REVIEW ARTICLE

Management and Treatment of Sports Related Oro Facial Injuries

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ABSTRACT

Sports influence the lives of majority of the world population. There are many reasons to participate in sports and physical activity such as pleasure, relaxation, competition, socialization and maintenance and improvement of fitness and health. The activity of sports comes with many adverse effects of which injuries or trauma is of prime concern. The Prevention of oro-facial trauma during any sports activities involves teaching proper skills, purchase and maintenance of appropriate equipment, safe playing areas and wearing and utilization of properly fitting protective equipment. The dental professionals have a prime role to play in prevention as well as treatment of Sports related injuries. Proper management of sports related injuries is of utmost importance to deliver sound health to sports personnel immediately.

KEYWORDS: Dental Fracture, Lacerations, Pulpotomy, Trauma

INTRODUCTION

The broad range of human activities beyond the daily routine of living and working includes recreation, sports and athletics. Sports are derived from an old combination of words that literally meant "to carry away from work". According to the Concise Oxford Dictionary, sport can be defined as "any pastime or game requiring physical effort that is undertaken for amusement, diversion or fun".[1] Such activity can be competitive or recreational, amateur or professional.

Given the high incidence of sports – related maxillofacial injuries, sports dentistry has a major role to play in this area. Sports dentistry has two major components. The first is the management of oro-facial injuries which includes many specialties of dentistry like oral surgery, endodontics, operative dentistry, orthodontics, hospital dentistry and patient behaviour management. While treating these injuries, the question which comes to mind is, why do so many young athletes have to suffer such preventable injuries which can negatively

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affect the patient's oral health for a lifetime? This realization brings into focus the second aspect of sports dentistry i.e. prevention through sports safety measures. Thus, dental professional can play an important role in meeting the challenge of preventing these sports – related injuries.

Sports attract an increasing number of participants. Activities range from traditional team sports to individual recreational activities such as skiing, use of motorized sport vehicles etc.[2,3] Athletes of all ages, both amateur and professional, periodically sustain injuries. Although advances in protective helmets, facemasks and mouth guards reduce the injuries to a significant degree, the face itself often remains an exposed area at risk.

Prevention of oro-facial trauma during sports activities includes teaching proper skills, purchase and maintenance of appropriate equipment, safe playing areas and wearing and utilization of properly fitting protective equipment.[2]

DIFFERENT FORMS OF ORO-FACIAL INJURIES AND THEIR MANAGEMENT

SOFT TISSUE INJURIES

Soft tissue maxillofacial injuries occur frequently during athletic completion. Such injuries range from minor abrasions to full-thickness lacerations. There may occur as participants collide, as in soccer, or as a participant is hit by athletic equipment, such as softball bat. Surgical repair of these facial injuries restores form and function and attempts to optimize the cosmetic appearance. Soft tissue injuries involve the scalp, forehead, eyebrows, eyelids, ear, nose, cheeks, lips and neck region. These soft tissue injuries affect livelihood of the sportsmen and children. It needs urgent cure.[4]

Several different types of injuries can occur

a. Skin abrasions:

They occur when skin forcibly rubs against an object or another participant. These contacts can result in superficial abrasions, removing the epithelium and papillary dermis, or may result in deep abrasions into the reticular dermis.

Treatment of abrasions includes initial cleansing, this cleansing range from gentle saline irrigation to vigorous scrubbing and saline irrigation. After cleansing, dressing can be applied which may include plain petroleum jelly, bacitracin ointment, or triple antibiotic ointment.

b. Haematomas:

It is the accumulation of blood within the subcutaneous tissue. They are usually associated with blunt trauma. They most likely occur in the scalp, peri-orbital or cheek region and usually resolve without treatment.

