

REVIEW ARTICLE



Treatment of Extrusive Luxation in Permanent Teeth: Literature Review with Systematic Criteria

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ABSTRACT

Introduction: Extrusive luxation is a traumatic dental injury caused by the action of oblique forces, characterized by partial displacement of the tooth out of its socket. The ideal treatment for this type of trauma involves repositioning the tooth in its socket. However, in cases where the tooth cannot be repositioned, different options may be considered, such as intentional reattachment and orthodontic intrusion. The aim is to review the literature on the extrusive luxation of permanent teeth while assessing the risks of complications for two methods of delayed treatment for extrusive luxation.

Materials and methods: An electronic search from August 2005 to August 2014 was performed by two reviewers independently, and conflicts were resolved by a third reviewer. The databases used were PubMed and Scopus; the reviewers performed a manual search of the following journals: Dental Traumatology, American Journal of Orthodontics, and Clinical Oral Investigation.

Results: After removing the duplicate studies, 328 articles were found. Out of these, 321 were rejected as not addressing the proposed research topic. In addition, five articles were excluded because apical repositioning was used for treatment. Therefore, four articles formed the basis of the study.

Conclusion: Factors, such as root formation, the degree of tooth mobility, and the presence of tooth vitality were decisive for the choice of treatment. However, both treatments were effective and showed favorable results, i.e., without periodontal and root damage.

Clinical Significance: Knowledge of the risks of complications among two methods of delayed treatment for extrusive luxation, as well as other important factors to take into consideration when choosing a treatment assists dentists in improving the prognostic.

Keywords: Extrusive luxation, Orthodontic intrusion, Reimplantation, Tooth injuries.

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INTRODUCTION

Extrusive luxation is a traumatic dental injury caused by the action of oblique forces. It is characterized by the loosening and partial displacement of the tooth out of its socket. This shift is responsible for the almost complete disruption of the periodontal ligament and the breaking of the apical neurovascular bundle. In this case, only the palatal gingival fibers prevent the tooth from being avulsed. Thus, this traumatic injury will lead to increased tooth mobility and changes in the pulp or pulp circulation infarction.^{1,2} This type of injury is relatively common and occurs in 15 to 61% of lesions between the permanent dentition and in 62 to 73% of cases between the lesions affecting deciduous teeth.^{3,4} The ideal treatment for this type of trauma consists of an accurate clinical and radiographic examination, repositioning of the tooth in its socket with digital pressure, semirigid fixation of the affected tooth to surrounding teeth for 2 weeks, occlusal adjustment and orientations for oral hygiene, prognosis, and a follow-up^{2,5-9} setting. However, in cases where the tooth cannot be reset due to a blockage by blood clot or as a result of late treatment, different options may be considered, such as intentional replantation¹⁰ and orthodontic intrusion.¹¹⁻¹⁵

Intentional replantation is the purposeful extraction of the tooth from its position of origin followed by irrigation, curettage of the socket, and almost immediate replantation of the tooth in the socket.¹⁶ In these cases, endodontic treatment with calcium hydroxide should be instituted 15 days after this procedure to prevent root resorption.¹⁷

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The intentional reimplantation can be considered a conservative approach that can satisfy the patient's individual esthetic and functional requirements.¹⁸

There are limited data on orthodontic therapy's prognosis for traumatized teeth, although it should be applied after curing. Although there is no consensus about the negative effects of orthodontic tooth movement after a severe dislocation, it is alleged that orthodontic treatment can be performed in the absence of ankylosis after 6 to 12 months of trauma.^{17,19}

Therefore, the aim of this study was to review the literature on the extrusive luxation of permanent teeth and to assess the risks of complications among two methods of delayed treatment for extrusive luxation, as well as other important factors to take into consideration when choosing a treatment.

MATERIALS AND METHODS

Literature Search

An electronic survey from August 2005 to August 2014 was performed independently by two reviewers (MMA and MFA), and conflicts were resolved by a third reviewer (LPF). The databases used were PubMed and Scopus, using the following keywords: Extrusive luxation, orthodontic intrusion, reimplantation, and tooth injuries.

The electronic search was supplemented by a manual search of the following journals: Dental Traumatology, American Journal of Orthodontics, and Clinical Oral Investigation in the period from August 2013 to August 2014.

Detailed Search Strategy

(Tooth injuries [MeSH Terms]) OR Tooth replantation [MeSH Terms] OR Dental luxation [MeSH Terms] OR Tooth Movement [MeSH Terms] AND Tooth injuries [MeSH Terms] AND Tooth replantation [MeSH Terms] AND Dental luxation [MeSH Terms] AND Tooth Movement [MeSH Terms] AND extrusive luxation) AND intrusion orthodontic) OR intrusion orthodontic) OR extrusive luxation.

