Common Dento-Alveolar Injuries, their Management, and Medico-Legal Impact

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Abstract

Dento-alveolar injuries are common in Sri Lanka. Victims of these injuries are unfortunate and go through painful and distressing episodes following trauma. From a medico-legal point of view, a better understanding of dento-alveolar trauma is important in decision making. This must be performed together with a dental specialist preferably a Consultant in Restorative Dentistry. The article highlights the common injuries, their management, prognosis, and medicolegal aspects.

Keywords: Dento-Alveolar Injuries, Medico-Legal Impact, trauma management, review protocols

Received: 30 May 2022, **Revised version accepted:** 22 June 2022, **Published**: 30 June 2022. ***Corresponding author:** Palipana PD, ✉ Email: priyakepalipana@sjp.ac.lk ORCID: https://orcid.org/0000-0002-5077-312X

Cite this article as: Palipana PD. Forensic Common Dento-Alveolar Injuries, their Management, and Medico-Legal Impact. Medico-Legal journal of Sri Lanka. 2022;10(1):31-37. DOI: http://doi.org/10.4038/mljsl.v10i1.7457

Introduction

Damage to the teeth and supporting tissues are termed Dento Alveolar Injuries (DAI). This is very common in modern populations.[1,2] It has multiple effects on the individual. These include aesthetic, psychological, functional, and social implications that take place immediately and as a result of associated complications. Meticulous assessment, rational diagnosis, and prognostic outcome are all important in the management and decision-making of these patients. The Cost of rehabilitation should also be kept in mind as it widely varies with different treatment options. The best treatment option cannot be easily drawn without considering multiple factors inclusive of cost, facilities available, etc.

Common causes of maxillofacial trauma according to the frequency are falls, assault, road traffic accidents, and sports injuries [3]

The classification is given by the International Association of Dental Traumatology (IADT). The type of injury is categorized by the affected tissue and there is a wide range of them. They are injuries to the dental hard tissues and pulp, injuries to the periodontal tissues, injuries to the supporting bone, and injuries to the gingiva and oral mucosa.[4] Though there is a classification to identify different injuries patients usually present with multiple injuries involving few teeth and soft tissues (Fig. 1)

Management of dental injuries is not simple and straightforward.[5]. It involves immediate management and the specific management of the affected teeth and supporting tissues. Subsequent management and review are very important as there can be many complications associated with dento-alveolar trauma which are diagnosed later especially in the developing teeth. Certain late presented complications need to be spotted early and their management is a tedious procedure. This involves a lot of time, energy, and expenditure. Immediate overall management is very important. Clearing the airway, ensuring breathing, and providing basic life support are priorities than attending to the dental injury. Assessing other injuries to the body and the consciousness is of utmost importance. Sometimes the patients and the bystanders are more concerned about minor damages in the maxillofacial region ignoring serious injuries and complications elsewhere in the body. Thus it is compulsory to assess the rest of the body and vital signs. Tetanus toxoid history and appropriate treatment are also highlighted.

Initial dental/ oral management involves the management of pain in the maxillofacial region which is usually severe. Wound toilets and primary suturing in the affected areas should be done without delay. Patients and next of kin should be assured of possible successful treatment outcomes following these injuries.

Hard tissue injuries

Enamel infraction is just having a crack line over the superficial surface of the tooth. The prognosis of these injuries is good. A sensibility test/ vitality test should be performed. This is to assess the viability of the tooth. The other basic investigation is the plain radiograph to exclude any associated injuries. It is obligatory to review the patient as recommended by the trauma guideline recommended by the IADT to identify complications early and remedy them.

Enamel fractures are instances where one loses part of the enamel. Like in enamel infraction sensibility test/ vitality testing together with radiographs should be performed. If the enamel fracture is very minimal one can always smoothen the sharpened edge resulting from trauma. In instances where aesthetics is important a restoration needs to be performed. Here again, the review is very important.

Enamel and dentine fractures are the category where there is the physical loss of both enamel and dentine. Immediate dressing of the exposed dentin with filling material like Glass Ionomer Cement (GIC) is done. Later the tooth can be built up to the original shape and color with a composite restoration. If the fractured piece is available, it can be always reattached (Fig. 1). As in all other cases, a review with sensibility tests and radiographs is necessary.

