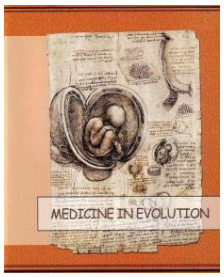
Biomimetic restoration of dental trauma in the frontal area



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Abstract

Aim and objectives: Dental trauma to the anterior teeth may involve only enamel or enamel and dentin, and in more severe cases may be found pulpal involvement which complicates the initial treatment. In these situations the affected teeth require an extended period of regular monitoring

Material and methods: A 12-year-old patient presented to the dental office with coronary fracture class II Ellis at the level of the left upper central incisor. The relevant history of the etiology of the injury was accidental fall during recreational activities.

Taking into account the fact that the patient was a 12-year-old child and the fractured coronary fragment was recovered, it was decided as a treatment solution to reattach the fractured fragment to the remaining coronary tooth.

Results: The technique of reattaching the recovered dental fragment respects the principles of biomimicry and allows obtaining a natural result, in terms of the optical characteristics of the future restoration

Conclusions: In the recall session, after a week, it was found that the restoration fits perfectly in the remaining dental tissues, requiring only minimal finishing touches in order to individualize the relief and surface texture, in accordance with those of the intact analog tooth and application of polishing operations

Keywords: biomimetic, trauma, fragment

INTRODUCTION

Coronary fracture is a shape disharmony that primarily affects the upper central incisors due to their position and the fact that they are the most proeminent teeth of the aesthetic area.

The therapeutic objectives in the case of dental traumas include: restoring oro-dental health, restoring functions, and finally obtaining a favorable aesthetic result for both the doctor and the patient.

There are situations in which the patient or relatives recover the part of the fractured tooth; in these cases an attempt is made to use the fragment which can be reattached to the remaining coronary abutment.

MATERIALS AND METHODS

Patient R.V., 12 years old, presented to the dental office with coronary fracture class II Ellis at the level of the left upper central incisor. The anamnesis of the relevant etiology of the lesion: accidental fall during recreational activities (Figure 1).

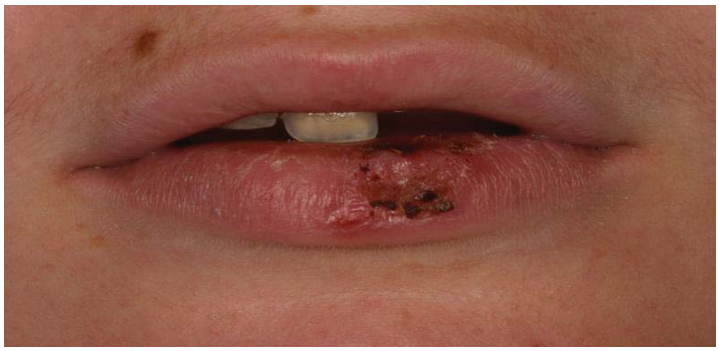

Figure 1. Rest position of the lips

The objective examination showed in addition to the absence of a portion of the crown of the central incisor and the existence of a post-traumatic wound healing, in the lower lip, which was sensitive to palpation and during functions.

Radiographic examination revealed an intact periodontal ligament, and the cortical bone had a typical, solid appearance; also, the integrity of the pulp chamber was found -at least in a two-dimensional image- (Figure 2).

