

**Review Article**

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## **Orthodontic management of traumatized teeth: a literature review**

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### **ABSTRACT**

Traumatic dental injuries can significantly impact the appearance and the functions of the affected teeth and can induce significant damages to the surrounding structures within the oral cavity including both the soft and hard ones. This present literature review aimed to discuss the appropriate orthodontic management of dental traumatic events and to present evidence from previous studies in the literature. The search took place in the relevant databases 1, such as PubMed, Web of Science, Scopus and Google Scholar to find the relevant articles that have previously discussed the topic to retrieve all the potentially related information that will help to formulate strong evidence. The literature review was focused on the orthodontic management considerations for patients that had dental traumas including crown and crown-root fractures, in addition to intrusion and extrusion luxation injuries. Overall, orthodontists should be able to deal with all the possible traumatic lesions as early as possible to avoid the development of any complications which might affect the prognosis of the affected teeth and the surrounding structures. Moreover, the evidence suggested that aforementioned lesions which was a period of at least three months should be recommended after applying the orthodontic treatment to early screen against any potential complications and maintain stabilization.

**Keywords:** Orthodontics, Dental management, Trauma

### **INTRODUCTION**

Traumatic dental injuries can significantly impact the appearance and the functions of the affected teeth and can induce significant damages to the surrounding structures within the oral cavity including both the soft and hard

ones. The etiology of dental injuries includes a variety of causes and events such as fierce sporting practices, accidents, falls, fights and other activities that might need surgical approaches.<sup>1,2</sup> Moreover, the occurrence of dental injuries is recently becoming more common among orthodontic patients. Therefore, many recommendations

have been declared to guide orthodontists to apply the right and the appropriate management and to enhance the prognosis of both the affected teeth and the orthodontics of the affected patient by applying the modality to avoid any further complications. Accordingly, multidisciplinary orthodontists play a major role in such activities to inaugurate proper management plans for these events.<sup>3</sup>

Many risk factors can attribute to having a traumatic dental injury. Also, some groups are more affected than others such factors might include the reduced length of the upper lip or incompetent lips lengths.<sup>4-7</sup> The orthodontic management of dental traumatic injuries might not be suitable for every patient and no standards have been reported in the literature. Therefore, orthodontists usually manage each case alone with no standardization for the management modality. However, the management modality can be applied based on the different factors such as the anatomy of the trauma, the health condition of the patient and the presence of other co-morbidities which might interfere with the modality, chronicity and severity of the injury. In addition, the presence of any related devices that might also interfere with the management plan. Planning whether orthodontic force should be applied or not is also another important factor when assigning the appropriate management plan. Root resorption can result from the administration of heavy force that might also cause other adverse events.<sup>8,9</sup>

Besides, having a previous orthodontic treatment is a risk factor for the potential development of teeth trauma in these patients. Although such cases have been previously reported in the literature, no concise guidelines were also found for the appropriate management of these cases and the treatment is usually based on the experience and the skills of the orthodontists.<sup>3,10,11</sup> Accordingly, the experience and the skills of these dentists are two important factors for conducting the appropriate management modalities in cases when urgent approaches might be needed to enhance the prognosis.<sup>12</sup> Moreover, researching these events to shed more light on the proper management and the interventions which is also play an important part in drawing unified and specific guidelines. This present literature review aimed to discuss the appropriate orthodontic management of dental traumatic events and to present evidence from previous studies in the literature.

## METHODOLOGY

A systematic search was conducted to identify relevant studies in the following databases like PubMed, Medline, Web of Science, Embase, Google Scholar and Scopus. The following search terms were used (orthodontic), (management) and (trauma). The reference lists were manually searched to identify additional relevant studies meeting inclusion criteria. We included any study that reports orthodontic management of dental trauma. No restrictions were applied.