Figure 1A. Photograph of the patient with broken teeth. Black arrows indicate the fractured teeth.

Figure 1B. Photograph of the broken pieces of teeth in a saline container

Figure 1C. Intraoral view of the broken teeth following pulpal treatment in the upper right central incisor indicated with black arrow

Figure 1D. Photograph following re-attachment of broken pieces

Complicated crown fractures are instances where the enamel, dentin, and pulp tissue are involved in the fracture. As denoted by the name these are more complicated as the pulp tissue is involved. The exposed pulp can get involved in pulpitis and its subsequent complications. Thus, proper management and maintaining the viability of the pulpal tissues should be the utmost task of the clinician. Yet the prognosis of the pulpal tissue depends on factors like duration following trauma to the time of presentation. If the patient is presented within 1 hour and the pulpal exposure is minimal i.e.

pinpoint in size the prognosis seems to be very good. The outcome also depends on strict adherence to the optimal treatment protocols. Or else if the exposure is large or the patient is presented late (after an hour) pulp capping treatment cannot be performed and a pulpotomy treatment has to be performed. During this procedure inflamed pulp tissue is removed. If the patient is presented much later (72hrs<) usually the infection has proceeded to the root and root canal treatment is indicated.

Crown – Root fractures

Crown root fractures are divided into 2 types namely true vertical fractures and oblique fractures.[2] True vertical fractures are the ones that extend right along the long axis of the tooth. Whereas oblique fractures extend along an oblique direction and the innermost extension terminates halfway down the root.[1,2] In true vertical fractures, as the tooth is completely separated into 2 the prognosis is poor. In oblique fractures prognosis depends on the extent along the root. If salvageable we can build up the tooth. Root canal treatment is indicated if the pulpal tissue is involved.

Horizontal root Fractures

Fig 2A. Radiograph of horizontal root fractures after placement of a medicament inside the root canal

These are the fractures occurring in the horizontal direction. They are categorized according to the site of the root fracture into 3 subtypes. They are Coronal 1/3rd fractures, Middle 1/3rd fractures, and Apical 1/3rd fractures.[3]

Complications are less if it is at the innermost part (apical corner) of the root whereas the prognosis is poor if the root fracture is very close to the gum margin. Poor prognosis is associated with communication with the oral cavity. Horizontal root fractures heal by callus formation between 2 fractured parts. Thus healing is facilitated by immobilization for a fairly long period. If the tooth becomes non-vital, root canal treatment must be performed up to the fracture line (Fig.2)

Fig 2B Radiograph showing the healing with callus formation at the fracture site indicated by black arrows

Injuries to the periodontal tissues

These are the worst type of injuries. They comparatively have a poor prognosis unless proper and timely management is performed. They are classified as Concussion, Subluxation, and laxative injuries. In laxative injuries, the tooth is displaced from its original position. [3]

Concussion and subluxation

As in concussion injuries to other parts of the body, these injuries lead to transient shock or damage to the periodontal ligament.[2] The periodontal ligament is the soft tissue which is consisting of a specialized type of collagen fibers involved in

attaching the root to the alveolar bone. The Tooth becomes tender for a transient period.

Subluxation is the loosening of the tooth within its bony socket and there is increased mobility.[4] There can be a little bit of associated bleeding. More importantly, the tooth is in its original place without any displacement.

Concussion and subluxation both have common management protocols.[2] These include review and symptomatic treatment. Analgesics to be prescribed if necessary and advise on (add a) soft diet since the patient is having tenderness. 0.2% Chlorhexidine mouthwash can be prescribed. At each review visit, sensibility/ vitality testing needs to be performed to identify whether the tooth becomes non-vital.

The Luxation injuries where the position of the tooth is changed are subdivided according to the direction of displacement. They are Extrusive luxation, Intrusive luxation, Lateral luxation, and Avulsion.[3] Elaborating further on this subdivision, in Extrusive luxation, the tooth has partly come out of the socket and in Intrusive luxation, the tooth is forcefully pushed into the bone. In lateral luxation injuries, the tooth is displaced in any of the non-axial directions.

