REVISTA CIÊNCIAS e ODONTOLOGIA

ACRYLIC INDEX ON TOOTH FRAGMENT REATTACHMENT: A CLINICAL TECHNIQUE

GUIA DE ACRÍLICO NA RECOLAGEM DE FRAGMENTO DENTÁRIO: UMA TÉCNICA CLÍNICA

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Resumo

Introdução: Fraturas coronárias são comuns na odontologia. A recolagem de fragmentos é uma opção de tratamento restaurador previsível que oferece várias vantagens, incluindo benefícios estéticos, preservação da estrutura dentária remanescente e aceitação imediata do paciente. No entanto, a técnica pode apresentar desafios, como manuseio adequado e a possibilidade de recolocação na posição incorreta. Além disso, o uso inadequado de materiais intermediários pode levar a resultados clínicos desfavoráveis. **Objetivo:** Este caso clínico descreve o passo-a-passo de uma técnica apresentada anteriormente para recolocação de fragmento coronário anterior usando um guia de acrílico. Ele também discute aspectos importantes sobre materiais e técnicas que devem ser incentivados na prática clínica para melhorar o resultado clínico e a longevidade do procedimento. **Material e métodos:** Paciente, sexo masculino, 9 anos, com fratura no incisivo central superior direito. O fragmento, armazenado em água da torneira, foi reposicionado usando um guia de acrílico. Após ataque seletivo e aplicação de adesivo, o fragmento foi recolocado sob anestesia local e isolamento absoluto, seguido de polimento e acompanhamento. **Resultados:** O fluxo de trabalho proposto utilizando um guia acrílico oferece um manuseio preciso do fragmento dentário, garantindo sua estabilidade, colocação adequada, posicionamento e colagem sem qualquer preparação dentária, aumentando a confiabilidade do procedimento. **Conclusão:** A recolocação de fragmento de coroa fraturada é uma abordagem econômica e deve ser considerada como o tratamento de escolha quando o fragmento é adequado. A combinação de materiais de colagem apropriados com um guia acrílico pode melhorar significativamente os resultados clínicos, garantindo o posicionamento preciso do fragmento.

Palavras-Chave: Traumatismos Dentários; Fraturas dos Dentes; Fraturas Coronárias; Trauma Dental; Colagem de Fragmento Dentário

Abstract

Introduction: Coronal fractures are a common occurrence in dental practice. Fragment reattachment is a predictable restorative treatment option that offers several advantages, including aesthetic benefits, preservation of remaining tooth structure, and immediate positive emotional response from the patient. However, reattaching fragments can present challenges such as proper handling and the possibility of incorrect reattachment. Moreover, improper use of adhesive materials may lead to unfavorable clinical outcomes. **Objective:** This report presents a clinical case describing step-by-step a previously presented technique for reattaching anterior crown fragments using an acrylic index. It also discusses important aspects regarding materials and techniques that should be encouraged in clinical practice to enhance the clinical outcome and longevity of the procedure. **Material and Methods:** A 9-year-old male patient with a fractured maxillary right central incisor was treated. The fragment, stored in tap water, was repositioned using an acrylic index, which facilitated precise alignment. After selective etching and adhesive application, the fragment was reattached under local anesthesia and rubber dam isolation, followed by polishing and clinical follow-up. **Results:** The proposed workflow utilizing an acrylic index offers a precise handling of the tooth fragment, ensuring its stability, proper placement, positioning, and bonding without any tooth preparation, thus increasing the reliability of the procedure. **Conclusion:** Fractured crown fragment reattachment is a cost-effective approach and should be considered as the treatment of choice when the fragment is suitable. Combining appropriate bonding materials with an acrylic index can significantly improve clinical outcomes by ensuring accurate fragment positioning.

Keywords: Tooth Injuries; Tooth Fractures; Crown Fractures; Dental Trauma; Fragment Reattachment.

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INTRODUCTION

Traumatic dental injury (TDI) is a distressing experience and a significant public dental health concern. Immediate treatment is necessary due to the dental damage and psychological trauma experienced by the patient and their parents. A 12-year literature review revealed that 25% of school children and 33% of adults had encountered trauma to their permanent dentition[1], with crown fracture being the most frequently reported.[2,3] The majority of cases involve uncomplicated fractures, characterized by enamel and dentin damage without pulp exposure.[2,3] Such fractures predominantly occur in the maxillary central and lateral incisors.[1,3] Invasive treatment options were commonly employed in the past. However, advancements in composite materials and adhesive protocols have enabled clinicians to restore fractured teeth while preserving the remaining dental structures.