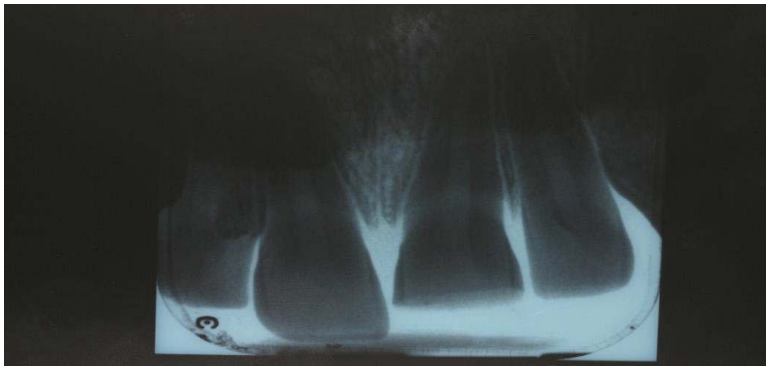

Figure 2. Retroalveolar radiography reveals the integrity of the pulp chamber and the absence of bone involvement

Vitality tests performed to establish a definite endodontic diagnosis revealed the presence of tooth vitality, while ruling out the existence of irreversible pulpal inflammation.

The presence of biofilm and tartar on the tooth surfaces indicates that the patient does not achieve a rigorous and correct oral hygiene, which led to the appearance of an incipient plaque gingivitis (Figure 3).

Figure 3. Fracture line at the incisor 2.1. the presence of plaque gingivitis and dyschromia of local, extrinsic etiology

Prior to the start of treatment, a professional hygiene was performed. Taking into account the fact that the patient was a 12-year-old child and the fractured coronary fragment was recovered, it was decided as a treatment solution to reattach the fractured fragment to the remaining coronary abutment.

In order to improve the fracture resistance of the complex to be restored (tooth-composite-reattached fragment), the fractured fragment was rehydrated by immersion in saline solution for 30 minutes.

Dam isolation was performed, which in addition to preventing intraoperative contamination, increases visibility on the operating field and provides comfort to the doctor (Figure 4).

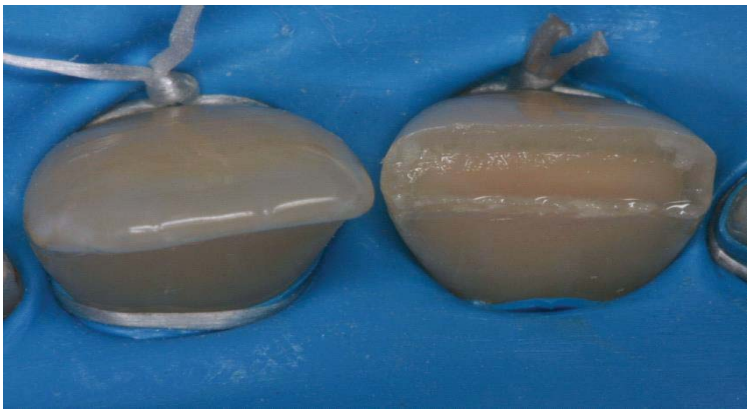

Figure 4. Fracture surface in the occlusal view

The next step was to make the adhesive substrate for both the tooth and the fractured tooth fragment. The technique of selective engraving was practiced, followed by the application of self-etching adhesive both at the level of the engraved enamel and at the level of the dentinal wound (Figure 5a, Figure 5b).

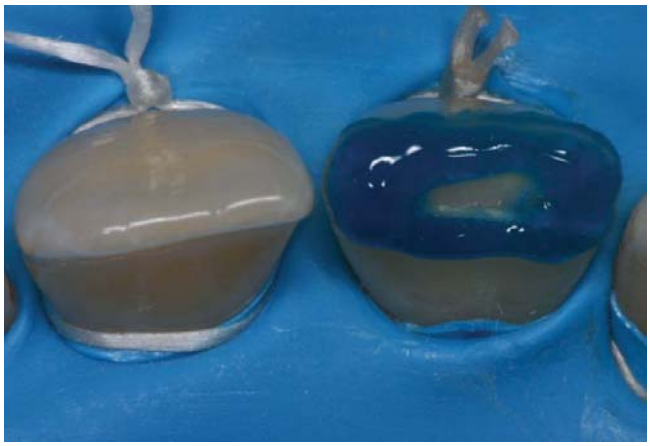

Figure 5a. Selelctive etching technique

Figure 5b. Etching enamel and dentine on the fractured fragment

The adhesive system used is of the latest generation - Scotchbond Universal Adhesive by 3M

The acid etching was done for 15 sec, and the adhesive was applied in abundance, stirring it for 20 sec, both at the level of the enamel and of the dentinal wound, from the level of both surfaces involved in the adhesion.