Extrusion injuries

Extrusions can be corrected by repositioning the tooth back into the original position of the socket by using the thumb pressure or asking the patient to bite on a plastic sleuth. This can be performed under local anesthesia.

Intrusive injuries (Intrusive luxation)

Figure 3. An incisor tooth with intrusive luxation showing in red circle

These injuries lead to damage or destruction of the periodontal ligament due to the crushing of these tissues. The Tooth will become rigid within the socket. Once the periodontal tissue is damaged the bone will come into direct contact with the root (Fig. 3)

The Radiograph shows the intrusive injury, note the radiographic features i.e. the absence of the periodontal ligament space and the position of the tooth compared to the adjoining central incisor.

Subsequently, the root will be replaced completely with the bone tissue. When an intrusive injury is diagnosed, immediate surgical extrusion has to be anticipated. This can be done only if the patient is presented early. Alternatively, if the patient is presented later orthodontic forces can be used to get the tooth into its original position.

Lateral luxation

These injuries lead to tooth displacement in lateral, buccal, or palatal directions. Treatment is to reposition.

Fig 4A Photograph of the bent tooth - Dilaceration indicated in white arrow

Following repositioning of all the luxation injuries for a shorter period like 2 weeks of duration is required.

When the luxation injuries affect the primary teeth (especially the intrusive injuries), there is a high risk of damaging the developing permanent tooth bud.

The permanent tooth bud is developing near the apical and palatal side of the deciduous counterpart (milk tooth). Damage through the deciduous tooth would cause various problems namely "Turner's teeth" and Dilaceration. Turners tooth is a discoloration/ and or malformation of the permanent tooth due to compromised enamel formation.

Bending of the tooth instead of having a single axis following trauma is called Dilaceration. The developing tooth will bend at a particular point due to the impact through the deciduous predecessor tooth (Fig. 4).

Fig 4B Radiograph of the bent tooth- Dilaceration showing in a red circle

Avulsion / Ex-articulation

This is the most vulnerable injury to the periodontal ligament or a dental trauma as a whole. An Avulsion is the complete removal of the tooth from its socket. Most of the time patient retrieves the tooth. Some patients and parents are not concerned about preserving and maintaining it in a good medium during transport to the dental clinic. It is very important to attend treatment as soon as possible.

The best treatment outcome would be achieved if the tooth is re-implanted within 1 hour, which is mentioned as the golden hour.[6,7]

It is also important to bring the avulsed tooth in a physiological solution. Such medium helps in maintaining the viability of periodontal ligament cells which are indispensable in regaining a physiological attachment to its original socket.[8]

Tooth replaced in the original position within the socket is then splinted by means of a dental wire and composite filling to the adjoining teeth. We call them flexible splints as they allow some amount of physiological mobility. Physiological mobility helps in maintaining the viability of the fibroblasts in the periodontal ligament in regenerating the periodontal ligament to its original form.

If the tooth is not brought in a physiological solution, presented late, or is contaminated very badly prognosis becomes poor. Poor prognosis is due to death of the periodontal ligament fibroblast leading to necrosis of the ligament. Necrosis or absence of the ligament leads to direct contact of the bone tissue with the tooth. Subsequently, the bone will gradually replace the root tissue which is called replacement resorption. Associated with that there will be lacking the physiological mobility and gradually the root will be completely replaced. Ultimately the crown part will fall down with the complete loss of the root.

A tooth that is retrieved and re-implanted would look almost healthy and aesthetic. Nevertheless, it cannot be considered a healthy counterpart because the prognosis is questionable as mentioned above. This is an important medico-legal factor, and the clinical diagnosis and management should always be considered before concluding on the prognosis of a given tooth. Trauma guidelines have very correctly indicated the prognostic factors of traumatized teeth.

Injuries to the supporting bone

All teeth are held in the alveolar bone which is an extension of the basal bone, either the maxilla or mandible. These injuries are classified as Injuries to the supporting bone, Communication of the alveolar socket, fracture involving alveolar bone alone, and fracture involving maxilla and mandible.[3]

These injuries should be managed conservatively by proper wound dressing and coverage of the alveolar bone. Affected teeth should be reviewed for sensibility and radiographic assessment. If Maxillary or Mandibular bones are affected, they have to be treated in a Maxillo-facial unit and their management is beyond the scope of this paper.