## DISCUSSION

### *Crown and crown-root fractures*

Evidence from previous studies has showed that crown fractures might constitute up to one to three fourth of the possible dental traumatic injuries and can ultimately lead to delayed or absent of permanent dentition.<sup>13,14</sup> Crown fractures can be mainly divided into complicated and non-complicated fractures and traumas which are based on the involvement of the pulp of the affected tooth. Moreover, previous studies have demonstrated that uncomplicated dental crown fractures are the most frequently reported in dental clinics as they constitute a total of 50% of the estimated dental fractures.<sup>15,16</sup> In cases of uncomplicated crown fractures, it has been reported that the tooth enamel and the dentin might be involved and impacted. Accordingly, specific radiological examinations should be conducted to adequately detect the lesion to plan the best orthodontic management modality that does not interfere with this trauma.

Orthodontics can inaugurate the management modality following the trauma that occurred by three months unless related complications were observed. Moreover, after this period, if suspicion of complications was present, further notice is recommended. Besides, it has been previously recommended that the orthodontics movement should be initiated in patients who have been observed to avoid having a complete root development and even before the development of the affected retained root.<sup>17</sup> On the other hand, complicated crown fractures might need special approaches. For instance, capping for the affected pulp from the traumatized tooth is recommended to cover the soft tissue of the affected pulp that is usually exposed and can lead to some complications.<sup>17</sup> Moreover, the orthodontic movement of the affected crowns is not recommended until the adequate appearance of the hard capping of the affected pulp has been designed to protect the pulp tissue. Previous investigations recommended radiological follow-up. The pulp vitality should be tested for at least three consecutive months from the capping. Moreover, it has been recommended that follow-up should be conducted for these patients after being orthodontically treated at six months and after one and two years.<sup>17</sup>

Crown-root fractures can be identified as traumatic injuries that involve the dentin, enamel or cementum. They are also divided into complicated and non-complicated fractures as crown fractures. The prevalence of crown-root traumas has been estimated to be 5% only among other dental fractures.<sup>18,19</sup> A partial pulpectomy is usually recommended for complicated cases, while other orthodontic procedures are usually performed like complicated crown fractures. For tooth restoration, previous investigations have suggested that the fracture line should be extended to a supra-gingival level. Extrusion was first introduced in 1973 and was then modified and reported by many clinicians and orthodontic

experts.<sup>20</sup> Moreover, it is recommended that endodontic approaches should be applied to the affected teeth before initiating the orthodontic management of modality and extrusion, which is then performed to adjust the coronal fracture line without any modifications to the bone line coronal margins, which will reduce any potential requirement to reshape the underlying bones. It has been previously estimated that it takes around one month to extrude 3-4 millimeters of one affected tooth. Fibrotomy can then be performed to obtain retention by a month approximately and to intervene against the occurrence of relapses.<sup>17</sup> Finally, previous investigations in the literature have reported that root resorptions are rare to be observed in these types of fractures.<sup>21-23</sup>

### **Subluxation and concussion**

A subluxation can be identified as a trauma affecting the surrounding and supporting structures of the tooth, which might result in the pathological loosening of the relevant tooth within its socket. Previous studies have demonstrated that the frequency of subluxation can contribute to 21% of the total dental traumatic injuries.<sup>24,25</sup> Moreover, secondary complications might also occur which may affect the prognosis of the affected sockets and relevant teeth. Such complications might be attributable to infections, inflammation, repair or replacement-related and loss of the tooth or marginal bone. Moreover, it has been reported that splinting might not be required for the affected parts unless multiple traumas were observed.<sup>17</sup> Additionally, this type of trauma is less frequent and less severe than other forms of injuries. A duration of three consecutive months of follow-up has been previously recommended before resuming the orthodontic management plan.<sup>3,26,27</sup>