Nonetheless, restorations with resin composite have certain drawbacks, including lower abrasion resistance compared to natural enamel, challenges in shade matching, difficulties in maintaining polishing and color, as well as reported sensitivity.[4] When a relatively intact tooth fragment is available, it can be bonded back to the tooth,[5] thereby maintaining the natural characteristics of wear, shape, surface texture, and color. This technique, known as fragment reattachment, represents a simple, conservative, fast, and cost-effective treatment option, which can yield immediate positive effects on the patient's self-esteem.[6,7]

However, the reattachment technique may present challenges, such as inadequate positioning and bonding of the fragment.[8,9] To mitigate this issue, it is crucial not only to consider the materials used and how the fragment fits the remaining tooth structure but also to establish a reference for the proper positioning of the fragment.[6,8-10] This report describes a previously presented technique involving the use of an acrylic index to hold the fragment, facilitating its handling, placement, reattachment, and cementation in the correct position.[8-11] Additionally, it discusses aspects related to the materials and techniques that should be encouraged clinically to achieve better results and ensure the longevity of the procedure.

CASE REPORT

A 9-year-old male patient was referred to the Dental Trauma Prevention and Treatment Project at University Hospital of Brasilia (HUB), DF-Brazil, with a history of traumatic dental injury (TDI) to the maxillary right central incisor following a fall (Figure 1). Previous treatment had been provided in a private practice, but the crown fragment became dislodged within a few days. The fragment was stored in tap water for five days (Figure 2). Upon extraoral examination, no signs of contusions, lacerations, or bone fractures were detected. Intraoral soft tissues appeared normal. Clinical evaluation of the fractured tooth included assessing mobility and vitality. The tooth exhibited physiologic mobility for an upper central incisor, and sensibility testing with EndoIce spray (Maquira, Maringá, PR, Brazil), percussion, and palpation indicated normal pulp response. A periapical radiograph confirmed an uncomplicated fracture involving enamel and dentin in the middle third of the crown.

Figure 1: Frontal retracted view of the fractured central incisors

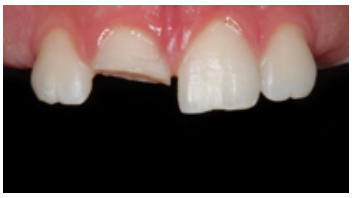
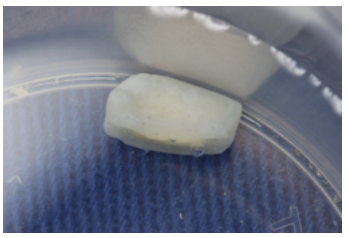


Figure 2: Aspect of fragment stored in a tap water



After assessing the tooth structure and the fractured fragment, it was noted that the marginal adaptation was not ideal (Figure 3). Excess lining material and resin composite from the previous

cementation technique were identified (Figure 4A, 4B). The hydroxide calcium cement and resin composite were removed using curettes and blade #12 (Figure 4C), resulting in improved fragment adaptation to the tooth structure (Figure 5A, 5B). The procedure was performed under local anesthesia and modified rubber dam isolation, ensuring a moisture-free environment. The color of the composite resin for cementation was selected before this stage, with medium opacity body resin (Filtek Z350 XT A1B, 3M Oral Care, St. Paul, MN, USA) being used in this case.

Figure 3: Frontal and palatal view of fragment fit – without remove any previous cementation material.

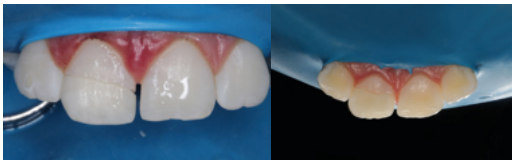
Figure 4: A-B, View of fragment with composite resin and hydroxide calcium cement. C, Fragment after removing of previous materials with curettes and scalpo blade.

A)

B)

C)

Figure 5: A, Frontal view and B, Palatal view: The fragment was adapted to the tooth remnant and kept in place with a thin layer of resin composite.