Inclusion Criteria

The studies eligible for inclusion had the following information: (1) Information about extrusive luxation, (2) cases in which the treatment of extrusive luxation was not possible through apical repositioning, (3) the accompanying case, and (4) written in English language.

Exclusion Criteria

Articles with secondary factors that interfered with the prognosis and treatment of the cases were excluded, such as periodontitis, inflammation, systemic diseases,

bone fractures, previous trauma, and chronic use of any medication. In addition, clinical cases where there was no monitoring of the case, or in which the follow-up was <6 months, as well as animal experiments from those in which there was no monitoring of the case, or that the follow-up period was <60 days were excluded.

Data Analysis

For the data analysis of the articles, we assessed the periodontal ligament space and the presence of bone or root resorption, dental loss, ankylosis, and pulp inflammation or infection problems. This analysis was clinical and radiographic.

RESULTS

Level of Evidence

The study included clinical cases with evidence level 4, based on the pyramid proposed by center-based health evidence – Cochrane. The absence of randomized controlled trials in this review was due to ethical issues involved in the management of trauma, mainly due to its unpredictability.

Study Selection

There were 309 articles in PubMed and 39 articles were found in Scopus, so after removal of duplicate articles our sample consisted of 328 articles. Of these, 321 were rejected as not addressing the proposed research topic. In addition, four articles were excluded because apical repositioning was performed or the follow-up was <6 months. In manual search, one article was found. Hence, four articles formed the basis of our study (Flow Chart 1).

Clinical Parameters Analyzed

For the data analysis of each article, some clinical and radiographic parameters were selected and analyzed

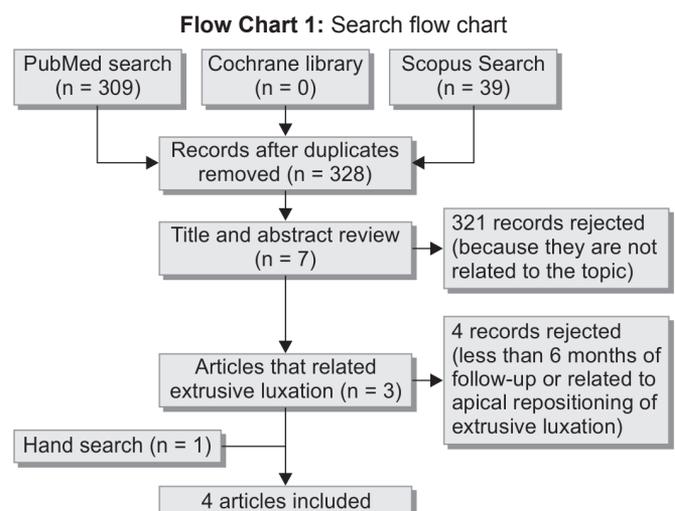


Table 1: Data extraction

Authors	Elbay et al ²⁰	Ebrahim and Kulkarni ²¹	Sübay et al ²²	Martins et al ¹²
Materials	12 years, male, tooth 11. Tooth treatment after 20 days of trauma. Involved tooth presented open apex, periapical disease, absence of pulp vitality, and increased periodontal ligament space (PLS) without root and bone fracture	17 years, male, tooth 12. Tooth treatment after 14 days of trauma. Degree of extrusion: 5 mm displacement lingual, mobility grade III. The tooth had become vital and asymptomatic. Radiographically was in initial stage of root development with open apex. No signs of bone and pulp pathologies	13 years, male, tooth 11. Tooth treatment after 30 days of trauma. Mobility grade I. Absence of pulp vitality, apical radiolucency, loss of lamina dura and increased periodontal ligament space. No signs of external and internal resorption	15 years, female, tooth 21. Treatment after 4 days of trauma. Extrusion grade IV mm. Grade II mobility. Absence of bone and root fractures
Treatment	Orthodontic intrusion (3 months). Total duration of treatment: 6 months. Endodontic treatment with curative of early intrusion and calcium hydroxide apexogenesis was done. After 3 months of intrusion canal was filled with gutta-percha	Orthodontic intrusion (19 months)	Orthodontic intrusion (4 months). Endodontic treatment with calcium dressing before the intrusion, for a week hydroxide was done. Soon after there was a filling with gutta-percha	Intentional replantation (10 minutes). Then endodontic treatment with curative calcium hydroxide for 1 week was held. Then, the channel was treated with the Tagger technique and sealed with sealer
Follow-up	2 years; conditions of clinical and radiographic normality were detected in addition to healing of periapical areas	6 months; continued root development, clinical conditions, and radiographic normal maintenance of pulp vitality	1 year; conditions of clinical and radiographic normality were detected	3 years; the crown presented slightly colored and extruded. Adequate gingival health and no root resorption or ankylosis

based on the results of each case. By doing so, we could evaluate and compare the success of the procedures for orthodontic intrusion and immediate reimplantation during the late treatment of extrusive luxation (Table 1).