In the same context, a concussion can be mixed with subluxation of the affected tooth. However, it has been found that a concussion is not usually associated with displacement or movement of the relevant tooth where the injury took place. Moreover, within the periodontal area and ligaments, some inflammation and edema can be observed. Tenderness over the affected area can be also noticed. However, bleeding is not frequently seen. The prevalence of concussion among other traumatic dental injuries has been found to constitute around 23%.<sup>24,25</sup> As subluxation, a three month follow-up period is recommended before starting the orthodontic management to properly intervene against any potential complications.<sup>3,26,27</sup>

### **Intrusion and extrusion luxation**

Previous research has demonstrated that the extrusive dental traumas are usually accounted for 7% of the total dental traumas that affect the permanent teeth and are known as the presence of an incomplete displacement of the affected tooth from its socket.<sup>25</sup> The initial management of these events is to restore the right position of the affected tooth to its socket using a flexible splint

and wait for at least two weeks for stabilization. If this step was not done as early as possible, the process of extrusion might become so difficult. As a result, the formation of clots makes it even more difficult to conduct the orthodontic treatment.<sup>28,29</sup> Nevertheless, pulp necrosis has also been frequently reported following this type of traumatic dental injury and the development of necrosis is a potent indicator for root canal modification and management.<sup>28-30</sup> For extrusive laxative traumatic dental injuries of permanent teeth that exceed two millimeters, laser management has been previously introduced as an efficacious modality that can effectively replace the endodontic management modalities.<sup>31</sup> Delayed or ignored early repositioning of the affected teeth might lead to the development of serious complications leading to reduced crown to root ratio and decreased support of the surrounding bony structures. Moreover, this will even make it harder for orthodontists to draw the appropriate management modality of this trauma.<sup>32</sup> Apart from applying orthodontic intrusive treatment modalities, reshaping of the crown to root ratio has been previously recommended as a substitution. Intentional replantation has also been previously described as an efficacious approach, however, it should not be used in cases where any underlying dental diseases or complications were already present.<sup>32-34</sup> A follow-up period of three to six months is recommended after applying the orthodontic treatment to adequately make sure no adverse events will develop following the trauma.<sup>3,17</sup>

Intrusion luxation type of dental traumatic injuries that is usually associated with impeding of the affected tooth into the underlying alveolar bone and can be complicated by potential fractures within the affected region. It has been previously noticed that such lesions affect the frontal maxillary teeth are more frequently than in other locations.<sup>35-37</sup> Moreover, it does not frequently occur in the permanent teeth as compared to the primary dentition period. Therefore, it can induce serious complications such as inflammation and necrosis of the relevant pulp and root, in addition to a potential loss in the marginal relevant bone.<sup>17</sup> The treatment of these types of injuries is variable and mainly depends on the maturity of the root of the apex of the affected tooth. Previous investigations have recommended that immature teeth should be observed for eruption as intrusions are not usually harmful and severe.<sup>38-40</sup>

However, interventions should be considered when eruption does not spontaneously occur or when intrusion is severe and can lead to serious complications. Affected mature teeth should be managed early, within the first few weeks following the lesion, by repositioning to prevent any potential pulp necrosis.<sup>41,42</sup> If bone fractures were noticed, surgical interventions are recommended for the appropriate repositioning of the affected parts.<sup>43</sup> It should also be noted that ankylosis of the affected tooth can result from applying a heavy orthodontic force for the management of luxation.<sup>44,45</sup> Long-term follow-up of applying orthodontic traction is also recommended and

can be an effective modality for managing ankylosed cases.<sup>46-48</sup>

## CONCLUSION

Traumatic injuries affecting the teeth are frequently seen globally and are observed to affect the different population groups including children, adolescents and adults. Orthodontists should be able to deal with all the possible traumatic lesions as early as possible to avoid the development of any complications which might affect the prognosis of the affected teeth and the surrounding structures. Moreover, as evidence suggests for the aforementioned lesions, a period of three months at least should be recommended after applying the orthodontic treatment to early screen against any potential complications and to maintain stabilization.

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