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Infant commissural burn management with reverse pull headgear

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Abstract

The care of a commissural lip burn of an infant can be a challenge. The prevalence, pathophysiology, surgical management, various positive pressure treatment modalities, and concepts important to prevention are discussed in this case report. The management of the commissural burn of a nine-month-old infant with a dental appliance which was anchored with a reverse pull headgear is described.

Upon reaching the age of approximately six months, the infant begins to crawl and eagerly explore the environment to the extent of parental and physical limitations. Using all sensory organs, especially taste, nearly every new discovery is placed into the mouth; the infant is therefore dangerously prone to ingesting poison, aspirating small objects, and burning the commissures of the lips by placing the live end of an electrical cord into the mouth. The following report describes the use of a reverse pull headgear in the management of an oral commissural burn sustained by a nine-month-old infant.

Prevalence of Oral Burns Among Children

The prevalence of oral electrical burns among infants has not been comprehensively studied. Thompson et al. (1965) reported that between 1945 and 1963, 45 children with electrical burns to the mouth were admitted for treatment to Children's Hospital in Toronto. Six children were younger than one year of age. Sixty-five per cent of the burns were to children between the ages of one and two years and 28% affected children between two and four years. Oral electrical burns to children represented 1.7% of all burn admissions. One of the 45 electrical burns resulted in death.

Orgel et al. (1975) reported that between 1957 and 1972, 51 children were seen at Montreal Children's Hospital for electrical burns to the mouth. There was a greater predominance of males and 29 of the 51 children were between one and two years. Similar data were presented in which the majority of cases involved children younger than four years with an equal prevalence of males and females.[1] Davies et al. (1958) reported 70 oral burn cases among 1893 admissions to the burn unit at another hospital during a five-year period for an incidence of 3.7%.

Over a seven-month period at the University of Texas Health Science Center at San Antonio, 25 children were admitted to the hospital with burns to various parts of the body, and eight cases involved lip burns which represented 10.8% of total burn admissions. The majority of these injuries were associated with the electrical connection of household appliances by an extension cord (Richardson and Kittle 1981).

Pathophysiology of Burns

Tissues with the highest water content are the least resistant to electrical current and, consequently, suffer the most damage from electrical insult. Blood, muscle, skin, tendon, fat, and bone are affected in decreasing order of resistance. Tissue damage caused by electricity may appear minor at the entrance and exit points, but the underlying tissue damage is more severe. Electrical burns can cause internal hemorrhage, intestinal perforation, shock, and cardiac arrest at the time of the injury. The seriousness of a burn is dependent upon the depth of penetration. Partial thickness burns are characterized by tissue destruction in varying depths between the epidermis and the dermis. Full thickness burns include the epidermis, the dermis, and damage to the subcutaneous layers including muscle and bone (Hills and Birmingham 1981).

Electrical burns are commonly classified as being either contact or arc burns. The contact lesion has entry and exit sites and the current usually passes from the point of contact to the ground.

[1] Fogh-Anderson and Sorensen 1966; Gifford et al. 1971; Gormley et al. 1972.

Arcing burns are the most common around the mouth. The burn results from the arcing of current between the live wire and the moistened mucosa. The tissue injury results from direct thermal changes at the entrance and exit sites, estimated to be as high as 3000° C. These burns are accompanied by deep muscle, vessel, and neural tissue destruction. Pain control is not usually a problem (Wood et al. 1978). The heat produced and the resultant tissue damage are related to the voltage, amperage, type of current, tissue resistance, duration of current flow, and pathway of current flow (Baldridge 1954). Because of vascular changes, the tissue loss is usually greater than expected. Secondary bleeding from the damaged labial artery may occur hours or up to two weeks after the injury (Dado et al. 1985).

Current flow from a 110V household line is generally not fatal and rarely causes large or extremely deep cutaneous burns. On the other hand, 220V has been shown to cause severe burns. Cardiac arrhythmias are associated with 110 and 220 voltage. Tissue destruction increases with increased amperage. Alternating current of low voltage is more dangerous than direct current. The longer the electric current enters the tissue the more severe the burn (Baldridge 1954).

