Soft Tissue Pediatric Facial Trauma: A Review

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ABSTRACT

Facial soft tissue injuries are common in pediatric trauma patients. Early diagnosis and definitive treatment as well as good postoperative wound care are important when dealing with soft tissue injuries, such as facial nerve and parotid injuries, animal bites, avulsive skin wounds and eyelid and ear lacerations. Children heal quickly, but they also tend to develop hypertrophic scars. Proper wound management during the healing period can help to minimize the risk of adverse scar formation. Dentists may be involved in the initial assessment of these patients. Knowledge of the diagnosis and management of soft tissue trauma is useful when dealing with pediatric patients and their parents post-operatively.

MeSH Key Words: child; facial injuries/etiology; facial injuries/surgery; surgical flaps

Dentists may be involved in the primary assessment of pediatric trauma patients. Dentists acquire a keen eye for detail through continued training and practice and this, combined with their knowledge of facial anatomy, makes them ideally suited to the diagnosis and management of facial trauma. Although dentists may not be involved in all aspects of craniofacial soft tissue treatment, they form an important part of the management team. Dental professionals may be one of the key health care providers who assess the patient postoperatively and provide some aspect of orofacial reconstruction. To be an effective member of the trauma management team, dentists require a thorough knowledge of the diagnosis and treatment of soft tissue craniofacial injuries.

There has been a gradual rise in the incidence of trauma in children, probably due to increased risk-taking and aggressive behaviour in children, who are more commonly left to their own devices without close supervision. Injury is still the number one killer of children, with a large proportion of the mortality related to head injury.[1]

In this paper, we review soft tissue injuries, the role of prophylaxis and, antibiotic use, and the prevention and control of scarring.

Soft Tissue Injuries

Soft tissue injuries are more common than fractures in children who have sustained facial trauma, particularly in younger children whose facial skeletons are resistant to fracture.[2] During initial assessment of any facial injury, it is important to review the mechanism and time of injury and determine whether it was witnessed. Knowing what caused the injury will be valuable during later exploration and debridement of wounds and the prediction of subsequent wound healing. Every effort should be made to cleanse the wound and remove all foreign material; this may have to be done in the operating room under anesthesia. If there is an open wound, the tetanus status of the child should be assessed and appropriate management commenced early.[3]

Figure 1: Deep laceration to the cheek from a dog bite. Evidence of deep subcutaneous fat implies possible underlying injury to the facial nerve.

Figure 2: Pulse-vacuum irrigation of a contaminated scalp avulsion injury is used to dislodge foreign bodies and decrease the bacterial load of the tissues.

Several key elements of wound care are important in predicting the quality of healing in children:

- eliminate foreign body contamination and the resulting excessive inflammatory response
- keep sutures below the skin surface, if possible
- use supportive skin dressings, such as wound support tapes, during the first 6 weeks of wound repair
- protect wounds from subsequent injury, excessive drying, wetting or temperature variations
- engage parental participation in postoperative wound care, such as cleansing the wound of debris and scabs, applying dressings and massaging scars.

The wound healing response is generally more intense and accelerated in children, as they do not usually have compromising systemic disease or indulge in abusive habits such as alcohol or tobacco use. However, although children heal quickly and predictably, increased collagen deposition in wounds tends to cause hypertrophic scars. Soft tissue wounds that are clean or only mildly contaminated and with little tissue compromise can be cleansed and closed. Antibiotics are not usually indicated unless there is a question of host immune status. Wounds can be closed up to 24 hours after injury. Older wounds should be thoroughly cleansed and their margins freshened before closure. Vigilance for wound breakdown necessitates a check 3 days after closure in the pediatric trauma patient. Blunt trauma may result in extensive and prolonged tissue damage with subsequent deep scarring and poor esthetics.

Nerve and Duct Injuries

Generally, wounds distal to a line drawn from the lateral canthal region to the mid-mandible will not require facial nerve exploration or repair. Wounds proximal to this line should be explored under magnification for possible nerve injury and the need for repair (**Fig. 1**).

Preoperative clinical assessment may reveal nerve injury and palsy. Injuries below the subcutaneous fat in the parotid region should be explored for parotid duct injury. A small catheter or a lacrimal probe inserted through Stensen's duct will reveal a proximal ductal injury in the wound bed.