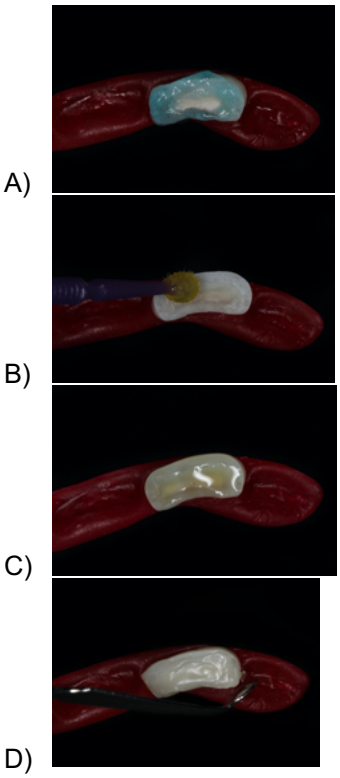
Prior to the reattachment procedure, both the fractured tooth and fragment were cleaned using pumice and water with a low-speed Robson brush. The fragment was positioned and stabilized with a small amount of composite resin, without prehybridization, while adjacent teeth were isolated with petroleum jelly. The fragment was not isolated, as it needed to be attached in the index. An acrylic resin (Dencor Clássico, São Paulo, Brazil) with low contraction was chosen to fabricate the index, which wrapped around the buccal and palatal surfaces (Figure 6). The index was limited to the incisal edge, avoiding extension beyond the prosthetic equator of the tooth, and it exposed the entire line of union. This technique facilitated the removal of excess bonding material during cementation and assisted in the manipulation and insertion of the fragment.8,9 The index was easily detached from the lubricated teeth while holding the fragment, and the resin stabilizing the fragment in position was removed using a #12 blade.

Figure 6: An Acrylic Index was made with the fragment in position, wrapping the incisals surface of incisors teeth and leaving the entire fracture line visible.

Subsequently, the fragment, still attached to the index, was selectively etched with 37% phosphoric acid gel (Attaque Gel, Biodinâmica, Ibiporã, PR, Brazil) for 30 seconds, followed by washing, air drying, and the application of an adhesive system (Single Bond Universal, 3M Oral Care, St. Paul, MN, USA) without polymerization (Figure 7A, 7B, 7C). The surface was air dried, and

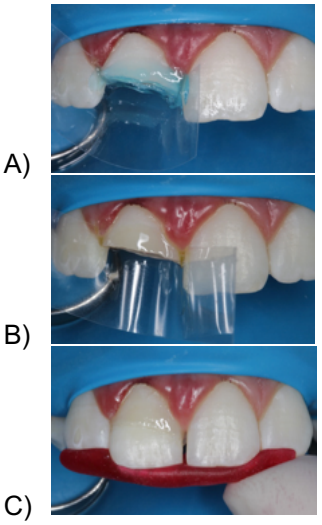
a single increment of body resin B1 (Filtek Z350 XT, 3M Oral Care, St. Paul, MN, USA) was placed over the fragment, being kept away from light or heat sources until the reattachment step (Figure 7D).

Figure 7: A, Enamel of the fragment was etched with 37% phosphoric acid gel. B, Aspect of the etched fragment. C, A single-component adhesive material was applied actively. D, one tinny increment of Body resin was applied on the fragment.



Briefly, the entire procedure was conducted in an ideal moisture-free environment. The remaining tooth structure was selectively etched with 37% phosphoric acid (Attaque Gel, Biodinâmica, Ibiporã, PR, Brazil) for 30 seconds, followed by thorough rinsing and air drying. The adhesive system (Single Bond Universal, 3M Oral Care, St. Paul, MN, USA) was actively applied to the surface for 20 seconds (Figure 8A, 8B), followed by air drying. The adhesive was polymerized only during the cementation process to avoid interference with positioning. The acrylic resin index, containing the fragment and filled with resin, was brought into contact with the remaining tooth, with digital pressure applied to allow the excess material to flow and fill any gaps (Figure 8C). Excess resin was removed with a spatula and brush before curing. Curing was accomplished using a Radii Xpert LED unit (SDI, Bayswater, Victoria, Australia) with a light intensity of 1500 mW/cm2, for 20 seconds on the vestibular and palatal surfaces of the tooth.

Figure 8: A, the tooth was selectively etched with 37% phosphoric acid gel for 30 seconds. B, the adhesive was applied on the tooth. C, the fragment was positioned with the aid of the acrylic index.



