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Impalement injuries of the oral cavity in children: a case report and survey of the literature

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Background. Impalement injuries of the soft palate and oropharynx are common in children, especially those of preschool age. These injuries are particularly common in toddlers, given their propensity to fall easily while carrying objects in their mouths. Although most of these injuries do not have lasting sequelae, some can have devastating neurological complications, and consequently, careful assessment of the patient during the early stages of trauma is imperative. Close follow-up for up to 72 h, and parental counselling and instruction should be considered as part of their immediate care.

Case report. A case of toothbrush impalement in a 4-year-old child is presented. The foreign body was noted to be lodged in the cheek. After careful triaging, history taking and appropriate imaging, surgical removal of this brush was carried out uneventfully under general anaesthesia. No further complications were noted postoperatively, and because of the type of injury, the patient was discharged within 24 h and reviewed as an outpatient.

Conclusion. A survey of the literature confirms that most injuries of this kind can be treated conservatively, and in many cases, without surgical intervention. However, careful assessment by an experienced clinician is necessary to rule out other complications. The present paper discusses the prevalence, management and complications associated with impalement injuries of the oral cavity in children.

Introduction

In the preschool age group, impalement injuries of the oral cavity are not uncommon because children of this age often walk about while sucking or holding objects in their mouths[1–3]. Treatment objectives include the uneventful healing of these injuries as well as restoration of normal function.

A review of the literature revealed that impalement injuries most commonly affect children aged 6 years or less. Most of these injuries can be managed in an outpatient environment, with few further complications or long-term sequelae[1–3]. However, for a small proportion of children, devastating neurological complications such as cerebral ischaemia caused by thrombosis of the internal carotid artery can arise, and given the delayed onset of neurological signs, this life-threatening situation can be easily overlooked[4–8]. As a result, various treatment protocols have been recommended for the management of impalement injuries, including hospitalization for up to 72 h for observation.

The most common objects causing impalement injuries in children are sticks, pencils, cylindrical toys and straws[2]. However, toothbrushes have also been reported in the literature[9–17], with several of these reports specifically involving the impalement of a toothbrush in the buccal vestibule[9,11,12,16,18]. Management protocols have varied in the literature; however, at least one case experienced similar anaesthetic difficulties associated with the position of the impaled object[11]. MacLeod reported on a 21-month-old girl who had fallen against the bathroom sink and impaled the toothbrush lateral to the ascending ramus, having penetrated the buccinator muscle and its fat pad. The solution was to cut and remove the handle of the brush to allow ventilation at induction. Similar cases have been reported elsewhere[9,12,16].

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Kosaki and colleagues reported on 12 cases of penetrating injuries to the oropharynx. Most of their patients were less than 4 years old and had fallen with a sharp object in their mouths[19]. The above authors described a worrisome list of potential complications and made the salient point that these injuries are to be taken very seriously. Kosaki *et al.* reported cases of deep neck abscess, pneumoencephalocele and internal carotid thrombosis from their survey of the literature. Among these cases, they reported on a 1-year-old girl who experienced a tonsillar fossa injury following a fall on her toothbrush. Within a few hours, she had developed a 'fever and sore throat', went on to develop dysphagia, and needed admission for rehydration and management of a cervical collection that sufficiently narrowed her airway to warrant intubation. Subcutaneous cervical emphysema and mediastinitis further developed and a diagnosis of retropharyngeal abscess was made, with the appropriate surgical management following shortly afterwards. The patient survived the ordeal, but had a 50-day-long hospital admission.

Takenoshita *et al.* reported on a 20-month-old girl who had been seen 3 days earlier after a fall with a toothbrush in her mouth and subsequently developed complications from a buccal fat pad hernia[16]. These same authors went on to present a series of 13 children (mean age = 2 years) with impalement injuries[3]. Takenoshita *et al.* had found a larger number of boys affected, and went on to suggest that the typical injury is caused by the child holding an object in the mouth and then falling forward, thus forcing the object into the oropharynx. In their series, the objects included plastic, wood, chopsticks and pencils. The injuries which caused bleeding typically lead parents to seek medical attention. The main site for trauma was the palate, rather than the cheek, as in the present case, or the tonsillar injuries reported by Kosaki and colleagues[19].