Haematomas of the nasal septum and ear are exceptions because blood accumulates beneath the septal or auricular perichondrium. These haematomas require surgical drainage and pressure dressings to ensure normal healing.[4]

c. Lacerations:

Full – thickness lacerations range from simple to complex. Most associated facial bleeding can be controlled with direct pressure. In general, facial lacerations are cleansed, and then closed in anatomic layers. Deep layers are closed with absorbable sutures, and the skin is closed with finer, non – absorbable sutures. In some circumstances, fine, rapidly absorbing gut sutures can be used for skin closure.

Lacerations that cross-anatomic borders (lip, vermilion, eyelid margins) require attention to detail for accurate tissue realignment. Antibiotic coverage should be considered.[5]

d. Tissue avulsions:

Avulsive injury is the loss of tissue. Avulsion is unlikely in typical sporting injuries but can occur in higher velocity sporting activities, such as high speed cycling, all – terrain vehicle use or hunting injuries. After control of local bleeding with direct pressure, referral for definitive care is necessary.[5]

SPECIFIC SOFT TISSUE INJURIES

a. Scalp region:

The scalp has an extensive vascular supply. Because of its unique subcutaneous anatomy, lacerated vessels cannot completely retract. This inability to retract completely results in impressive bleeding from relatively small lacerations. Initial pressure tamponade is useful in stopping blood loss. Haemostasis can then be completed with cautery or suture placement. After cleansing, closing is accomplished in layers. After repair, scalp wounds require a pressure dressing and a suction drain to prevent haematoma.

b. Forehead region:

It is an extension of the scalp. It has special characteristics near the brows. Passing along a line from the inferior aspect of the earlobe to approximate 1cm lateral to the brow is the temporal branch of the facial nerve. Any lacerations in this temporal area may result in nerve injury, loss of brow elevation and forehead elevation on that side. Brow laceration should be carefully aligned anatomically during closure to avoid cosmetic deformity. Brows are not shaved before repair. Forehead lacerations are also closed in layers, including deep muscular repair of corrugator supercilli, frontalis and orbicularis oculi muscles.[4,5]

c. Eyelid region:

Eyelid laceration involved not only eyelid tissue, but also the eye and the lacrimal system. Pressure tamponade for bleeding control should not be placed directly over the eye itself. Any necessary pressure should be carefully directed over a bony peri orbital surface.

Beck Barry W and Holton James B stated that repair of eyelid lacerations require layered repair with fine sutures of skin, orbicularis oculi muscle, tarsus, levator aponeurosis and conjunctiva.[5]

d. Cheek region:

The cheek region contains special anatomic structures. These layers include the branches of the facial nerve, the facial muscles and the parotid gland. Cheek lacerations are also closed in layers. These include from deep to superficial intra oral mucosa, buccinators muscle, parotid gland and facial nerve or buccal fat, facial muscles, subcutaneous fat and skin.

Facial nerve injuries of the main trunk or of the temporal or mandibular branches require microsurgical repair.Repair of the parotid duct may include primary suture repair and transoral stent placement. With limited lacerations, normal salivary function is usually obtained after uncomplicated healing.[5]

e. Lip region and tongue:

Lip repair requires attention to perfect anatomic alignment of the lips i.e. vermilion border, commissure and philtrum, Temporary tacking structures align these structures before formal

repair is started. Lip repair includes the layers of intra oral mucosa, orbicularis oris muscle, subcutaneous tissue and skin or lip mucosa. The

deeper intra oral mucosa and muscle layers can be closed with 3–0 or 4–0 chromic absorbable sutures. The external lip mucosa can be closed with 4–0 or 5–0 absorbable sutures. Skin is usually closed with 5–0 or 6–0 non–absorbable sutures.

Tongue lacerations also occur usually associated with adjacent teeth. Their severity and location determine the necessary surgical intervention. Pressure tamponade is helpful with initial haemorrhage management.[6]

f. Nasal region:

Nasal lacerations often have associated nasal fractures. After fracture reduction, laceration is repaired in layers. Nasal layers include intranasal mucosa, nasal cartilages, subcutaneous tissue and skin. According to Demas Peter N, lacerations along the nostril, columella and dorsum must be carefully aligned to avoid deformity.[4,6]

g. Ear region:

The ear is anatomically cartilage sandwiched between skin layers and has a rich blood supply. During surgical repair, the ear cartilage must be well covered to avoid post injury chondritis. Ear pressure dressings are used to prevent subperichondrial haematomas.

