

Interdisciplinary Orthodontic Treatment to Reestablishment Smile Function and Aesthetics

Tratamento Ortodôntico Interdisciplinar Para o Reestabelecimento da Função e Estética do Sorriso

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Abstract

Extrusive tooth movements are an important resource in orthodontic treatment and allow the manipulation of teeth and periodontal tissues. They can be performed quickly or slowly, depending on the patient's need. Rapid extrusion is indicated for cases in need of prosthetic preparation or restoration, where the bone and gingival tissues are intact, such as horizontal and oblique fractures, coronary or external root resorption, iatrogenic perforations (trepanations) and the presence of subgingival caries. The aim of this study is to describe the treatment of a patient who had a coronary fracture of the right upper central incisor, with a limit located 1 mm above the level of the bone crest. Rapid orthodontic extrusion was performed, to restore biologic distances and allow the preparation for prosthesis. It started with partial differentiated bonding of a fixed orthodontic appliance to the upper arch, to allow for a 3mm orthodontic extrusion. At the end of the extrusion, periodontal surgery was performed to increase the clinical crown and endodontic treatment. After these procedures, the case was concluded with the fixed prosthesis installation. The realization of an integrated planning allowed the restoration of aesthetics, with preservation of the functional periodontal limits for the patient.

Keywords: Tooth Movement Techniques. Orthodontic Extrusion. Crown Lengthening.

Resumo

Os movimentos dentários extrusivos constituem um recurso importante no tratamento ortodôntico e permitem a manipulação dos dentes e dos tecidos periodontais. Eles podem ser realizados de forma rápida ou lenta, dependendo da necessidade do paciente. A extrusão rápida está indicada para casos com necessidade de preparo protético ou restauração, onde os tecidos ósseo e gengival encontram-se íntegros, tais como fraturas horizontais e oblíquas, reabsorções coronárias ou radiculares externas, perfurações iatrogênicas (trepanações) e presença de cárie subgengival. O objetivo deste trabalho é descrever o tratamento de uma paciente que apresentava fratura coronária do incisivo central superior direito, com limite localizado 1mm acima do nível da crista óssea. Realizou-se extrusão ortodôntica rápida, com a finalidade de restabelecer as distâncias biológicas e permitir o preparo para prótese. Iniciou-se com colagem diferenciada parcial de aparelho ortodôntico fixo no arco superior, para permitir a extrusão ortodôntica de 3mm. Ao término da extrusão, realizou-se cirurgia periodontal para aumento da coroa clínica e tratamento endodôntico. Após esses procedimentos, o caso foi finalizado com a instalação da prótese fixa. A realização de um planejamento integrado permitiu o restabelecimento da estética, com preservação dos limites periodontais funcionais para a paciente.

Palavras-chave: Técnicas de Movimentação Dentária. Extrusão Ortodôntica. Aumento da Coroa Clínica.

1 Introduction

Orthodontic extrusion is considered a challenge for restorative dentistry, mainly because the teeth to be moved are due to trauma in the upper anterior teeth¹. In this region, the occurrence of fractures below the amelo-cemental junction comprises 5% of the lesions affecting permanent dentition, and among the treatment alternatives is the extrusive orthodontic approach². This is a non-surgical technique that provokes forces in the cervical-incisal direction of the tooth, with bone formation in the alveolar crest zones³, promoting clinical changes in the architecture of bone and gingival tissues, providing a better environment for prosthetic restorations⁴.

The approach requires a multidisciplinary treatment, which can combine orthodontics with other areas, such as endodontics, periodontics, prosthodontics and implantation¹.

The choice of treatment depends on the extent and morphology of the subgingival lesion, the root length and morphology and the esthetic appearance of the region^{1,4}. In addition, it can be indicated when necessary: to recover biologic distances in fractured teeth, to reduce or eliminate bone defects, to prepare the site for implantation, to recover bone height and to level the gingival topography^{1,5}.

The extrusive orthodontic technique can be classified as slow or fast extrusion, depending on the activation protocol adopted. Slow orthodontic extrusion exposes the healthy dental structure, but usually requires a longer treatment. Whereas fast extrusion presents a small treatment interval, providing clinical results in the short term. In addition, rapid extrusion results in lengthening and readjustment of periodontal fibers, without severe bone remodeling due to rapid movement⁶.

The fast orthodontic extrusion technique presented its first reports in 1940, by Oppenheim⁶, who observed the tension of periodontal fibers around a tooth that was submitted to movement. This tension caused bone deposition in the region of the dental apex and along the walls of the alveoli as an extrusive movement was performed⁶. Two decades later, the studies by Ingber⁷ and Ponboriero et al.⁸ have enriched the literature with new reports. They confirmed that rapid extrusive movement would be well indicated in cases that would not require vertical gain of gingival or bone tissue^{7,8}.