After removing the acrylic index, excess resin was carefully removed with a #12 blade (Figure 9A), and the occlusion was checked. Final cementation was completed, and the restoration was polished using a combination of sandpaper strips (Epitex, GC Corporation, Tokyo, Japan), abrasive discs (Sof-Lex Polishing disks, 3M Oral Care, St. Paul, MN, USA), and a polishing system (Diacomp Plus, EVE American Inc., Naples, FL, USA) to achieve a high gloss and smooth surface (Figure 9B, 9C). This ensured improved wear resistance, reduced biofilm retention, and minimized marginal staining. The final appearance of the reattached tooth and the polished restoration can be seen in Figure 10.

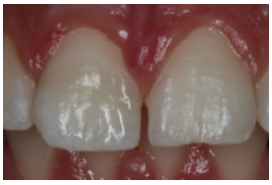
Figure 9: A, Excess composite was removed using a scalpo blade 12 #. B, finishing procedure made with sandpaper strips. C, Polishing procedure made with silicon disks.

A)

B)

C)

Figure 10: Final aspect of the tooth fragment reattachment.



A small chip on the incisal edge of the maxillary left central incisor was restored with composite using a single shade (Filtek Z350 XT A1B, 3M Oral Care, St. Paul, MN, USA) (Figure 11A, 11B). According to the International Association of Dental Traumatology (IADT) guideline, clinical and radiographic follow-up examinations were conducted at six weeks and one year. The patient was satisfied with the outcome, despite the visible union line. After a two-year follow-up, all aspects of the examination demonstrated a successful bond between the hydrated fragment and the vital tooth (Figure 11C).

Figure 11: A, Protrusive movement postoperative-smile view. B, One week after fragment reattachment and incisal restoration – buccal view. C Final outcomes in protrusive movement- Fragment reattached (11) and incisal restoration (21) after 2 years follow-up.

DISCUSSION

The reattachment technique is a reliable treatment option for restoring aesthetics and function in cases of tooth fracture. It is considered the treatment of choice when the fragment is properly saved after a traumatic incident.[5-15] Several assessments need to be performed before reattaching a tooth fragment, including clinical and radiographic evaluations, mobility and sensibility tests of the remaining tooth.[5] Additionally, the fragment should be relatively intact and exhibit good marginal adaptation to the fractured tooth.[8,14]

The storage condition of the fragment is a crucial consideration in tooth fragment reattachment. Various studies have investigated different storage methods to maintain hydration. Some studies suggest storing the fragment in saline or milk to maintain hydration.[16] Alternatively, storage for at least 2 hours, in solutions such as egg white and 50% dextrose have been found to provide higher bond strengths.[17] Other options, including coconut water, artificial saliva, and tap water, have demonstrated that even a 1-hour hydration period can yield bond strength values comparable to fragments stored for 24 hours.[18] Furthermore, a

vitro study indicated that rehydrating fragments for 15 minutes before bonding can sufficiently increase moisture levels and enhance reattachment strength, particularly when using a multimode adhesive.[19] These findings highlight the importance of adequate hydration before the reattachment procedure. Several studies have shown that storing the fragment in any liquid medium is superior to keeping it dry.[16-19] However, there is currently no consensus in the literature regarding the ideal storage solution for reattaching fractured tooth fragments.

It is important to acknowledge the potential disadvantages associated with tooth reattachment. A significant consideration is the impact on aesthetics, as the fragment may undergo dehydration after the fracture, resulting in a compromised appearance and a potential inability to recover its original color.[20] However, Toshihiro and Rintaro presented a one-year clinical follow-up in which the crown fragment was kept in dry conditions for 12 days prior to bonding. Interestingly, after 1 month of cementation, the fragment exhibited some restoration of its original color and translucency due to intraoral rehydration.[13] Therefore, the replacement of the crown fragment should still be considered even if it does not initially recover its original color,[13] and regular follow-up examinations are necessary to assess the long-term stability and appearance of the reattached tooth.[10]