Smyth *et al.* reported three cases in which occult pharyngeal perforation occurred without any clinical signs of breach of the pharyngeal wall[20]. In all cases, a lateral, soft-tissue neck X-ray was diagnostic of perforation, showing the presence of retropharyngeal air. Consequently, they advocated the routine performance of soft-tissue neck X-rays in all patients who present with a history of falling on a rigid object held in the mouth.

Law *et al.* discussed a rather significant complication of internal carotid artery thrombosis and mediastinal sepsis from their own cases[10]. Carotid thrombosis was presumed to be caused by compression of the artery against cervical vertebrae, leading to an intimal tear and thus dissection. Mediastinal sepsis was caused by soiling at the time of injury. In yet another significant case[7], a 2-year-old child fell on a toothbrush, resulting in carotid artery thrombosis and stroke following a blunt pharyngeal injury. She was treated with anticoagulation and made a complete recovery.

Kupietzky has published a salient article recently that deals with the anatomy of the region in question[2]. It behooves any surgeon who may deal with such injuries to have a good working knowledge of the surgical anatomy of this complex area.

Case report

A 4-year-old, previously well girl was received in the present authors' hospital emergency department on a Saturday morning with 'the head of the toothbrush embedded in the left cheek'. The child was not distressed despite the ordeal and had stable observations. Her airway was not compromised, and apart from mild eczema, her medical history was non-contributory. The child and her brother had been left in the custody of their grandmother for the weekend, and whilst an exact history could not be established, it appeared that the brother had pushed his sister (the patient) whilst she had the toothbrush in her mouth. The result was the impalement of the bristle end of the brush in her left cheek.

The emergency department staff had sought transfer of care to the oral and maxillofacial surgeon. The child was examined more fully 2 h after the initial triage by the first author (O.J.Y.). The bristles and some of the shaft of the brush were well buried into the cheek and palpable from the skin side, although there was no through-and-through laceration (Fig. 1). There was no bleeding. Apart from a missing lower deciduous incisor, which was established

Fig. 1. Extraoral view of a 4-year-old child with an impalement injury.

Fig. 2. Computerized tomography scan. The arrow points to the bristles of the brush as lodged in the tissue plain.

to have exfoliated (unrelated to the present injury) the night prior, the remaining oral examination was unremarkable. Most notably, the child could purse her lips, smile and puff her cheeks, suggesting that there was no existing injury to the VIIth cranial nerve. A computerized tomography scan was carried out and showed that the bristles were well past the buccinator muscle, having come to rest at the anterior edge of the masseter muscle. The brush head was inferior and away from both the parotid duct and the VIIth cranial nerve (Fig. 2).

In light of possible iatrogenic injury to the VIIth cranial nerve, the parotid duct and buccal vasculature, it was decided to remove the toothbrush under general anaesthesia. Consideration was given to potential infection resulting from the presence of oral microorganisms on a used toothbrush, and 500 000 units of intravenous (IV) penicillin and 250 mg of IV metronidazole was commenced immediately.

Some 6 h later, having obtained adequate gastric emptying to allow for the safe delivery of the anaesthetic, a state of general anaesthesia was induced. This warranted using nasal prongs for preoxygenation and an IV induction (through the IV access already procured for administration of antibiotics). No muscle relaxants were given so as to allow for quick reversal of the state of unconsciousness. Once the patient was anaesthetized, the toothbrush stem was cut using a heavy orthopaedic 'bolt cutter', thus allowing the anaesthetic team to ventilate the child by mask. The remainder of the induction was routine, and nasal intubation was used to allow maintenance of anaesthesia as well as to give adequate access to retrieve the toothbrush.

Having disinfected the skin and mucosa, the toothbrush stem was bluntly dissected and freed from its bed (Fig. 3). The bristle end was identified and retrieved. The wound was widened away from the parotid papilla and a haematoma in the base of the wound was retrieved. The brush and any bristles were carefully removed next. The wound was then thoroughly washed with a dilution of three parts hydrogen peroxide to two parts sterile water and also saline. The wound was closed in two layers, but no drain was deemed necessary.

Fig. 3. Impalement of a toothbrush.

The patient was discharged from hospital the same day with oral penicillin (125 mg/5 mL syrup) and oral metronidazole (100 mg/5 mL) for 5 days. Follow-up was arranged in private rooms, initially on day 4 and again on day 7, when the sutures were removed. In the 3 years since the injury, there has been no facial palsy, parotid sialadenitis or wound sepsis.