Although most studies are successful with this technique¹⁻⁸, contraindications for the procedure can occur⁹, such as: when there is a decrease in the root-crown ratio, dental mobility and bone loss⁶. In addition, it is necessary to know how much the tooth should be extracted to maintain the biologic distance and perform the restorative procedure.

The amount of extrusion is dictated according to the most apical remaining root portion in relation to the bone crest. Therefore, this distance is measured and + 3mm is added. Force is applied in the upright direction, the root is usually not compressed against the bone neither does it press the periodontal ligament between bone and tooth, consequently, no bone resorption is expected^{5,6}.

Therefore, this study presents orthodontic extrusion and its indications, in addition to describing the treatment of a patient with coronary fracture of the right upper central incisor, treated with fast orthodontic extrusion, in order to restore

biologic distances and allow preparation for prosthesis.

2 Case Report and Development

2.1 Diagnosis and Etiology

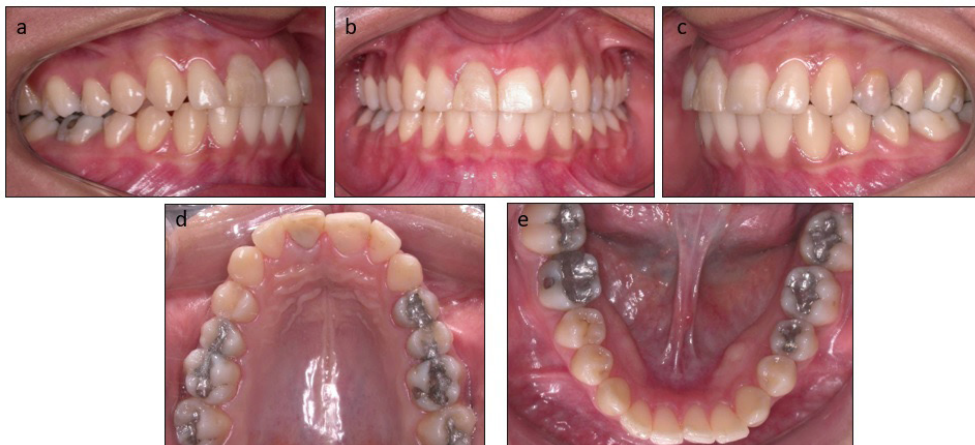
A 18-year-old female patient, L.F., appeared at the dental office with a major complaint related to esthetic nuisance in the right upper central incisor (tooth 11). In the extraoral evaluation, a mesofacial growth pattern and straight profile (pattern I) were verified, with the presence of passive lip sealing (Figure 1 a and b). Intraoral examinations showed smooth crowding in the upper and lower anterior teeth (Figure 2 a, b, c, d and e); whereas radiographic examinations (panoramic and periapical) revealed the presence of fracture at the tooth 11, located 1mm above the alveolar bone crest (Figure 3 a and b).

Figure 1 a and b - Mesofacial profile, pattern I with presence of lip sealing



Source: The authors.

Figure 2 a, b, c, d, e - Class I Angle patient, with gentle crowding on the upper and lower anterior teeth



Source: The authors.

Figure 3 a and b - Panoramic and periapical radiography



Source: The authors.

Upon physical examination, the onset of a gingival inflammatory process result of a direct communication between the oral environment and the connective tissue was observed due to the biologic width invasion. In addition, this gingival tissue was irregular and non-esthetic compared to the homologous contralateral tooth.

To perform a conservative treatment and preservation of fractured tooth, rapid extrusion of approximately 3mm of tooth 11 was necessary to allow prosthetic preparation and respect the biologic distances, guaranteeing periodontal and

esthetic health. Rapid extrusion is indicated to correct the vertical dental position, with minimal gingival level change.

This set of characteristics obtained during the diagnostic phase, together with the elaboration of a multidisciplinary treatment plan, led to the resolution of the case through the combination of endodontic, orthodontic, periodontal and prosthodontic treatment for the success of the case.

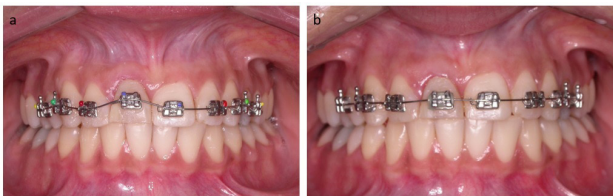
2.2 Objectives of the Treatments

Treatment was performed with the following objectives: (1) rapid extrusion of root 11 to restore the biologic distances and allow prosthetic preparation, (2) endodontic treatment and installation of intracanal pin, (3) periodontal esthetic surgery to increase the clinical crown, (4) one-piece fixed prosthesis construction, (5) improvement of function and esthetics.

