of the selective removal of the carious lesions, which can keep an affected dentin layer in the wall that can be demineralized, leading to the maximum preservation of the dental structure, to a greater comfort to the patient and a lower chance of pulp exposure, in addition to dispensing anesthesia[7-11].

There are several techniques that can be mentioned within the minimally invasive approach, and one of them is the chemical and mechanical removal of the dental caries[10-13], which includes the use of a papain-based compound product, called BRIX-3000[10,11], which chemically softens the tissue that cannot be re-mineralized and allows it to be removed using hand tools. Basically, the chemical action results from the interaction of papain with the exposed collagen, causing the dissolution of dentin minerals and bacteria, making infected dentin more softened, which facilitates its removal with the use of non-cutting instruments[10-15].

BRIX-3000 was launched in 2012 as a differential of a product also the base of papain widely used since its launch in 2003, in the chemical-mechanical removal of the dental caries, *Papacárie*, composed of papain, chloramine, thickener and toluidine blue. The difference between these products is that BRIX-3000, according to the manufacturers, has the quantity of papain altered (3,000 U/mg at 10% concentration) and is bioencapsulated by EBE technology, which provides the gel with the ideal pH to immobilize enzymes and release them only at the time of proteolysis on collagen[12,13].

Therefore, the objective of this study is to report a clinical case of chemical-mechanical removal of the dental caries using the enzymatic gel BRIX-3000, aiming at reducing the production of aerosols to prevent the spread of COVID-19.

2 Report and Development of the Clinical Case

For follow-up and recording of procedures, a clinical record was completed, in which personal data, main complaint, general health data, confirmation of the Covid-19 vaccine and negative (RT-PCR) test for SARS-CoV-2 virus were collected, as well as receiving the informed consent form, which contained the purpose of the care, reporting of discomforts and recommendations to be followed during the treatment.

An 8-year-old female patient sought care at the Universidade Paranaense (Headquarters), accompanied by the mother, complaining of sensitivity in the posterior teeth, exceptionally in the dental elements (55 and 65) (Figure 1). After anamnesis and clinical examination, the presence of dental caries was detected in the pointed dental elements, as well as in some anterior teeth. Since the main complaint was related to elements 55 and 65, radiographic examination was performed, which showed absence of periapical lesion and cold sensitivity test, obtaining a positive response.

Figure 1- Initial picture: presence of dental caries in the dental elements 55 and 65

Source: The authors.

For the treatment, partial removal of the dental caries was proposed by means of chemical-mechanical removal of the caries, using papain-based gel BRIX-3000 (Brix Medical Science/Carcañá/Argentina, Ortodente/Belo Horizonte, MG) (Figure 2), as an ideal non-invasive alternative for the pandemic moment, since this procedure does not make use of rotatory instruments, thus minimizing aerosolization.

Figure 2 - BRIX-3000 Papain-based Gel (Brix Medical Science/ Carcañá/Argentina, Ortodente/Belo Horizonte, MG)

Source: The authors.

The procedure was performed without anesthesia, under relative isolation of the operative field with dental rolls and use of a sucking device, following the principles of atraumatic restorative treatment (ART).

The papain-based BRIX-3000 gel (Brix Medical Science/ Carcañá/Argentina, Ortodente/Belo Horizonte, MG) was taken to the dental element cavity 65 (through a dental excavator (number 2) - Kit ART Duflex (SS/White, Rio de Janeiro/RJ), leaving it to act for about 2 minutes (Figure. 3), following the manufacturer's guidelines. After 1 minute, the formation of oxygen bubbles was observed and the gel that initially presented translucent green staining became turbid (Figure 4). After this time, the infected tissue was first removed in the surrounding walls by curettage performed with dental excavator (number 2) - Kit ART Duflex (SS/White, Rio de Janeiro/RJ) and then the infected dentin from the pulp wall was mixed with the gel being easily removed (Figure 5).

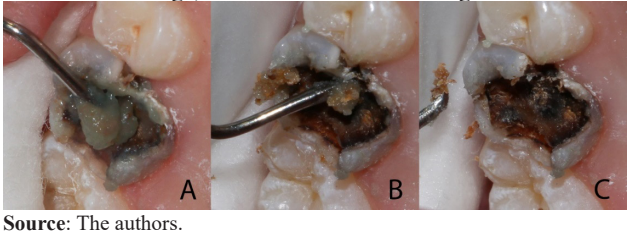
Figure 3 - Application of BRIX-3000 papain-based gel, leaving it to act for 2 minutes

Source: The authors.