Periodontal Ligament Space

After initial clinical and radiographic evaluation of each case, the periodontal ligament space was increased. However, after treatment, this increase was recovered and the periodontal ligament was in normal conditions in all cases during periods of follow-up.

Presence of Bone Resorption

There were no reported cases of bone resorption during follow-up periods.

Presence of Root Resorption

There were no reported cases of root resorption during follow-up periods.

Dental Loss

There were no reported cases of tooth loss during follow-up periods.

Ankylosis

There were no reported cases of ankylosis during follow-up periods.

Inflammation or Pulpal or Periradicular Infections

There were no reported cases of inflammation or pulpal or periradicular infections; also we did not observe the presence of pulp calcification in follow-up periods.

Pulp Vitality

The absence of pulp vitality was detected in the works of Elbay et al,²⁰ Martins et al,¹² and Sübay et al²² before treatment. In the study by Ebrahim and Kulkarni,²¹ the pulp vitality before treatment was maintained, even after the conclusion of the case, and during the follow-up period.

Various Alterations and Clinical Characteristics

After 3 years, Martins et al¹² found the crown to be yellowish and slightly extruded. This had not been found in the other studies.²⁰⁻²²

DISCUSSION

Currently, all of the studies on the treatment of traumatically extruded permanent teeth have limitations and the proposed guidelines for treatment are not based on strong evidence.

According to the included studies,^{12,20-22} there is insufficient evidence that one type of treatment is a superior option, although there are favorable and unfavorable for each option proposed treatment points.

The most important points to be discussed were the degree of root development, the degree of tooth mobility, the maintenance of pulpal vitality, and the treatment time.

Because there are more cases of orthodontic intrusion than intentional reimplantation for the treatment of late extrusive luxation, and due to the final results of each case, as in the study of Martins et al,¹² where tooth extruded at the end of follow-up showed change in chromatic crown and a slight extruded positioning, orthodontic therapy²⁰⁻²² appears to be safer compared with intentional replantation.¹² However, this small difference may not be important when comparing the practicality of endodontic access, financial issues, the number of visits, the time required for repositioning teeth, patient comfort, and esthetics, which can make intentional reimplantation a preferable approach to orthodontic therapy. Furthermore, it is noteworthy that coronary chromatic alteration and lightweight extruded tooth positioning at the end of the follow-up of traumatized tooth, which has been subjected to intentional replantation,¹² has no relation to the treatment itself, or with some endodontic treatment failures, or endodontic and containment procedures after reimplantation.

The degrees of mobility and root formation are perhaps the most relevant factors for the choice of treatment. Martins et al¹² selected intentional replantation because the extruded tooth mobility had grade II, leading to a poor prognosis if the tooth was not immediately repositioned. In contrast, in the clinical case described by Ebrahim and Kulkarni,²¹ the present extruded tooth mobility was grade III and the proposed treatment was assessed orthodontic intrusion because their roots were in a stage of early development and open apices. This is due to the fact that teeth with open apices exhibit a profound capacity for revascularization after trauma.²³ Both manual repositioning and intentional replantation can produce an already traumatized tooth, secondary to trauma, which may cause more damage to the periodontal ligament and the neurovascular bundle, as well as endanger the vitality of the teeth. Thus, gradual repositioning is a less traumatic alternative that can preserve the vitality of the tooth, prevent ankylosis, and encourage periodontal healing. In two other studies, the traumatized tooth had an open apex²⁰ or grade I mobility,²² making orthodontic treatment the first option of choice.

Although the obliteration of the pulp canal is the second most common complication after the healing of an extrusive luxation, since this problem was detected in 35% of cases studied by Lee et al,²⁴ this problem was not detected after the follow-up period in the case described by Ebrahim and Kulkarni.²¹

Studies indicate that pulp necrosis after extrusive luxation occurs in between 26 and 43%^{24,25} of cases; this occurred in two studies selected for this review.^{20,22} Andreasen and Pedersen²⁵ found a significantly higher level of necrosis in mature teeth pulp; however, Lee et al²⁴ reported the degree of extrusion to be the main factor

responsible for the pulp necrosis and the endodontic obliteration, in the case of traumatic pulp extrusion.

In the studies included in this systematic review,^{12,20-22} the results after the follow-up period showed no occurrence of root resorption, which is a rare complication involving dentoalveolar trauma.²⁴

Factors, such as root formation, degree of tooth mobility, and the presence of tooth vitality were decisive for the choice of treatment. However, both treatments were effective and showed favorable results and no periodontal or root damage.

CONCLUSION

Currently, the proposed guidelines for the choice of treatment are not based on strong evidence. Therefore, there is a need for further studies on the subject to develop protocols and guidelines for the treatment of late extrusive luxation, since few studies have been found on the theme.

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