2.3 Treatment Progress

To perform rapid tooth extrusion 11, partial bonding of the orthodontic device was performed using 3M Oral Care Brackets (slot .022", standard Capelozza prescription I), with an active bonding on tooth 11 (2mm in cervical direction, to facilitate extrusive movement) and passive on the other teeth (Figure 4 a and b). Extrusion was initiated with .018" Nitinol (Orthometric) wire, in addition to tooth wear 11, to avoid premature contact with the antagonist arch.

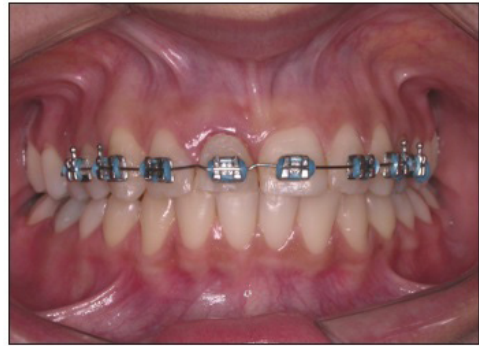
Figure 4 a and b - a- Active bonding on tooth 11, b- Patient return after 1st activation



Source: The authors.

After initial extrusive movement, it was replaced by a .018" steel wire, with extrusion bend of more 1mm, to complete the 3mm that was the objective of the treatment (Figure 5). The follow-ups were performed every 7 days, during 3 weeks, then the extrusive movement of 3mm was performed, according to the initial plan. When reevaluating the case, extrusion of a further 1mm was necessary for the safety of the posterior prosthetic preparation (Figure 6). At the end of another week, it was found that the bone level was favorable for the continuity of the treatment, but it was observed that the extrusive movement caused a gingival irregularity with the homologous tooth (Figure 7 a and b). Thus, the fixed appliance was remained when the endodontic treatment was performed. After the post-extrusion containment period, periodontal plastic surgery was performed to correct the gingival irregularity and another 60 days were expected to continue with the prosthetic treatment.

Figure 5 - Steel wire .018", with extrusion bend



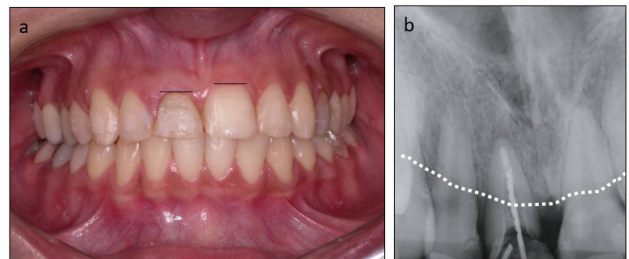
Source: The authors.

Figure 6 - Evolution and activation of orthodontic wire with bend



Source: The authors.

Figure 7: a- Gingival irregularity with homologous tooth, b- bone level favorable for the continuity of treatment



Source: The authors.

2.4 Treatment results

The objectives of the orthodontic treatment of tooth 11 were achieved in 4 weeks with an extrusion of approximately 4mm. Thus, the appliance remained as retention for 90 days.

After this period, the patient was referred to the prosthetist, who during the evaluation, found a periodontal surgery necessary to increase the clinical crown of tooth 11. Even with the rapid tooth extrusion, the gingival level is common to accompany part of the extrusive movement. Thus, the procedure would return the patient's gingival esthetic.

After performing the surgery, further 60 days were waited for the due periodontal healing of the region. Soon after this period, the construction of the fixed prosthesis of tooth 11 was started, which would return the esthetic and function to the patient's smile (Figure 8). The objectives of rapid orthodontic extrusion were achieved in 4 weeks, and it was possible to observe the success of the treatment by comparing the photos

before and after treatment (Figure 9 a, b, c, d).

Figure 8 - Result after the multidisciplinary treatment



Source: The authors.

Figure 9 - Before and after the multidisciplinary treatment



Source: The authors.

3 Discussion

Orthodontic extrusion involves a multidisciplinary approach and has benefited adult patients with esthetic and functional improvement¹. The technique can be classified into two types: slow or fast orthodontic extrusion¹⁰. The first one is characterized by the migration of gingival and bone tissues, which changes the alveolar crest level. While rapid extrusion causes predominantly dental migration, without changing the crest level¹⁰. The magnitude of the force, both in slow and fast orthodontic extrusion, is similar, however, the protocol for the activation interval differs. At slow extrusion, 1 mm of activation per month is established, however, at rapid extrusion, activation results in 2 to 3 mm of extrusion in the first two weeks of treatment¹⁰.