Figure 4 - BRIX-3000 reaction to infected tissue. Formation of oxygen bubbles and change of translucent green staining to turbid staining after 1 minute of gel application

Source: The authors.

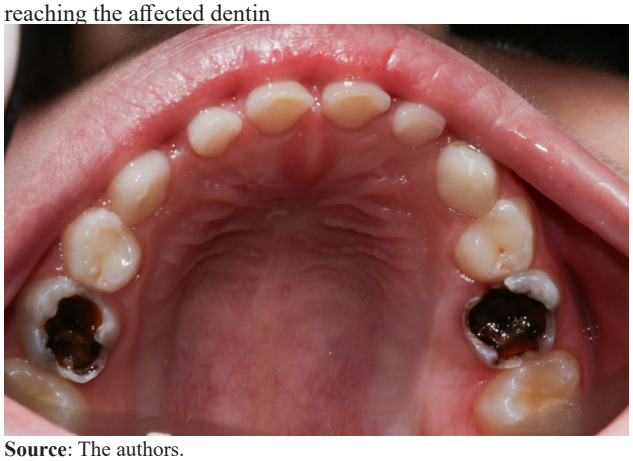
Figure 5 - Infected dentin removal sequence. A – gel application, B – lesion curettage, C – Carious material being removed



Source: The authors.

After removal of all the gel, the cavity was cleaned with moistened cotton, avoiding the water and air of the triple syringe, with the objective of not generating aerosols and dry with cotton. The manufacturer advises that as many applications as necessary should be performed to remove all the infected carious tissue. In this case, after the first application, we have already noticed that all infected tissue had been removed, since only dentin "chips" were present when using the excavation, in addition to acquiring a vitreous aspect (Figure 6). At this moment, there was a complaint of pain sensitivity on the part of the patient, thus confirming the presence of affected dentin.

Figure 6 - Vitreous aspect of the cavity after the 1st application of the gel, demonstrating that the infected dentin was removed, reaching the affected dentin



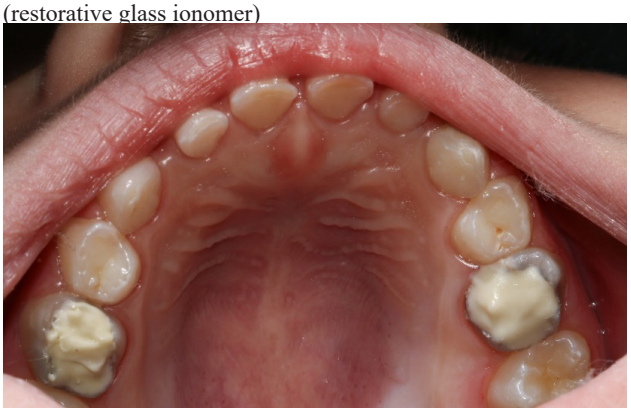
Source: The authors.

The cavity was then washed with chlorhexidine solution (0.2%) (Loção Dermo Suave Riohex 0.2% - Rioquímica, São José do Rio Preto/SP) for the removal of dentinary residues and then dried with cotton. For the pre-treatment of dentin and enamel, acid conditioning of the cavity was performed with 11.5% polyacrylic acid (Vitro Conditioner- DFL/Rio de Janeiro/RJ). The conditioner gel was applied with micro brush (kg Brush - KG Sorensen Extra Fine, Cotia/SP), leaving it to act in the cavity for 20 seconds. Then, both enamel and dentin were washed with moistened with cotton and dried with cotton. The restorative material (Vidrion R-SSWhite, Rio de Janeiro/RJ) was prepared in the proportion of 2 drops of the liquid for two measurements of powder, bonded and spatulated in glass plate, with plastic spatula.