Electrical burns can heal with substantial tissue damage and are the most common cause of microstomia in children (Evans 1971). Lip deformation, alveolar mucosa adhesions, ankyloglossia, impaired jaw growth, malocclusion, dental dysplasia, and tooth loss are other types of tissue damage (Needleman and Berkowitz 1974). Although permanent teeth are usually unaffected, the alveolar ridge, floor of the mouth, and buccal sulcus may be involved. Malocclusion, cosmetic deformity, incontinence of saliva, loss of primary teeth, psychological sequalae, gas gangrene, traumatic cataracts, and death are also complications and/or sequalae (Small 1976).

Treatment

Opinions have varied over the years as to whether commissural lip burns were better managed surgically or nonsurgically and the mode of treatment may vary. Some surgeons recommend early surgical lip repair (Thompson 1965), but the majority prefer to delay surgery until at least six months after the burn (Pitts et al. 1969). Reconstructive lip surgery may be carried out as early as the fifth or sixth day postinjury. The type of surgical procedure is dependent upon the amount of tissue damaged by the burn and whether the upper and lower lip are both involved. The objective of cheiloplasty is to complete early grafting in order to avoid contractures (Small 1976).

Conservative nonsurgical techniques have been shown to be successful in eliminating or minimizing the need for surgical revision.[2] Such techniques are completed by the pediatric dentist, the prosthodontist, or the orthodontist who is consulted to manage the commissural burn.

A dental appliance or oral splint is used to treat such burns. There are several objectives for positive pressure commissural burn appliances. The device should restore function and esthetics, promote tissue healing, reduce scarring, improve symmetry, and maintain the size of the oral stoma. Insertion and removal should be easy and cause little discomfort to the child. The appliance should be retentive, comfortably tolerated, and compatible with tissue-bearing areas.

Several different appliances have been used in the management of oral electrical burns. The appliances may be categorized into two basic types — tooth supported and tissue supported. Nearly all appliances have acrylic extensions around which the injured lip heals.

Most children who are victims of electrical burns have a nearly complete complement of teeth. Appliances described for these children are removable and use the teeth for retention (Vorhies 1987). Several have used a removable overdenture with clasps on the primary second molars.[3] Larson (1977) described a Hawley retainer removable appliance with acrylic posts designed to position the commissure and prevent contraction of the lip.

Silverglade (1983) described the management of a 12-month-old child with a fixed oral splint which may be used for the infant who has few and partially erupted teeth. The splint is fabricated with stainless steel crowns, orthodontic wire, and cold-cure acrylic. The stainless steel crowns are adapted to the partially erupted incisors, a labial wire is soldered to the crowns, and acrylic posts are formed to support the commissures. The appliance is cemented to the primary incisors.

Fixed appliances have been recommended by Wright et al. (1977) who used orthodontic bands on the maxillary central incisors and maxillary second primary molars. With this technique retention may not be adequate for children with short clinical crowns.

Graubard et al. (1982) described the management of a 12-month-old infant using circumzygomatic sutures for retention of an acrylic stent.

Tissue supported appliances are indicated for the infant who has few teeth, a low tolerance for pain or discomfort, or cannot understand the reason for wearing an appliance. Compliance is therefore minimal. Several tissue supported appliances have been designed to compensate for these factors.

A removable appliance for an infant which must be primarily tissue supported is described by Port and

[2] Colcleugh and Ryan 1976; Larson 1977; Wood et al. 1978.

[3] Wright et al. 1977; Ryan 1979; Silverglade et al. 1982; Silverglade and Rubera 1986.

Cooley (1986). Infants younger than one year do not have a sufficient number of erupted teeth to maintain an appliance. Erupting teeth have short clinical crowns which are poor abutments for removable appliances.

Extraoral management of commissural burns has been proposed. Richardson and Kittle (1981) described an appliance composed of a nonflexible, clear acrylic face mask upon which two U-shaped posts were fabricated, also from acrylic, which maintained the distances of the commissures from the midline. The face mask was held upon the child's face with a cap that was fitted to the head using headgear hooks. One disadvantage of this appliance was that a general anesthetic had to be administered to the child in order to obtain a facial moulage upon which the facial mask could be constructed. Otherwise this appliance is an excellent burn appliance for the very young child. Josell et al. (1984) described another extraoral retained appliance for the management of oral electrical burns. He formed an orthodontic wire loop using .045 orthodontic wire which hooked around the commissures of the mouth. The wires were anchored to the child's face by an occipitally supported headgear. The appliance was inserted on the burn side first and subsequently the unaffected side and removed in reverse order. The appliance was well tolerated by a 12-month-old child and the pressure exerted by the retraction loops prevented scar formation in the commissures.