Injuries to the gingiva oral mucosa

Common types of injuries to gingival oral mucosa are Lacerations, Contusions, and abrasions of the gingiva.[4]

These gingival injuries are managed conservatively most of the time yet any damage to the alveolar bone should be excluded. Adequate coverage of the root with healing has to be monitored.

Splinting

There are different types of splints. Mainly they are classified as Rigid splints and Flexible splints. [9] Flexible splints allow physiological mobility in the tooth which facilitates optimal healing of the tooth-supporting tissues. [10]

Rigid splinting allows the least movement of the affected tooth and they are rarely used. The duration of splinting should be minimal, usually extending to 2 weeks duration. In root fracture cases maximum splinting time of 3 up to 4 months is performed. Such long-term splinting facilitate healing by callus formation.

Review protocols

It differs according to the type of injury. Assessment criteria during review visits are very important. It is useful to monitor the healing and to identify possible complications early. The presence of infection, abscess, and swelling are useful clinical indicators. During the examination looking for sinus tracts and mobility of the tooth are essential.

Percussion of the tooth is very informative. Abnormal rocky noise on percussion indicates that the root is getting replaced by bone tissue (ankylosis).

A tooth that is giving a positive response to sensibility testing may later give a negative response indicating the tooth is dead. In such instances, Root canal treatment has to be performed. Root canal treatment is performed to preserve the tooth within the arch in a non-pathological status. One of the common complications associated with non-vital teeth is discoloration which is very unaesthetic.

The radiological assessment during reviews is to identify the evidence of healing or possible new complications. Periodontal ligament and continuation of the lamina-dura should be assessed radiographically. Any evidence of root resorption in and around the root should be detected early to halt the progression. Radiographic evidence of infection within and around the tooth should be assessed. Change in the shape of the natural root shape may indicate resorption.

Some treatment strategies are for induction or facilitation of normal physiological formation of the tooth structure. All these should be carefully monitored radiographically.

Complications of traumatic dental injuries

These can be immediate, intermediate, or late complications.[11] And they can be associated directly with the trauma like loss of tooth substance, iatrogenic or negligence by not doing the proper treatment at the correct time given by the recommended international protocols.[12]

Some complications are associated with re-trauma especially in children as some children are more vulnerable to trauma. Associated complications and their severity also depend on the type of trauma and tissue response.[13,14] Young teeth have better resilience and come out of complications.

In the long run discoloration of the tooth and tooth loss associated with resorption or infection could take place.[15] Cystic formation and various other sequelae of pulpal disease can be developed. Pain associated with infection is distractive. Dental pain is described to be one of the worst pains leading to various psychosocial problems.

Continuous reviews with multiple visits to dental surgeries are unavoidable.

Medico-legal aspects

The above-described injuries have a lot of Medico-legal implications.[16,17] It is compulsory to identify the type of trauma and time of presentation as they lead to various implications both immediate and long-term.[16] These injuries are associated with the disturbance of the normal day-to-day activities of the patient and keep them away from the workplace or school. DAIs are usually associated with aesthetic and psychosocial consequences.

It is crucial to identify whether the injury itself has contributed to the damage. At times the poor pre-existing condition of the patient's dentition may have been causal to the damage. Thus, recognizing whether the trauma has been attributed to the lost/ damaged tissues is crucial. Traumatic injuries need long-term reviews. If complications occur extensive treatment is needed. This has to be considered in compensation.[18]

If the affected tooth is lost and replacement is needed, different modes of treatment are available. Cost is significantly variable and ideal treatment cannot be easily evaluated or recommended without a comprehensive assessment of multiple factors.

Conclusion

DAI are quite common in Sri Lanka. Detailed examination and thorough diagnosis are always useful in predicting the possible treatment outcome. Complications are presented later and the prognosis and rehabilitation would be extensive. Treatment options are of a wide range and the cost cannot be

predicted easily. A dental specialist's contribution to medico-legal matters would be remarkable.

Disclosure statement

Conflicts of Interest: The authors declare that they have no conflicts of interest.

Funding: None

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