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Review Article

Trauma to the Central Incisor: The Story So Far...

Dania Siddik*

Consultant Paediatric Dentist, Guy's & St Thomas' NHS Foundation Trust, London, UK

***Corresponding Author:** Dania Siddik, Consultant Paediatric Dentist, Guy's & St Thomas' NHS Foundation Trust, London, UK.

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Abstract

This is an evidence-based clinical presentation on managing some of the most common traumatic dental injuries in the growing child. Based on clinical scenarios, a diagnostic trauma work up with clinical tips will be discussed tailored to the different types of traumatic dental injuries.

Learning objectives: to be able to diagnose various dental injuries, understand the different current recommendations and guidelines in relation to dental traumatology, appreciate the holistic approach to the management of the child and his dental injury, recognise the importance of different endodontic techniques including reviewing the concept of regenerative endodontic in relation to dental traumatology, have a systematic approach to the management of the acute trauma as well as the medium and long term management.

Keywords: *Intrusion; Avulsion; Regenerative Endodontics; Biodentine; MTA*

Introduction

In any dental traumatology, the following essential questions should be asked including where, when, how it happened and whether there has been any other injuries, loss of consciousness, nausea, vomiting and previous dental injuries. It is essential to rule out any non-accidental injuries and confirm the child is up to date with immunisations including anti-tetanus vaccination and systemic antibiotic if need be.

Following confirmation of the medical, social and dental histories; we proceed with the orofacial examination including the extra oral and intra oral examination. The extra oral examination includes inspection and palpation for step deformities, limitation in mouth opening and other facial injuries that require urgent attention for soft tissue or facial bones. Intra oral examination includes checking for deviation on mouth opening, interference with occlusion, difficulties in mouth opening or closing, soft tissue injury as well as hard tissue injury of the alveolar bone and teeth not to forget the possibility of teeth fragments embedding in soft tissues i.e. the upper and lower lips.

Extra oral radiographs mainly dental panoramic tomography, lateral cephalogram are used to assess the extent of dental injuries and dental development, while intra oral radiographs are used to aid with diagnosis including alveolar bone fracture, root fracture, root maturity, proximity of the pulp tissue to the fracture and possible fragments in soft tissues.

While the main focus is the traumatised tooth, the dental trauma protocol remains the same for any dental trauma starting with reassurance, soft diet, oral hygiene instruction and analgesics, dental treatment plan depending on the type of the dental injury, long term prognosis and a review protocol.

Classification, Epidemiology and Aetiology

In the UK 1 in 5 children have experienced traumatic dental injuries to their permanent anterior teeth before leaving school. Boys are affected twice as often as girls with peak incidence of dental injuries at 2-4 and 8-10 years of age. Predisposing factors are increased overjet, protrusion of anterior teeth and insufficient lip seal, human behaviour, environmental factors, falls, sports activities, accidents, and dog bites. Facial lacerations and dental trauma occur in roughly 50% of children with non-accidental injuries [1].

Injuries to the permanent incisor

Enamel Dentine Fracture: The most common type of traumatic injury to permanent teeth is enamel fracture followed by enamel and dentin fracture. 26 - 76% of dental injuries are crown fractures. Management includes dentinal coverage with Glass Ionomer cement bandage, provisional restoration if need be and acid etch composite resin restoration as a final restoration. Possible long-term restorations are crowns and veneers.

Figure 1: *Enamel dentine fracture.*

Enamel Dentin Pulp Fracture: Following confirmation of the diagnosis, the treatment of choice is pulp capping and partial pulpotomy. In young patients with open apices, it is very important to preserve pulp vitality by pulp capping or partial pulpotomy in order to secure further root development. This treatment is also the treatment of choice in patients with closed apices. Calcium hydroxide compounds and Mineral trioxide aggregate white MTA are suitable materials for such procedures. In older patients with closed apices and an associated luxation injury with displacement, root canal treatment is usually the treatment of choice.