All nerve and ductal injuries require micro-repair with permanent sutures. In addition, severed ducts should be stented for at least 2 weeks or until epithelial tissue continuity has been restored in the lumen.[4] When ducts are stented, the patient should be prescribed antibiotics for 7–10 days, as the gland may become somewhat static and prone to obstructive sialadenitis. The use of chewing gum or sugar-free lozenges to stimulate saliva production may be considered.

Bites

Animal bites require confirmation of rabies status, thorough wound exploration and irrigation and prompt closure of the linear aspects of the wound. Puncture wounds should be irrigated to their depths, kept open and seen frequently to detect infection. All animal bites will result in intense but temporary (2–3 days) inflammation, which should subside.

Human bites are more problematic due to the presence of virulent and resistant organisms.[3,5] Wounds should be thoroughly cleansed, then approximated, but not completely closed, if there is any concern over tissue viability. The infectious status (hepatitis, HIV, etc.) of the offending person must be ascertained and documented and appropriate management must be commenced.

Antibiotic prophylaxis is advisable for both animal and human bites. Amoxicillin–clavulanate is widely regarded as the gold standard in the treatment of animal and human bites.[3] Antibiotic therapy in the penicillin-allergic patient is more controversial. Clindamycin combined with trimethoprim–sulfamethoxazole is an appropriate choice in children, and azithromycin may be an option in the pediatric penicillin-allergic patient.[3]

Avulsive Wounds

Avulsive wounds of the facial region result from high velocity recreational activities, such as bicycling, skateboarding, etc., or from motor vehicle accidents including those involving off-road vehicles. Under general anesthesia

in the operating room, wounds require careful exploration under magnification, debridement, pulse-vacuum irrigation with an antibiotic-containing solution (**Fig. 2**), conservative trimming of nonviable tissue margins and primary closure if possible. Avulsed or widely undermined soft tissue flaps require proper suction drainage to prevent hematoma formation and pressure or support dressings to allow both arterial inflow and venous outflow. Frequent checks of the wound to confirm tissue viability are important. If there is concern over viability, steps should be taken to optimize tissue vascularity through suture removal, improved tissue support or enhancement of wound drainage. Adjunctive measures such as hyperbaric oxygen treatment have been shown to be beneficial for marginally viable or hypoxic wounds.[6]

When loss of tissue is extensive, a staged approach to reconstruction is required. The initial effort is directed at cleansing and debriding the wound to prevent infection and further tissue loss. Serial wound debridements and numerous tissue dressing changes may be required in the first 2 weeks after injury. Vacuum-assisted drainage can be helpful to remove debris, reduce the circumference of wounds and stimulate the vascular bed in preparation for final repair. Large avulsive wounds, e.g., in the scalp, may require staged tissue expansion and local flap reconstruction (**Fig. 3**).

Figure 3: (a) A hair-bearing scalp avulsion defect addressed with a staged reconstruction using **(b)** tissue expansion, followed several weeks later by **(c** and **d)** second-stage scalp advancement.

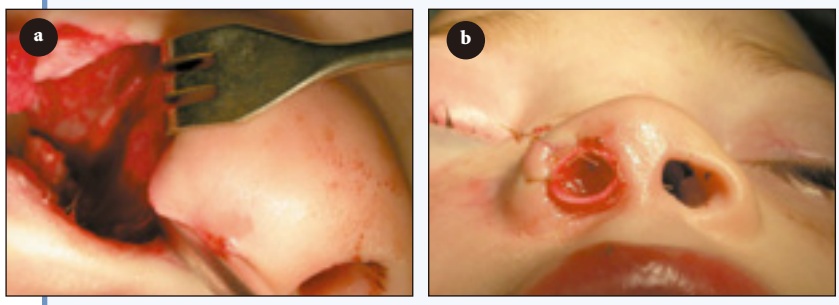

Figure 4: (a) Complex wound with avulsion of nasal cartilage. **(b)** Postoperative repair using supportive stent and bolster dressings, which will remain 5–7 days.