Prevention

Infant safety requires that the parent create a safe environment in and around the home by eliminating potential hazards. Nuts, carrot sticks, popcorn, and similar foods also must be avoided because such foods readily lodge in the airway. Electrical outlets and worn extension cords can be deadly. Protective plugs should be placed in electrical outlets. Cords should be repaired and appliances should be disconnected when not in use.

Case History

The following case report describes the management of an electrical burn to the mouth of an infant using a reverse pull headgear. The infant sustained an electrical burn to the right commissure.

J.E. was a nine-month-old male infant who, according to the mother, drooled saliva onto the live end of an extension cord which connected the television to the wall socket. The mother heard his cries from an adjacent room and came to the rescue. She immediately observed the child's burned lips and took him to the emergency room of the local hospital.

Medical examination, blood chemistry, and an electrocardiogram were completed. The emergency room physician prescribed acetaminophen with codeine for pain and recommended that the mother cleanse the lips three times each day with hydrogen peroxide and apply topical antibiotic ointment. The infant was not admitted to the hospital even though he experienced post-traumatic epileptic-like seizures at home twice daily for three weeks. The seizures were characterized by generalized shaking and bruxing of the teeth. The child was referred by a general surgeon to a plastic surgeon who consulted a pediatric dentist to assist in managing the commissural burn.

Two days after the burn the superficial tissue layer of the upper lip sloughed and four days later the tissue peeled from the lower lip. The pediatric dentist's first opportunity to examine the infant was 10 days after the injury (Fig 1). At that time the infant's four maxillary primary incisors and the mandibular primary central incisors were completely or partially erupted. Four weeks later all necrotic tissue had sloughed, initial healing had occurred, and scar contracture was not yet evident.

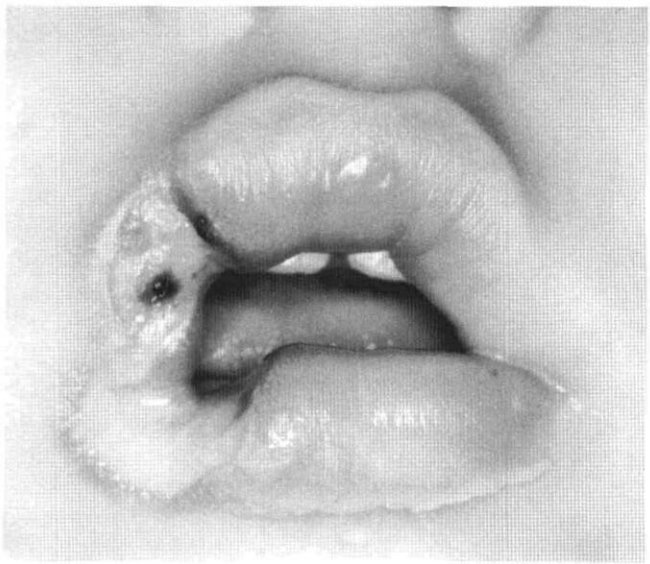

FIG 1. Nine-month-old infant 10 days after an electrical burn to the right commissure.

Considering the number of unerupted primary teeth and anticipating minimal compliance, a reverse pull headgear was modified to retain the lip commissural burn appliance. Reverse pull headgear is designed to therapeutically manage skeletal maxillary retrusion for children in the 6- to 8-year-old age group. Anchorage is obtained from the appliance resting on the chin and forehead. In this case the headgear was molded into a positive pressure appliance and was modified to avoid any orthopedic or orthodontic results.

