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Dentoalveolar Fracture with Dental Pulp and Periodontal Involvment Management: A Review Article

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1. Abstract

1.1. Introduction: Dentoalveolar fractures is common fracture in accident, could be results from motor vehicle accidents, interpersonal violence, falls, sports, bicycle accidents, and other unusual causes. While motor vehicle and interpersonal violence are implicated in the vast number of adult facial fractures, the etiologies in children are somewhat different in that "falls" during daily activities appear to be the most common cause. The wide range of aetiologies clearly suggest that there are factors specific to each study with regard to socio-economic, transport medium, infrastructure, sporting and recreational facilities, etc. which affect the incidence and types of facial fractures observed. Population characteristics are further reasons for differences.

1.2. Discussion: The management of complicated crown fractures is more challenging. If the exposed pulp tissue is vital, pulp capping or pulpotomy should be performed in cases without extensive crown loss. In cases of severe loss of crown substance or a lengthy interval between injury and treatment, pulp extirpation should be performed via Ca(OH)2 application in the root canal. Permanent root canal filling is carried out later in such cases. If the exposed pulp tissue is already necrotic, Ca(OH)2 should be applied immediately after canal debridement. The course of treatment for uncomplicated crown–root fractures depends on the fracture location. An intact coronal fragment must be removed and inspected carefully to determine whether restoration of the remaining fragment is possible.

1.3. Conclusion: Pulp necrosis is the most likely complication of dentoalveolar injury. Pulp canal obliteration is characterized by the deposition of hard tissue within the root canal space and dark-yellow discolouration of the clinical crown. This complication is seen most frequently after tooth luxation or horizontal root fracture.

2. Introduction

Dentoalveolar fractures is common fracture in accident, could be results from motor vehicle accidents, interpersonal violence, falls, sports, bicycle accidents, and other unusual causes. While motor vehicle and interpersonal violence are implicated in the vast number of adult facial fractures, the etiologies in children are somewhat different in that "falls" during daily activities appear to be the most common cause. The wide range of aetiologies clearly suggest that there are factors specific to each study with regard to socio-economic, transport medium, infrastructure, sporting and recreational facilities, etc. which affect the incidence and types of facial fractures observed. Population characteristics are further reasons for differences [1].

The practitioner should first ask when, where, and how the injury occurred and whether any treatment has been provided since that time. Answers to these simple questions could provide important clues. The patient's general health status should be known and his or her current situation examined when any nausea, vomiting, unconsciousness, amnesia, headache, or visual disturbance has oc-

curred after injury. The examination of a patient's dentoalveolar injuries should assess the condition of the extraoral and intraoral soft tissues, jaws, and alveolar bone; establish the presence of any tooth displacement or mobility; and include tooth percussion and pulp testing. Lacerations, abrasions, and contusions are very common in dentoalveolar injuries. Any vital structure crossing the line of laceration should be noted [2].

The removal of blood clots, saline irrigation, and cleaning of the oral cavity facilitate inspection. Any foreign body within surrounding tissues should be examined carefully because bone or tooth fragments might have penetrated these areas, depending on the mechanism of injury. All fractured or missing teeth and restorations should be assumed to have been swallowed, aspirated, or lodged in adjacent structures. Alveolar segment fractures can be detected readily by visual examination and palpation. However, examination may be difficult because of postinjury pain. Sublingual ecchymosis on the mouth floor is pathognomonic for an underlying mandibular fracture. Step defects, crepitation, malocclusion, and gingival lacerations should raise the suspicion of possible underlying bony defects. The presence of fractured teeth should be noted. The depth of the fracture is very important. Complete mobility of the crown may indicate crown–root fracture. Post-injury occlusion should be checked and any displacement, intrusion, or luxation should be examined carefully. Percussion tests to determine sensitivity and pulp vitality should be performed to rule out periodontal ligament injury and many types of tooth fracture [3].

3. Discussion

3.1.Dentoalveolar Fracture Management and Treatment

The aim of dentoalveolar fracture treatment is to re-establish the normal form and function of the masticatory system. The involvement of pulp tissue makes a great difference in the treatment protocol [4].