Special Wounds

Special wounds, such as those involving nasal and ear cartilage, require thorough cleansing and removal of any foreign bodies, then meticulous approximation of the cartilage and skin. Cartilage requires less oxygen than bone, but it still needs complete soft tissue coverage and support or bolster dressings (**Fig. 4**) to eliminate hematoma and seroma formation. Bolster dressings can generally be removed in 5–7 days. Cartilaginous disruption, particularly of the nasoseptal cartilaginous skeleton, is susceptible to growth disturbances.

Injuries to the eyelids require an initial ophthalmologic assessment and possibly dilation and slit lamp examination to rule out globe injury. Fluorescein staining will reveal corneal epithelial and lacrimal injuries. If the tear ducts are injured, obstruction, stasis and infection may follow, so prompt and thorough evaluation is necessary. If a child will not tolerate lacrimal and canalicular evaluation, then a detailed examination in the operating room is indicated. Placement of silicone intubation tubes through the severed tear ducts will preserve the canalicular and lacrimal system. The eyelids are composed of anatomical layers called lamellae (anterior, middle and posterior), and each lamella must be repaired or supported to ensure proper eyelid function.

Surgical treatment of eyelid injuries is completed in the operating room under general anesthesia with the patient paralyzed to prevent unexpected movement. The tissue is irrigated thoroughly and loose flaps of skin are debrided (**Fig. 5**). A corneal shield is routinely used to prevent corneal abrasion, which can be a painful and irritating postoperative sequela (**Fig. 6**). Just as the vermilion border and white roll are the important landmarks

Figure 5: Avulsive eyelid injury.

Figure 6: Complex eyelid laceration with corneal shield in place.

Figure 7: Silicone pressure dressings on scars resulting from a dog bite. These dressings are soft, cleansable and well tolerated by children.

in lip repair, the gray line of the eyelid is the key to proper lid alignment. The tarsal plate, which is the supportive structure of the eyelids, must also be repaired. If the orbital septum has been violated, yellowish orbital fat will be seen protruding through the septum. Meticulous hemostasis is mandatory before closure of the septum to reduce the risk of retrobulbar hematoma, which may place excessive pressure on the globe and optic nerve and could potentially result in blindness. Some surgeons monitor the orbit for 24 hours in hospital and, although the treatment is controversial, place the patient on steroids to prevent increased intraorbital edema and pressure.[7]

Scar Management

Because children have a tendency to heal with scarring, it is important to guide the wound during active healing.[8] All permanent sutures should be removed in 3–5 days and wound support dressings applied for 10–14 days to remove tension from the wound bed, which would increase collagen deposition. During this period, any irritating influences and encrustations should be removed from the wound and the area should be kept moist and covered. Topical antibiotic ointment should be discontinued after 7 days to prevent tissue reaction.

When the wound is well epithelialized, usually in 7–10 days, silicone sheeting or topical scar gels can be applied for several weeks (**Fig. 7**). These agents keep tension off the wound, as well as maintain slight pressure on it, to help reduce excessive collagen deposition into the scar. During this period, it is important to avoid excessive wetting, drying, heat or irritating agents that might exacerbate the inflammatory response. The patient should use sunblock with a high sun protection factor while outside and wear a wide-brimmed hat to cover the face, if possible, for up to a year after injury to avoid ultraviolet stimulation of melanocytes in the wound bed and subsequent hyperpigmentation.

Children with darker skin pigmentation may be prone to excessive scarring (keloids) and pigmentation changes. If scarring appears to extend beyond the wound margins, a keloid scar may be forming. Topical hydrocortisone, injectable triamcinolone and even low-dose radiation may be helpful in reducing keloid scars. Finally, scars that are discoloured can be tattooed with permanent medical grade pigment to match the surrounding skin. Revision of scars should be deferred until final maturation is complete — approximately 6–12 months postinjury.

Conclusions

Pediatric facial injuries are common due to children's high level of physical activity, decreased supervision and tendency toward risk-taking behaviour. Dentists may be involved in the initial assessment of these patients and can refer them appropriately for definitive treatment. Repair of soft tissue wounds is a high priority — identifying and maintaining tissue viability is paramount, as is early diagnosis and repair of nerve and ductal integrity. Wound support and daily cleansing of wounds, as well as measures to decrease tension, help decrease scar formation.

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