The material was inserted into the cavity by means of a Centrix syringe (Centrix-DFL system, Rio de Janeiro/RJ) (Figure 7), in order to avoid bubbles during insertion of the material. Setting time was observed, performed removal of excesses with Holemback #3S type instruments and restoration protection with cavitary varnish (Varnal- Biodinâmica, Ibiporã/PR), being the same applied with micro brush (kg Brush - KG Sorensen Extra Fine, Cotia/SP) in 3 layers and occlusion check. The same procedure was performed in the dental element 55. Patient was oriented to return after 7 days for the treatment of the other teeth and to finish the definitive

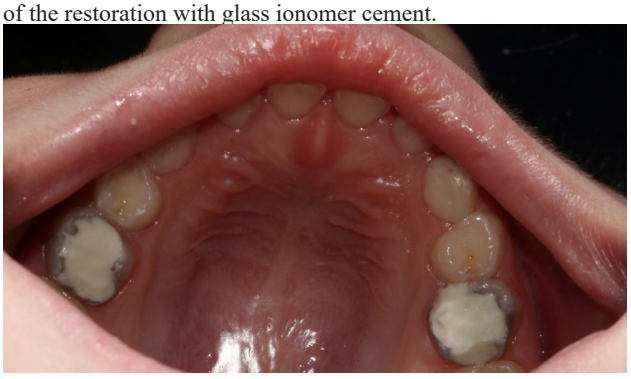
restorative procedure. Figure 8 shows the clinical aspect of the teeth (55 and 65) after completion of the restoration with glass ionomer cement.

Figure 7 - Insertion in the cavity of a temporary material (restorative glass ionomer)



Source: The authors.

Figure 8 - Clinical aspect of the teeth (55 and 65) after completion of the restoration with glass ionomer cement.



Source: The authors.

2.1 Discussion

Faced with the pandemic by COVID-19, professionals and staff needed to modify the care protocols to avoid the spread of the virus and reduce the risk of contamination among patients, professionals and staff, prioritizing the performance of minimally invasive procedures, in an attempt to reduce or eliminate the production of aerosols[1-5]. With this, many clinics have reduced patient access, limiting activity to urgent and emergency care[6,16,17].

The American Dental Association[18] decreed on March 16th, 2020 that dentists should postpone elective treatments, only attending cases of urgency and emergency. This decree, with the passing of the months, was changing according to each country and state. In Brazil, the guidelines of the National Agency for Sanitary Surveillance (ANVISA)[19], with the support of the Federal Council of Dentistry, have guided procedures that can generate aerosols during care, and should suspend them in suspected and confirmed cases of Covid-19[20] infection.

Urgent procedures are considered, acute dental pain, due to inflammation of the dental pulp (pulpitis); extensive caries or restorations with problems that are causing pain; pericoronitis; postoperative alveolitis; abscesses (dental or periodontal) or bacterial infection, resulting in localized pain and edema; fracture or dental trauma; cementation or fixation of fixed crowns or prostheses; adjustment or repair of removable prostheses that are causing pain or with the involved chewing function; replacement of intracanal medication for endodontics in cases of pain or pulp necrosis; adjustments/ replacement of orthodontic device that is ulcerating the oral mucosa[16].

On the other hand, the procedures considered as emergency are uncontrolled bleeding; diffuse cellulitis or bacterial infections, with edema, with intraoral or extra-oral localization, and potential risk of airway impairment of patients; trauma involving the bones of the face, with potential involvement of the patient's airway[16].

At the beginning of the second semester, the elective consultations were resumed, according to the situation of each place (state and/or municipality). With this, fear, caused by the lack of information about the transmission of this virus, provided the emergence of new strategies such as temperature measurement before the visit, patient cheeks with 1% or 1.5% hydrogen peroxide or 0.2% povidone. In addition to greater severity on the use of existing ones, thorough surface disinfection after each care and full use of protective equipment: beanie, glasses, N95-type mask, face-shield, gloves and white coat[6].

In addition to the enhanced biosafety measures in dental care, there is also the need for greater professional attention in relation to the therapy indicated for treatment, aiming especially at reducing or eliminating aerosols, since scientific evidence has shown the transmission of the virus through these[1-5,9,19]. Thus, it is important to prioritize the replacement of the use of a high-speed turbine and triple syringe, by alternative measures, such as a low-rotation pen, manual instruments and irrigation with saline solution, and the non-use of dental cuspidors[5,6,19,20].