The next step was to reattach the fractured fragment to the remaining dental abutment using a composite flow resin; FiltekTM Ultimate Flowable (3M Espe) shade A2 was used, which was applied to the fracture surface of the tooth.
The fractured segment was carefully placed at the tooth using light digital pressure; the excess composite material was removed, after which it was photopolymerized for 40 sec from the vestibular and oral, taking care that during the polymerization reaction no positioning changes occur (Figure. 6).

Figure 6. The tooth after adhesive reattachment with Filtek™ Ultimate Flowable (3M Espe)

To strengthen the reattachment, a circumferential biconcave-concave bezel was made along the fracture line, approximately 1 mm wide; for this, a globular, fine-grained diamond cutter was used. On both sides of the bevel, both vestibular and palatal, the preparation of the enamel in the form of skirting was practiced, in order to extend the adhesion surface at the amellar level (Figure 7). The entire surface of the enamel prepared in the form of a bevel and skirting was finished with polystyrene with fine grain, to make the presence of the future restoration imperceptible optically.

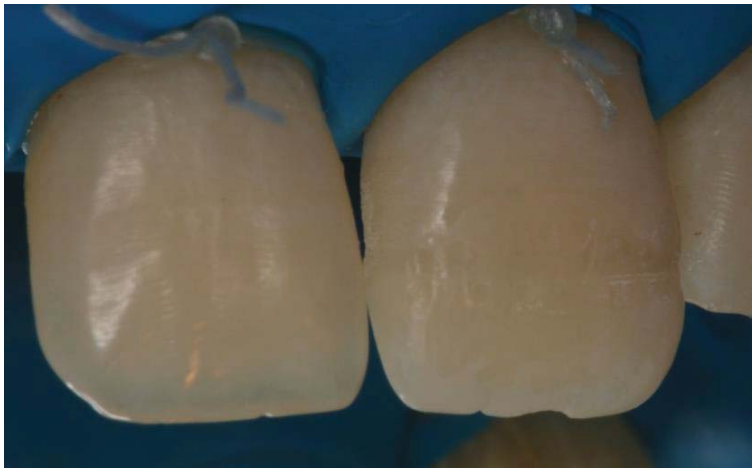

Figure 7. The buccal aspect of the enamel preparation

The tooth thus prepared was acid etched again, then the adhesive was applied, and after light curing a layer of resin with amelular translucency was applied - shade A2E, at the level of the circumferential preparation applied in enamel along the adhesive joint line.

This partial plating was done with FiltekTM Ultimate Universal (3M Espe), a high-performance nanocomposite that provides excellent aesthetics for restorations in the anterior area (Figure 8)

Figure 8. Tooth aspect after strengthening the adhesive reattachment with Filtek™ Ultimate Universal (3M Espe)

In the recall session, after a week, it was found that the restoration fits perfectly in the remaining dental tissues, requiring only minimal finishing touches in order to individualize the relief and surface texture, in accordance with those of the intact analog tooth and application of polishing operations (Figure 9).

Figure 9. The semi-profile view of the central incisors indicates similar surface and chromatic characteristics

Finishing and polishing the composite filling are the final stages of the treatment that ensures the desired aesthetics and longevity of the final result. These steps are necessary not only for the long-term stabilization of chromatics, but also to ensure oral health by reducing the accumulation of biofilm (Figure 10).

Figure 10. Oclusal view: morphological similarity between the two central incisors

One week after the end of the treatment, the disappearance of the edema from the lower lip is observed together with the healing of the abrasions (Figure 11).