The choice of extrusion type should be considered according to case planning and the characteristic of the tooth involved¹¹. Slow orthodontic extrusion is more indicated when the objective is to induce the formation of a new bone in the sense of tooth traction⁴, in addition, by means of this technique, a great benefit achieved is the gingival papilla formation^{12,13}. This technique is totally predictable and safe, since the tooth traction must be done with soft forces¹⁴, without overloading

the periodontium, avoiding the total rupture of its fibers.

On the other hand, in the present case report, because it is a case of dental fracture, with preservation of bone levels, the best alternative would be rapid orthodontic extrusion. Due to the prosthetic purpose and the particularity of this case, such as the need to recover the invaded periodontal biologic widths, the activation protocol was performed in a shorter time interval, with weekly periodicity.

The objectives of rapid orthodontic extrusion were achieved in 4 weeks successfully. Once the necessary vertical positioning was established, the orthodontic appliance itself remained in the containment period, passively adapted to the teeth. Thus, the tooth was stabilized to prevent its re-intrusion inside the alveolus.

There is no consensus in the literature about the best period for the tooth which suffered traction to remain in retention, this is due to the particularity of each case, bone type and quantity of extrusive movement^{11,15,16}. Generally, an adequate period varies from 2 to 4 months^{11,17,18}, and retention may be the fixed or removable appliance itself, or rigid contentions. In the present case, contention was maintained for 90 days, for bone filling and reorganization of periodontal ligament¹⁵. After this period, by means of X-ray examination, it was possible to observe the normality of the lamina dura and the adequate thickness of the periodontal ligament^{19,20}.

For the type of appliance used, there is a diversity in the methods of dental traction where this procedure can be checked with fixed appliance^{9,15,20}, removable appliances¹, elastic bands associated with orthodontic buttons and brackets^{17,18}. All modalities can be used successfully, provided that the amount of activation allows movement, at the required speed and quantity.

The amount of tooth extrusion can be influenced by the active treatment time, type of appliance used and the tooth condition to be extracted in question²¹. In the present study, extrusion of approximately 4 mm was obtained over a period of 4 weeks, maintaining the integrity of the moved tooth. This result corroborates with the study by Malmgren et al.²⁰, which evaluated external apical root reabsorption in patients submitted to orthodontic extrusion. Their data concluded that there was no statistically significant reabsorption in these cases, obtaining an average of 3 mm of extrusion in a period from 3 to 6 weeks of active treatment.

Janson et al.¹ presented two reports of cases where it was possible to extrude 5 mm in a period of 3 weeks. However, some authors recommend that extensive tractions be performed only on teeth that will be replaced by implants. In this case, the tooth should be extracted practically until the end, and the greatest benefit is the quality of the palatine bone formed, which will allow an excellent binding for the implant to be installed²².

An important characteristic in this clinical case was the invasion of the biologic width by fracture. For this reason, the treatment of choice, in these clinical situations, is based

on distancing the compromised dental area from the biologic width before the restorative treatment is performed. For this purpose, periodontal surgical treatment (increase in the clinical crown) or orthodontic extrusion can be performed in these cases⁹.

Periodontal surgery is a fast and objective method, however, if performed alone, it will produce an elongation of the crown due to the new periodontal insertion, which may cause a disharmony in the marginal gingiva contour, compromising the gingival esthetic^{9,23}. Thus, the indication for isolated surgical-periodontal treatment should be restricted to cases in which esthetics are not a fundamental factor, such as the posterior region of the dental arches, not being well indicated in the anterior teeth.

Thus, in situations of biologic width invasion, in which periodontal surgery is contraindicated, as in this case, the choice alternative is fast orthodontic extrusion. In this technique, although the objective is to cause dental extrusion without gingival migration, in some cases there is a need to perform a complementary periodontal surgery, because even with rapid extrusion, the gingival level is common to accompany part of the extrusive movement⁹.

However, not all cases of periodontal biologic width invasion in esthetic areas can be treated by orthodontic extrusion²⁴. If the remaining root length is less than the crown height (crown-root ratio 1:1), it is more prudent to extract the tooth and rehabilitate the patient through a prosthesis or implant, since there will be little root inserted in the bone to obtain the necessary stability.

Finally, the treatment techniques employed allowed the resolution of the case with a favorable prognosis for the long-term stability of the extrusive movement and of the surrounding bone and gingival tissues, demonstrated by the esthetic obtained after the retention period was respected.

4 Conclusion

In view of the evidences regarding orthodontic extrusion, its indications, advantages and disadvantages, it can be stated that the technique is highly safe and effective for the benefit of the patients' function and esthetics. However, when the treatment plan involves a multidisciplinary approach, it fulfills the particularities of each case. Thus, in the case reported, due to the care and communication among the different specialties, it was possible to obtain an effective orthodontic, endodontic, periodontal and prosthodontic treatment, respecting the periodontium physiological limits, for the recovery of the smile esthetics and the patient's self-esteem.

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