3.2. Dental Tissues and Pulp Involvement

Simple crown infractions do not require treatment. Multiple cracks can be sealed with restorative materials to prevent staining. For uncomplicated crown fractures affecting only the enamel, grinding of the sharp edges is one possible solution. In cases of extensive enamel loss, a composite restoration may be used for recontouring. If a considerable amount of dentine is exposed, it should be covered with glass ionomer as an emergency treatment, and permanent composite restoration with bonding agents can be performed immediately or at a later stage. If the missing fragment is found, bonding to the tooth can be attempted with dentine bonding agents. Periodic follow-up visits should be scheduled to monitor pulp vitality [5].

The management of complicated crown fractures is more challenging. If the exposed pulp tissue is vital, pulp capping or pulpotomy should be performed in cases without extensive crown loss. In cases of severe loss of crown substance or a lengthy interval between injury and treatment, pulp extirpation should be performed via Ca(OH)2 application in the root canal. Permanent root canal filling is carried out later in such cases. If the exposed pulp tissue is already necrotic, Ca(OH)2 should be applied immediately after canal debridement. The course of treatment for uncomplicated crown–root fractures depends on the fracture location. An intact coronal fragment must be removed and inspected carefully to determine whether restoration of the remaining fragment is possible. If the fracture does not extend too far apically, the remaining fragment is suitable for restoration, and the pulp has not been exposed, the treatment protocol is the same as described above for crown fractures. Gingivectomy, ostectomy, or orthodontic extrusion might be required later for tooth restoration. In complicated crown–root fractures, pulp extirpation and Ca(OH)2 application are recommended during the emergency stage, followed by the permanent restoration of the remaining tooth fragment after root canal filling [6].

Surgical extrusion is an option for such fractures because the pulp tissue cannot be devitalized as in uncomplicated crown–root fractures. When no combination of procedures successfully renders the remaining fragment restorable, extraction of the tooth is necessary. When root fractures are located above or close to the gingival crevice, the whole tooth should be extracted; when the remaining tissue allows tooth restoration, only the coronal fragment should be removed for root canal therapy and post and core restoration. Fractures between the middle and apical thirds of the tooth have a good prognosis for pulp survival and the joining of root fragments to one another during healing. A displaced or mobile fragment should be repositioned correctly and the tooth should be splinted for 2–3 months. During this time, the fragments usually calcify. The tooth should be inspected for signs of pulp necrosis during follow-up visits and root canal therapy should be performed if necessary [7].

3.3. Involvement of Periodontal Tissues

Concussed teeth present only tenderness to percussion in the horizontal and vertical directions. Removing the tooth from occlusion is the only accepted treatment option in such cases. Subluxated teeth show no clinical or radiographic displacement, but damage to the periodontal ligament tissue is present. Periodontal tissue rupture can cause bleeding from the gingival margin crevice. Treatment in these cases is the same as described for concussion, and follow up monitoring of pulp vitality is necessary. Extrusive luxation is characterized by neurovascular and periodontal ligament rupture with mobility and bleeding from the gingival margin. Pulp necrosis and external root resorption may be seen in later stages [8].

The tooth should be positioned properly and splinted to uninjured

adjacent teeth with an acid-etch/resin splint for 3 weeks. Other methods of splinting used routinely in oral and maxillofacial surgery are not recommended. If pulp necrosis occurs, endodontic therapy should be performed. Lateral extrusions often involve the alveolar bone, and may be characterized by complex gingival lacerations and step deformities. The goal of treatment is to properly reposition the alveolar bone and tooth, which can be accomplished with the application of an acid-etch/resin splint for 4-8 weeks. Intrusive luxation is characterized by obvious tooth displacement and comminution and fracture of the alveolus. The risks of pulpal necrosis and inflammatory root resorption are higher in such cases than in other dentoalveolar injuries [9].

Affected teeth with complete root development and closed apices should be repositioned and stabilized with a non-rigid splint. Endodontic therapy within 10–14 days after injury, including canal filling with Ca(OH)2, is recommended to retard or inhibit the inflammatory or replacement resorption process. Intrusion of an incompletely developed tooth is discussed in the 'Midfacial Fractures in Children' section below. The fate of an avulsed tooth depends on the cellular viability of the periodontal fibres that remain attached to the root surface prior to reimplantation. Important factors determining the success of treatment measures are the length of time that the tooth has been out of the socket, the state of the tooth and periodontal tissues, and the manner in which the tooth has been preserved before replantation [10].