Figure 2: *Enamel dentine pulp fracture: Case A.*

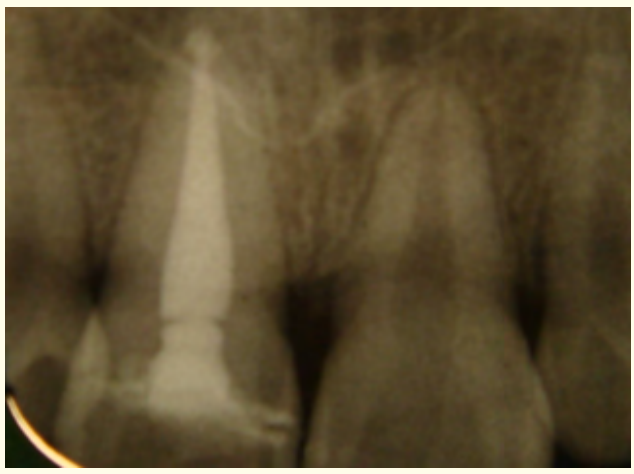

Figure 3: *Enamel dentine pulp fracture: Case B.*

Intrusive Luxation: It is the displacement of the tooth into the alveolar bone with comminution or fracture of the alveolar socket. It makes 0.3 to 1.9% of all dental trauma affecting permanent teeth and is considered the worst dental injury through damage to periodontal ligament, alveolar bone and gingival attachment as well as intrusion of bacterial plaque. Soft tissue radiograph is to consider if penetrating lip lesion. In incomplete root development, when mild or moderate intrusion less than 7 mm, conservative treatment is advised. If severe intrusion then conservative, orthodontic or surgical repositioning are options depending on the clinical judgement. If complete root

development, when mild intrusion, conservative approach is considered. In moderate case between 3 - 7 mm, active repositioning and if severe then surgical repositioning [2]. In all cases, it is vital to discuss the poor prognosis of the tooth with the parents. Orthodontic extrusion results in slightly better marginal bone healing compared to surgical repositioning, the surgical repositioning remains the treatment of choice in multiple intrusions and or deep intrusion over 7 mm.

Figure 4: *Intrusive luxation.*

Avulsion: Exarticulation or total luxation, total displacement of the tooth outside the socket. It makes 0.5 to 3% of all injuries to permanent teeth and is the most serious of all dental injuries. In this case, additional questions are vital mainly the medium or storage condition, the dry time as well as the total extra oral time. At the site of the accident: instruct to replant the tooth immediately following rinsing in tap water for 10 seconds. If not then storage in saliva, milk or saline. Some commercial tissue culture mediums include Hank's, ViaSpan and Propolis. The clinical procedure includes checking for bony fracture, removing the contaminated coagulum, checking the stage of root development. The tooth is rinsed with saline. If closed apex, immediate re-implantation, if open apex, then pre-treatment with tetracycline

for 5 minutes then re-implantation with light digital pressure. Splint for 10 days [3]. If the dry time is less than 30 minutes and extra oral total time of less than 90 minutes then chances of periodontal ligament healing and possible pulp regeneration for immature tooth or root canal treatment for mature tooth following re-implantation. If dry time over 30 minutes or extra-oral total time over 90 minutes then root canal treatment prior to re-implantation is advised.

Figure 5: *Avulsion.*

Dental Materials

Mineral Trioxide Aggregate: First introduced in 1993, consists of tricalcium silicate, tricalcium oxide and silicate oxide. With pH 12.5, the main characteristics are hydrophilic, biocompatible, direct bone apposition, inductive effect on cementoblasts, actively promotes hard tissue formation, facilitates the regeneration of PDL.

Biodentine: Bioactive dentine substitute, first introduced in September 2011. It is Ca silicate based formulation with mechanical properties similar to the sound dentine [4].

Regenerative Endodontics: Challenges are encountered with the non-vital immature incisor mainly the open apex situation, the thin dentinal walls and the reduced ratio crown root. Apexification has advantages proven throughout the years including good success rate and straightforward technique. This technique using calcium hydroxide has an antimicrobial effect which achieves further disinfection [5]. The main concerns are the multiple visits, risk of root fracture, barrier formation and no real increase in root dimension. Apexification with MTA main concerns are discoloration, cost, technique and the clinician's experience. Therefore, alternative has been thought and suggested in the regenerative endodontic technique. The latter is a biologically based procedure designed to replace damaged structures, including dentin and root structures as well as cells of the pulp-dentin complex. The main objectives of regenerative endodontics include regeneration of pulp like tissue ideally the pulp dentin complex, regenerate damaged coronal dentin following a carious exposure, regenerate resorbed root, cervical or apical dentin. Main requirements are stem cells (Dental Pulp Stem Cells, Stem Cells from Apical Papilla), growth factors TGF transforming growth factor, BMP bone morphogenetic protein, scaffolds provide framework for cell growth, differentiation and organisation at a site. Natural (collagen), synthetic (polymer hydrogel), porous and biocompatible. The requirements are disinfection of the canal, providing a scaffold and coronal seal. The clinical technique includes Irrigation with sodium hypochlorite and or chlorhexidine, antibiotic paste; ciprofloxacin 200mg, Metronidazole 500mg, Minocycline 100mg, temporary restoration and Review in two weeks. The second visit includes gentle irrigation and debridement, initiation of apical bleeding with a small file with aim for a blood clot in the third apical of canal, placement of coronal plug of MTA and the access sealed with bonded restoration.

Conclusion

The above presentation is an overview of the management of some of the most encountered dental injuries to the permanent central incisor. The new technique of regenerative endodontics enables us to change the way we manage the non-vital immature tooth taking into consideration the need for longer follow up and further research.

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