Ear sustaining isolated haematomas also require attention; otherwise cauliflower ear or wrestler ear deformity may occur. Early acute treatment consists of drainage of the haemotoma and a pressure dressing.[4,6]

FACIAL FRACTURES

Sports – related facial fractures of all types can occur. The most common are nasal fractures, zygomatic fractures and maxilla-mandibular fractures.

These may be due to being struck with any hard object, athletic equipments, and participant contact or motorized sports vehicle accidents.

a. Mandibular fractures:

They occur most commonly in the angle, condyle and symphsis. Mandibular fractures are of several types:

- Greenstick fractures result in incomplete fractures. These are usually seen in children rather than adults.
- Simple fractures are complete bone separations without small fragmentations.
- Comminuted fractures involve bone and multiple fragments.
- Compound fractures occur when fractured bone communicates with the outer environment. All fractures of the tooth bearing regions of mandible must be considered compound.

Mandibular fractures can also occur favorably or unfavorably. In an unfavorable fracture, the angulation of the fracture permits easier displacement of the fragments by the attached muscles of mastication. A favorable fracture is less displaced by the muscle's tension.

Quereshy Faizal A. et al has given the management of mandibular fracture in a very systematic manner.[7] According to them. In multiple facial fractures, the mandible is treated first. This approach then provides a stable base to work superiorly toward the midface.

- Mandibular fractures can be treated with
- Closed reduction using only maxillomandibular fixation.
- Open reduction with internal fixation plates, either intraorally or extraorally.
- Combined opened reduction and maxillomandibular fixation.

- Occasionally, external pin fixation devices for severely comminuted fractures.[4,7]

Maxillomandibular fixation includes various methods. The most commonly method uses prefabricated arch bars wired to the teeth in each arch. The maxillary arch is then fixated to the mandibular arch using wires or elastics attached between the arch bars themselves.

Condylar fractures in growing children may result in growth deformities. Most pediatric sports – associated condyle fractures remain in continuity and are treated with closed reduction. Limited maxillomandibular fixation and subsequent jaw mobilization with guiding elastics is used until occlusion is re-established.

According to Fonseca Raymond J, in adults, maxillomandibular fixation is placed for 6 weeks in non-condylar fractures and 2 – 3 weeks in condylar fracture treatment.[8] Reducing the intermaxillary fixation period in condylar fractures permits earlier motion and less opportunity for limitation of condylar motion.

Dental rehabilitation related to dentoalveolar fractures includes traditional restorative procedures and implant reconstruction.

b. Midface fractures:

According to Peter N Demas, midface fractures include isolated nasal fractures, isolated zygomatic arch fractures, orbitozygomatic complex fractures, nasoethmoid fractures and maxillary LeFort fractures.[4,8]

Rene Le Fort had classified maxillary fractures as

- Le Fort I (entire maxilla only)
- Le Fort II or pyramidal fractures (maxilla plus the nasal region)
- Le Fort III or craniofacial separation (maxilla plus nasal, orbital and zygomatic areas).[6,8]

The palate itself may also comminute and have dentoalveolar fractures associated with any Le Fort level fracture. Generally, lower velocity sport injuries do not result in Le Fort II or III injuries. Sport injuries tend to cause more isolated midface fractures such as nasal, orbital or malar.[7,8]

Treatment of midface injuries, which involve the maxilla and dental occlusion, consist of Le Fort I, Le Fort II, and Le Fort III fractures. Occlusion is primarily reestablished by maxillomandibular fixation with the mandible. According to Salin Michael B, the maxilla is fixated with open reduction using a miniplate system.[9] If Le Fort fractures continue up to nasal, ethmoid, orbital or zygomatic regions, the surgical repair continues superiorly to reconnect the maxilla to these areas. Miniplates or microplates are usually used, although wire fixation and suspension techniques remain surgical options.