It is known that rotatory instruments generate an expressive amount of oral fluids in dental cavitary preparation procedures, which can contaminate within a radius of up to 2 meters, and these droplets are small enough to penetrate deeply into the lungs[3,8,9]. In view of this, it is pertinent to use minimally invasive techniques in restorative dentistry, which do not use rotatory instruments, reducing or eliminating aerosol and, consequently, contamination, resulting in greater safety in clinical care in relation to the transmission of infectious diseases[3,6,8,9,19-21].

Moreover, the use of these techniques presents advantages such as reduction of painful symptoms during the procedure, elimination of sound discomfort and preservation of healthy dental structure, allowing the patient to repair the disease without damage to the esthetics or quality of the treatment[7,12-15].

Within the minimally invasive approach, some techniques can be mentioned, such as: chemical and mechanical removal of caries injury, atraumatic restorative treatment (ART), use of fluorine varnishes, sealants, silver diamine fluoride,

among others. Chemical and mechanical removal of caries has demonstrated positive aspects regarding disease control. This technique consists of the use of a chemical agent that provides the softening of the dentin carious tissue, favoring its removal with the use of non-cutting instruments, preserving to the maximum the healthy dental structure[7,12-15].

The first published studies on chemical-mechanical removal agents of caries were in 1975, introducing a method using 5% sodium hypochlorite, to which sodium hydroxide, sodium chloride and glycine were later added, originating GK-101. This product was effective in the removal of carious dentin, but it presented the disadvantage of doing it very slowly. Faced with the failure of the GK-101, manufacturers launched, based on the same formula, the Caridex which was also unsuccessful because it presented limitations such as high cost, the need to apply large quantities and a short life. Despite this, the search for a chemical-mechanical agent that would meet the desired clinical requirements did not cease, and in 2003 was made available in the Brazilian market, with the aim of being used in the public health service due to its low cost, *Papacárie*, whose composition contains basically papain, a protein extracted from papaya, chloramine, thickener and toluidine blue. This product presented itself as a promising alternative for the preservation of healthy dental tissue and for the treatment of patients with aversion to dental care[13].

However, the chemical-mechanical agent selected in this clinical case was BRIX-3000, which was launched in 2012 and presented as a differential of *Papacárie* in its concentration of papain (3,000 U/mg at 10% concentration), which was bioencapsulated by EBE technology. This technology is a unique Brix *Medical Science* bioencapsulation technique that allows proteolytic enzymes to be immobilized and released only at the time of proteolysis on degraded collagen, causing an increase in enzyme activity from 50 to 60%. Furthermore, as an endoprotein similar to human pepsin, papain has antibacterial, bacteriostatic and anti-inflammatory action, which contributes to a more accelerated healing repair, since it only acts on the injured tissue, since the plasma does not have alpha-1-antitrypsin, the antiprotease responsible for inhibiting protein digestion in normal tissues. In the carious tissue, collagen is partially degraded and papain acts on it due to its ability to digest dead cells[7,13].

The minimally invasive treatment determines that the most external layer of caries lesion, infected dentin, is removed, since it is a dead, irreversibly denatured, infected and non-demineralized tissue, and the most internal layer, the affected dentin, is maintained, since it is a vital, sensitive, reversibly denatured tissue, slightly infected or not infected and demineralized. Thus, the difficulty of treatment is to determine when to stop dentin removal and the use of the chemical-mechanical agent favors this aspect, because its direct action on the predegraded collagen facilitates the removal of the dental caries with manual instruments[7,12-15].

The chemical-mechanical agent is indicated in the case of dental caries with cavitations without pulse involvement, following the doctrine of minimally invasive restorative treatment. Thus, this citation is in accordance with the data obtained by anamnesis, clinical and radiographic examination: absence of periapical lesions, absence of pulsed pain, positive sensitivity test, and presence of sufficient dental structure[7,12-15].

In addition, the choice of the enzyme gel BRIX-3000 in this clinical case, in addition to the advantages of being a successful, atraumatic and conservative treatment, was also due to its characteristic of not using rotatory instruments, since this way it minimizes the aerosolization and prevents the spread of the Covid-19 virus.

3 Conclusion

The use of minimally invasive techniques, as in the case of the enzyme gel BRIX-3000, has proved to be, in the context of the COVID-19 pandemic, an affordable alternative against the dissemination of aerosols, with good cost-benefit and efficient control of caries disease.

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