The selection of appropriate techniques and materials for reattachment procedures in dentistry involves many factors. Several studies have explored the fracture strength of various restorative materials and designs used for reattaching anterior fractured teeth. Bhargava et al. found that nanocomposites exhibited the highest mean fracture strength values with both simple bond and chamfer designs[21] Toshihiro and Rintaro utilized composite resin filled with a double chamfer margin in the fracture line to reinforce the bonding site.[13] Reis et al. concluded that the combination of materials is as important as prior preparation when evaluating fracture resistance.[22] Conversely, Chazine et al. reported that while the choice of materials may not significantly influence the outcome, the preparation technique, particularly the labial and lingual bevel, could have a positive effect.[23] A systematic review indicated that simple tooth fragment reattachment is the preferred technique for reattachment. [24] Moreover, an increase in bond strength between the tooth fragment and dentin was observed when an intermediate material was used. This was predominantly reported with an adhesive system using a composite material with favorable properties.[24-26] It is important to note that the use of liners and bases should be minimized, as they tend to decrease the bond strength of the rebounded fragment and compromise the overall esthetics of the case. When the pulp is not exposed, a meticulous adhesion protocol should be sufficient for pulp protection.[14,26] In the present case, the failure of the initial treatment attempt could be attributed to the use of excess lining material, which lacks adhesive properties. Additionally, the incorrect position of the fragment, as evident in Figure 3, may have contributed to the unfavorable outcome.

Proper handling and positioning of the fragment are critical for successful reattachment.[20] A retrospective study showed a high survival rate (84.4%) for reattached tooth fragments after dental trauma, indicating the potential value of relocating fragments that are recovered or saved.[27] Successful cases have utilized various techniques, such as flexible adhesive tips, [14,20] gutta-percha sticks, Godiva, [8] and free-hand placement.[13] In 2007, Alvares et al. showed a silicone index for improved handling, but concerns regarding obstructed views of the palatine.[6] Also small thickness can cause an elastic deformation of the silicone and change the fragment's position when some digital/finger pressure is applied.[8]

Although this clinical technique report is not original, it is crucial to highlight it due to its simplicity, cost-effectiveness, and advantages in handling and positioning. [8-11] This technique limits digital pressure during cementation, provides a clear visualization of the cementation line, allows for excess removal, and prevents fragment displacement,[8,9,11] as the acrylic undergoes slight polymerization contraction, firmly holding the fragment in place. The bonding technique employed in this case did not require any wear of the dental structure (such as bevels, chamfers, or other types) based on the principles of minimally invasive dentistry. [9,24] Any additional wear for aesthetic purposes should only be considered after hydrating the fragment, taking into account the

patient's aesthetic satisfaction and the cost-benefit of the additional structural wear.

Este tópico geralmente não é subdividido e existem várias maneiras de escrever uma boa discussão. Assim a forma que é proposta neste documento não é mandatária e, antes do autor adotar esta sequência de pensamento para a escrita da discussão, deve, antes, verificar a

natureza de seus dados, do trabalho que se tem em mãos e do tema em questão, uma vez que alguns dos itens descritos abaixo podem não ser aplicados em todos os trabalhos, assim como possam existir itens importantes em uma discussão que não estejam apresentados neste modelo.

Assim, sugere-se para a escrita da discussão a seguinte sequência de exposição: a) apresentação dos principais resultados, sem ser repetitivo, levando em consideração os resultados que foram descritos imediatamente antes; b) contestação dos resultados com a literatura, apontando, neste caso, os estudos que corroboram ou que contradizem os achados, contudo, sempre buscando elucidar o porquê das diferenças, levando em consideração a metodologia utilizada; a população; o tempo etc.; c) posteriormente a isso, o autor explicará o fenômeno, implantando aqui suas convicções, sempre apresentando dados ou mostrando a lógica que substancia a sua opinião; d) após dar suas contribuições para a área, é importante que o autor apresente as limitações do estudo, uma vez que não há trabalhos perfeitos nem acabados e sempre haverá algo a ser melhorado ou ampliado; e) agora é hora de falar da aplicabilidade do estudo, da relevância e das possíveis contribuições para a área; f) é importante, também, que o autor aponte suas percepções metodológicas para auxiliar no delineamento das futuras pesquisas.

CONCLUSION

The reattachment of fractured crown fragments represents a cost-effective method for restoring anterior fractured teeth and achieving functional and aesthetic restoration. When the fragment is suitable and properly saved, it should be considered as the treatment of choice. By employing the appropriate technique and using suitable bonding materials in combination with an acrylic index for accurate positioning of the fragment, excellent results can be achieved.

CONFLICT OF INTEREST: The authors deny any conflicts of interest related to this case report.

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