Isolated zygomatic arch fractures may be treated, according to Ellis Edward, as open procedures with rigid plate fixation but can often be treated with less invasive techniques.[61] Smaller incisions in the peri-orbital brow region, or in the temporal hairline (Gilles's method), can be used to pass an instrument subcutaneously for elevation of the arch fracture.[7,9]

Repair of orbital blow out fractures is usually through a transconjunctival incision or subciliary incision. Displaced orbital convents are elevated back into the orbit, and the orbital floor bone fragments are repositioned if possible. Repair of more extensive orbitomalar complex fractures may include a trans-

conjunctival approach combined with a scalp or peri-orbital incision.[4,9]

INJURIES TO THE TEETH

A sequela of sports – related traumatic oro facial injuries is often tooth fracture. There is a variety of tooth fracture categories, with different potential therapies associated with the type of fracture, which is as follows:

Classification of Traumatic Injuries to the Teeth

There are many approved classification regarding tooth of fracture. Some important classifications are as below:

- Andreasen classification
- Bennett's classification
- WHO classification
- By Ellis and Davey

✓ *Andreasen classification (1981)* [10]

- Injuries to hard dental tissues and pulp.
  - Enamel infarction
  - Enamel fracture
  - Enamel – dentin fracture
  - Complicated crown fracture
  - Uncomplicated crown – root fracture
  - Complicated crown – root fracture
  - Root fracture
- Injuries to periodontal tissues
  - Concussion
  - Subluxation
  - Extrusive luxation
  - Lateral luxation
  - Intrusive luxation
  - Avulsion
- Injuries to supporting bone
  - Comminution of mandibular or
  - maxillary alveolar socket
  - Fracture of maxillary or mandible
  - socket wall
  - Fracture of maxillary or mandibular
  - alveolar process.
- Injury to gingival or oral mucosa
- Laceration of gingival or oral mucosa
- Contusion of gingival or oral mucosa
- Abrasion of gingival or oral mucosa

✓ *WHO classification (1993)*

Number	Feature
873.60	Enamel fracture
873.61	Enamel and dentin fracture without pulp exposure
873.62	Enamel and dentin fracture with pulp exposure
873.63	Root fracture
873.64	Crown – root fracture
873.66	Concussion, Luxation
873.67	Intrusion, Extrusion
873.68	Avulsion
873.69	Soft tissue injuries

✓ *By Ellis and Davey (1960)*[11]

Class I: Simple fracture of crown involving only enamel with little or no dentin .
Class II: Extensive fracture of crown involving considerable dentin but not exposing dental pulp.
Class III: Extensive fracture of crown involving considerable dentin and exposing dental pulp.
Class IV: The traumatic tooth that becomes non vital with or without loss of crown structure.
ClassV: Total tooth loss avulsion
Class VI: Fracture of the root with or without loss of crown-structure.
Class VII: Displacement of tooth with neither crown nor.root-fracture.
Class VIII: Fracture of crown en masse and its displacement.
Class IX: Traumatic injuries of primary teeth.

For practical and clinical treatment purposes Ellis classification is commonly adapted. Hence the management and treatment of injuries are explained as per Ellis classification.

ELLIS CLASS I

- An Ellis class I fracture involves enamel only.

- A periapical radiograph should be taken to confirm that no further pathology exists and to provide a baseline radiograph for further comparison.
- The traumatic tooth should not be exposed to further trauma, therefore, immediate management includes the smoothing of rough enamel edges and the placement of resin composite without extensive finishing and polishing or no treatment at all.
- The vibration and heat produced during finishing and polishing can further traumatic the tooth, thus it is recommended to wait 4 – 8 weeks until final polishing of the restoration is completed.[11]