Avulsed teeth should be stored temporarily in milk, saliva, saline, or Hank's solution. More than 15 min of extraoral exposure of a periodontal ligament will deplete most cell metabolites in the dental tissue. Teeth in poor hygienic condition and those with moderate to severe periodontal disease, gross caries involving the pulp, apical abscess, infection at the replanting site, and bony defects and/or alveolar injuries involving the loss of supporting bone are generally not replanted [11].

For individuals with avulsed teeth with mature or closed apices who present within 2 h after injury, the tooth is placed in Hank's solution for about 30 min, then in doxycycline (1 mg/20 mL saline) to inhibit bacterial growth and aid pulpal revascularization; replantation and splinting with an acid-etch/resin splint for 7–10 days are then performed. Endodontic cleansing and shaping of the canal should be performed, and Ca(OH)2 filling should be applied immediately prior to splint removal [8].

The use of final gutta-percha obturation 6-12 months later is contingent on the resolution of canal and/or root pathology. To optimise the success of treatment, avulsed teeth should be replanted and stabilized within 2 h, before periodontal ligament cells become irreversibly necrotic. Teeth with apical openings >1 mm in diameter have a much better prognosis than do those with more mature or closed apices; however, when the extraoral period exceeds 2 h, apical root morphology has little effect on the treatment success rate [12].

4. Complications

Pulp canal obliteration is characterized by the deposition of hard tissue within the root canal space and dark-yellow discolouration of the clinical crown. This complication is seen most frequently after tooth luxation or horizontal root fracture. A tooth with pulpal canal obliteration does not require treatment unless the pulp tissue becomes necrotic and develops periradicular radiolucency. Pulp necrosis is the most likely complication of dentoalveolar injury. Its incidence depends on the type and severity of injury and the extent of root development; teeth with fully formed roots are affected more often. If pulp necrosis is detected, root canal therapy should be initiated immediately to prevent inflammatory root resorption. Internal root resorption can be an issue after most dentoalveolar injuries [13].

This process is usually detected radiographically; if it is identified at an early stage, root canal therapy has an excellent prognosis. The risk of tooth fracture after endodontic therapy is increased in cases of large defects. Follow-up radiography is useful for the detection of internal root resorption. If necrotic pulp is not removed, inflammation of the root surface may occur and the tooth root will be resorbed. Inflammatory root resorption can be detected radiographically and treated by Ca(OH)2 dressing after canal debridement. Ankylosis can occur following damage to large areas of the periodontal membrane, as a primary result of trauma, or as a result of inflammatory root resorption. Osseous replacement proceeds slowly in adults; the tooth may serve for several years, but will loosen eventually [14].

4.1. Endodontic Considerations In Dental Trauma

The outcome of traumatic events involving teeth depends on three factors: the extent of injury, the quality and timeliness of initial care, and the follow-up evaluation and care. The extent of injury is influenced by the severity of the traumatic event and the presence or absence of protective gear such as mouthguards, face shields, airbags, and seatbelts. Direction of force against the teeth and supporting structures and the type of impact-blunt or sharp-also can determine how much tissue damage will result [15].

The quality and timeliness of initial care contribute to a desirable outcome by promoting healing. A good example is the avulsed tooth: if it is replanted within the first few minutes after avulsion, the prognosis is good, with a high rate of success. It is important to note, however, that the quality of initial care also is important. the initial treatment should not add more trauma to already injured tissues. A good example of this principle is with respect to luxated teeth: the repositioning of displaced teeth and adjacent tissues must be done very gently to promote desirable wound healing and long term favorable outcome [16,17].

Follow-up evaluation and care are important components of long-

term successful outcomes. A replanted avulsed tooth may show an excellent initial response-healing of the severed periodontal ligament-but if the necrotic pulp is allowed to harbor bacteria, the resultant root resorption will lead to loss of the tooth. Often the long-term outlook for a traumatized tooth is related to the response of the tooth's pulp-thus the importance of endodontic considerations in dental trauma [18,19].

5. Conclusion

Pulp necrosis is the most likely complication of dentoalveolar injury. Pulp canal obliteration is characterized by the deposition of hard tissue within the root canal space and dark-yellow discolouration of the clinical crown. This complication is seen most frequently after tooth luxation or horizontal root fracture.

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