Figure 11. The smile with the harmonious integration of the resoration at the level of the composition

The images in Figures 11 illustrate the restoration of dental aesthetics that is in harmony with the cleft lip and the smile line.

The patient will return to the dentist's office for regular check-ups in order to monitor the vitality of the tooth and, possibly, to make a splint to wear when practicing sports (to minimize the occurrence of other post-traumatic dental injuries).

RESULTS

The clinical results obtained demonstrate that the working technique is not difficult to perform, benefits from a lower cost price than other dental treatments and allows the restoration of the aesthetics and functionality of the tooth. This technique also eliminates the need to make the silicone shaper used to create the palatal surface when it is necessary to layer the composite material.

From a conservative and aesthetic point of view, the technique of reattaching the dental fragment is superior to prosthetic treatments for making veneers or other types of fixed

prosthetic restorations. Using this technique it is easy to obtain optimal long-term retentivity and adequate mechanical strength of the remaining tooth-fractured dental segment complex.

DISCUSSIONS

Reattachment of the dental fragment in case of trauma is described as a conservative and effective technique to restore the function and aesthetics of a patient who has been subjected to such an injury. This technique is advantageous because it preserves the original characteristics of the dental structure and maintains the occlusal stops which are sometimes difficult to reproduce when performing a restoration in the anterior area [1].

The success of this therapy is also dictated by the choice of adhesive materials that provide by their composition mechanical properties suitable for restoration and are biocompatible with dental and periodontal tissue [2]. It is important that during the restoration work, the insulation is of the best quality so as not to compromise the final results, so it is mandatory that during this procedure the dental dam is not missing from the operating field.

In all cases where patients have benefited from the technique of adhesive reattachment of the fractured dental fragment to the remaining coronary abutment, the importance of long-term monitoring is of utmost importance. Initially, the evolution will be monitored monthly through clinical and paraclinical examinations in order to detect any complications that may occur; subsequently, boosters may be reduced, their frequency also depending on the availability of patients. [3]

This restoration technique gives the patient emotional stability and social reintegration due to the fact that his dental tissue is preserved and integrated in both dental and facial harmony. The patient and relatives are finally satisfied that the recovered fragment could have been integrated into the restoration.

When choosing. as a final decision, in order to reattach the fractured fragment, it is important not to omit the conditions that allow such treatment: extension of the fracture line, recovery of the fractured dental segment, conditions for the use of the recovered dental fragment, aesthetics, prognosis of the final result and possibilities economic benefits of the patient [4].

The final success of the restoration largely depends on the adhesive properties of the materials that currently make a strong connection between the remaining tooth and the tooth fragment recovered from the fracture. However, the materials selected for the treatment to be performed should not be chosen solely in terms of mechanical properties; it is necessary to take into account their biocompatibility as well as the possibility to achieve an interface as closely adapted as possible between the remaining dental structure and the dental fragment to be attached, without subsequently allowing infiltrations to occur at the level of restoration. [5]

CONCLUSIONS

Post-traumatic dental fractures affect the patient, pigs from an aesthetic point of view and exposure in society. Given the fact that this type of injury is found mainly in children and adolescents, being the consequence of accidents that occur during recreational activities. [3]

The technique of reattaching the recovered dental fragment respects the principles of biomimicry and allows to obtain a natural result, in terms of the optical characteristics of the future restoration. The adhesive reattachment between two fragments of the same tooth provides remarkable aesthetic, functional and psychosocial results which justifies the use of this therapy to create an appropriate morphology of the tooth that has been traumatized. [6]

Both the clinical case and the data from the literature demonstrate that, when the dental fragment is reattached in a relatively short time, it is possible to maintain the vitality of

the pulp tissue. The exclusion of the need to practice additional preparations that would involve an additional sacrifice of dental structure and obtaining a quality adhesion using only the adhesive technique demonstrates the ultraconservative nature of the treatment.

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