ELLIS CLASS II

- Ellis class II fractures involve fracture of both enamel and dentin, leaving dentin, leaving dentin exposed.
- Hypersensitivity is the main fracture of this type of fracture therefore; the exposed dentin should be protected as early as possible after the trauma occurs.
- A periapical radiograph should be obtained to verify the extent of the traumatic incident and to provide a baseline view for subsequent comparison.
- Traditionally, it was recommended by Louis Grosssman, that calcium hydroxide be placed over all exposed dentin, followed by the placement of a resin composite restoration.[11] The calcium hydroxide was believed to protect dentin from bacteria as well as from the phosphoric acid used to etch the enamel before the placement of the resin composite restoration. But this method could not seal the exposed dentin adequately leading to micro leakage and sensitivity.
- Current recommendations stress the importance of sealing the dentin. Therefore, the placement of a dentin bonding agent or glass ionomer cement over the exposed dentin, followed by the placement of a resin composite restoration, is considered appropriate.[63] This is important to eliminate bacterial contamination of the dentinal surface and to insulate the dentin from acidic and thermal challenges. The resin application must have incisal clearance to avoid traumatic occlusion. Final contouring and polishing can complete in 4 – 8 weeks.
- The replacement of the original fractured tooth fragment using the acid – etch technique can also be done successfully as given by Andreason and Andreason.[10,11] This technique is particularly effective for large fractures. Placement of 0.5 –1.0mm bevel on the fractured enamel edges on both fractured tooth fragment and the remaining fractured tooth is recommended. The enamel can then be acid – etched with 35% to 40% phosphoric acid, followed by the application of an unfilled resin and placement of resin composite to bond the fragment in place.

ELLIS CLASS III

An Ellis class III fracture involves the fracture of enamel and dentin with exposure of the pulp. Definitive guidelines were recommended for the management of such fractures.

The partial pulpotomy involves removing 1.0-2.0mm of pulp tissue with a high speed diamond bur. Spoon excavation or partial pulpotomy with a low speed round bur is not

recommended because further trauma or incomplete tissue removal.

After removal of 1-2mm of tissue, hemostasis is achieved and then calcium hydroxide is placed directly over the pulp tissue, which is then covered with glass ionomer cement followed with a resin composite restoration.

Donly Kevin J has stated that the partial pulpotomy is recommended in young teeth that have open apices.[12] These teeth, if not traumatized concurrently with other injuries, such as luxation or displacement, have an excellent chance of recovery. As exposure size increases with greater chance of bacterial penetration, root canal therapy may be considered.

PULPOTOMY

Fractured tooth having large pulp exposure may warrant a pulpotomy, rather than partial pulpotomy. In teeth with incomplete root formation, pulpotomies are extremely important to maintain pulp vitality.

In a pulpotomy, the coronal pulp tissue is removed with a high-speed diamond bur. After hemostasis is achieved, calcium hydroxide is placed over the exposed pulp.

The involved teeth are followed clinically and radiographiclally, if internal root resorption or pulpal necrosis is noted, apexification is necessary for immature roots that have not achieved apical closure or routine root canal therapy for those that have achieved apical closure.[11,12]

ELLIS CLASS IV

Ellis class IV involves those traumatized teeth, which becomes non-vital with or without loss of crown structure.

When complete pulp necrosis occurs, a plupectomy, or complete removal of the pulp is necessary. If root formation is not complete, then to achieve apical closure, apexification is done.

After extirpation of necrotic pulp, calcium hydroxide is filled in the canals. The antimicrobial effects of the calcium hydroxide prevent internal and external root resorption. $Ca(OH)_2$ must be replaced every 3 – 6 months until a definitive hard tissue barrier is created at the apex. At this time, conventional root therapy is completed.[11,12]

ELLIS CLASS V – TOTAL TOOTH LOSS OR AVULSION

Because of its anatomic position the most frequently avulsed tooth is the maxillary central incisor. Boys are three times more likely to experience avulsion than girls, most frequently occurring between ages, 7 – 11 years. According to Andreasen, erupting teeth have loosely structured periodontal ligaments, which favor avulsion.[10,12]

The ideal treatment for all avulsed teeth is immediate replantation at the site of the injury. The avulsed tooth should be washed with normal saline to remove dirt or any foreign body present and should be preserved in a bottle or container filled with normal saline or milk.