Three measurements were made of the infant's head so that the reverse pull headgear could be fitted to the face. The measurements included: (1) the distance from the inferior border of the chin to the separation of the lips; (2) the inferior border of the chin to the horizontal

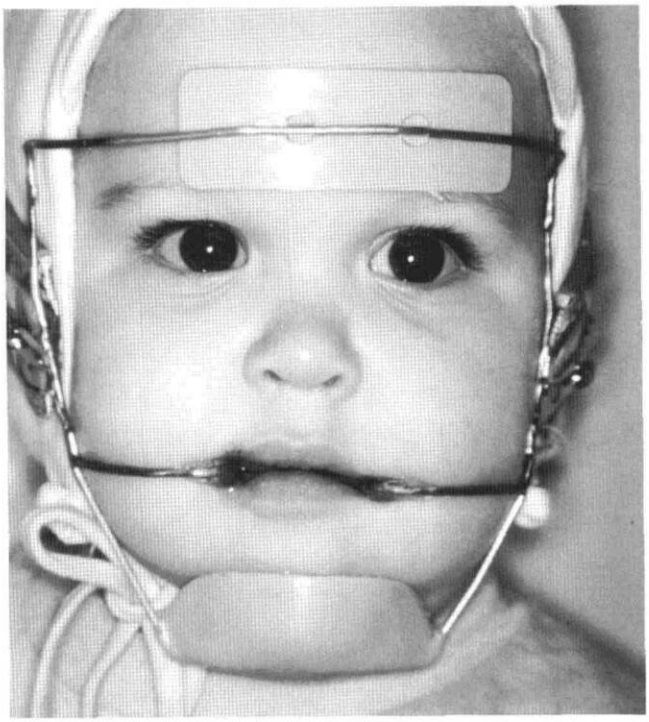

FIG 2. Infant wearing a reverse pull headgear with the outer bow covered with acrylic contoured to the lip commissures.

FIG 3. Lateral view of the infant wearing a reverse pull headgear secured to headgear pads which were stapled to the infant's bonnet by orthodontic elastics.

and vertical center of the forehead; and (3) the distance from the midline to the unaffected commissure of the lips. The headgear was scaled down in its vertical dimension so the chin cup and forehead rest would be appropriately positioned on the infant's face. The left and right wire outer bows of the headgear were reshaped to the commissures, clear liquid, and powder acrylic flowed over the wire bows, and the unit was positioned and shaped to maintain the right and left lip commissures equidistant from the midline (Fig 2).

Anchorage for the headgear was provided by stapling headgear pads to the infant's bonnet (Fig 3). Orthodontic elastics were used to attach the headgear to the bonnet. The parents were instructed on how to correctly and gently insert and remove the appliance. Parental cooperation was important in gaining the infant's cooperation. Weekly re-evaluations were scheduled for one month to correct a problem such as excessive pressure to a commissure. Components which occupy the buccal vestibule have a high potential for irritation if overextended or improperly oriented. For the remainder of the treatment period adjustments were extended to biweekly inspections of tissues.

The infant adapted well to the headgear and according to the mother wore the headgear at all times except when bathing and eating. The treatment period was of three months' duration. Treatment results were considered satisfactory six months after the initiation of therapy (Fig 4) because microstomia, cosmetic deformity, incontinence of saliva, loss of primary teeth, and the need for plastic revision were prevented.

FIG 4. The right commissure of the lip six months post-treatment.

Treatment was discontinued in consultation with a plastic surgeon. Infant cooperation had diminished somewhat by the end of the treatment period.

Conclusion

An extraoral approach using a reverse pull headgear

in the management of an electrical burn to the commissure of an infant's lip has been described. This treatment method was effective for the minimally cooperative infant and the appliance was well retained without any need for dental abutments. The results in this case demonstrated such an appliance to be well tolerated, to prevent microstomia, and to reduce the need for cheiloplasty subsequent to a commissural electrical burn.

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Health related to job security

If you think your job is secure, you'll feel better, according to a recent study. The relationship between job security and employee health was studied by a psychologist who found: (1) the more permanent employees believed their positions to be, the greater was their physical and mental health; (2) the higher employees rated their own job performances, the more permanent they viewed their positions; and (3) employees' perception of their own job security was the single greatest predictor of their health.

What can pediatric dentists do to capitalize on this information? Staff members should be recognized when they're doing a good job, with the implication that their job is secure.