Patient and the avulsed tooth should be taken to a qualified dentist for replacement of the tooth as early as possible.

According to Paul K71, the clinical success of replanted avulsed teeth has been poor, ranging from 4% to 5%. One cause for this poor rate is the lack of recognition that avulsed teeth have different conditions that require different treatments. Earlier, there has been one predominant philosophy for the treatment of avulsed teeth: replant the tooth immediately or

as quickly as possible after the avulsion. But now the dental trauma research has showed the increased success of immediately replaced teeth is related to maintenance of root periodontal ligament cell vitality rather than the length of extraoral time.

The treatment of avulsed teeth depends on the specific clinical conditions that are associated with a particular avulsed tooth. These clinical factors are the physiologic status of the periodontal ligament, the stage of root development and the length of extraoral time. For each permutation of these factors, a different treatment may be indicated.

Successful long-term retention of replanted avulsed teeth depends on a wide range of factors. Each of these factors can be viewed as a link in a long chain of steps that range from handling of the periodontal ligament cells, use of biological storage media, maintenance of periodontal ligament cell vitality, timing of pulp extirpation, to splinting. Every step in this process is critical, and the final success of the replanted tooth reflects the quality of the treatment rendered at each step.

To provide the best chance for success after replantation, the root periodontal ligament cells should be in the most physiologically healthy status as possible, only then it can differentiate and form a new periodontal ligament. To attain this healthy status, biological storage and protection from periodontal ligament cell crushing is of paramount importance.

Many methods of storage have been recommended. Except for the pH balanced cell culture media, all of these are either damaging to the periodontal ligament cells (water and saliva) or at best limited in benefit like milk.

Paul K, showed that milk is able to maintain the osmotic pressure for periodontal ligament cells but does not have the ability to reconstitute depleted cell metabolites and restore viability.[13]

ELLIS CLASS VI

According to Andreasen, root fractures comprise 0.5 – 7% of injuries to the permanent dentition predominantly in the maxillary central incisors in the age group 11 – 20years.[10,13]

Root fractures occur most frequently in the middle third of the root. Caliskan and Pehlivan found root fractures of the middle third twice as frequent as those in the apical third and less than 10% in the coronal third. The ultimate goal of treatment of root fractures is reunion of the segments by a calcified callus. This is best achieved by immediate reduction of the fracture followed by rigid immobilization of the incisal segment to allow for reunion. Proceeding with removal of the pulp and root canal therapy are contraindicated pulpal necrosis is ascertained.

Immobilization of the incisal segment is achieved by placement of an acid – etched, resin arch wire splint. The splint is left in place for 3 to 4 months to allow for union of the fragments. Following splint removal if mobility of the incisal segment is present, permanent splinting to adjacent teeth may be necessary to prevent bone loss.

ELLIS CLASS VII

The objective in the treatment of displaced teeth is repositioning as soon as possible, application of splint if necessary and doing root canal treatment if needed. Splinting is usually required except in some minor displacement with very little mobility. If any doubt exists whether to splint, it should be done. Splinting time is 7 – 10 days. With accompanying bony fractures, splinting time may have to extend for longer periods.[13]

CONCLUSION

Education of authorities, parents, and children involved with sports and recreation activities at school is recommended regarding the risk factors involved in the occurrence of these dental injuries. Screening programs could be conducted for school children to identify those with high anatomic and behavioural risk for occurrence of traumatic injury to the anterior teeth so appropriate preventive measures such as preventive orthodontic treatment and use of mouth guards can be implemented. Sufficient knowledge regarding the sports injuries and protective devices, equipment available should be disseminated to the sports persons. A healthy population can build up a healthy progressive nation. Let us hope people around the world will understand this and give sufficient importance for the sports activities.

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