Discussion

There are several case reports in the English literature involving the impalement of a toothbrush in the buccal vestibule[9,11,12,16]. Management protocols have varied in the literature; however, at least one case experienced similar anaesthetic difficulties associated with the position of the impaled object to the current case[11].

Potentially serious sequelae following an injury of this nature are not rare. These include deep neck abscess[10,18–20], widespread emphysema[10,21], internal carotid thrombosis[4,6,7,22–29] and stroke[5,7,23,30]. The current case saw the head of the toothbrush remain lateral to the ramus of the mandible. However, medial impaction to the ramus of any object has far more serious complications. Despite a successful surgical retrieval, observation of the patient for up to 72 h has been suggested to account for the delay of some neurological complications and/or infection. It is not essential for a clinically stable child to remain an inpatient, but it is essential that parents are made aware of what signs to look for, given appropriate instructions and informed that they should seek immediate medical attention for their child should this become necessary.

Serious complications are highlighted in the report by Kosaki *et al*. of the 1-year-old girl who experienced a tonsillar fossa injury following a fall on her toothbrush[19]. As noted previously, this patient quickly deteriorated and required aggressive management of her injury. Although this child survived the ordeal, she required a lengthy hospital admission. Injuries which cause bleeding typically lead parents to seek medical attention. The main site for trauma had been the palate, rather that the cheek, as in the present case, or the tonsillar injuries reported by Kosaki and colleagues[19].

A review of the management of impalement injuries in individuals aged between 1 and 16 years of age highlighted the fact that these injuries in children get treated by a variety of specialists[31], which makes data collection and, hence, the development of evidence-based clinical guidelines difficult. Of the 43 patients included in the present review, eight involved the impalement of objects in the dangerous peritonsillar area. Although all their cases healed uneventfully, the above authors went on to review the non-English literature and found 24 cases of thrombosis of the carotid artery after similar impalement injuries in the palate, with seven of these cases dying of complications.

Conclusion

Impalement injuries of the soft palate and oropharynx are commoner injuries in children that adults. Serious complications rarely arise, allowing for their management in the outpatient setting, by and large. However, parental counselling on possible sequelae and close follow-up are recommended.

Nonetheless, penetrating injuries of the oropharynx can be quite devastating, and significant morbidity and even death is possible. One must be aware that neither the mechanism of injury nor the degree of injury correlates with the potential for neurovascular sequelae.

The following findings are common:

1 the patient was under 4 years of age;
2 an object was held in the mouth at time of the fall;
3 there was a tendency to trivialize the injury, particularly when bleeding may not have been significant; and
4 late-onset complications.

A thorough medical history, followed by careful clinical and radiographic examination, is indispensable. It is essential to establish the sequence of events leading to the injury, the forces involved, the nature of any projectiles or foreign bodies involved, and any other contributing events. This, coupled with a sound knowledge of surgical anatomy, pathology and microbiology, will allow the clinician to accurately assess the injuries and the inherent

potential risks. It is important that these injuries are 'respected' rather than trivialized. All findings should be documented and, ideally, photographs taken. Investigations should be well thought out. Computerized tomography scans can accurately identify the position of the impaled object in three dimensions. This allows a survey of the adjacent structures, which will minimize further surgical injury. Oral wounds may be contaminated with the local flora as well as the contaminants on the impaled object, and therefore, antibiotic therapy is recommended. Tetanus toxoid may be appropriate.

Therefore, management of impalement injuries in children should be performed in the following fashion:

- assess the history and clinical scenario;
- refer the patient for immediate assessment by a trauma centre if the impalement of the object is severe or extrication is likely to bring about complications;
- careful follow-up is required because of the delayed onset of neurovascular complications; and
- instruct parents of the possible signs and symptoms of complications.

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What this paper adds

- A case report is presented of impalement of a brush foreign body in the cheek.
- Surgical removal of this foreign body is elaborated.
- Postoperative management and aftercare are discussed.
- A survey of the relevant literature is presented.

Why this paper is important to paediartric dentists

- Childhood impalement injuries of the soft palate and oropharynx may be first reported to a dentist.
- Some of these injuries can have serious sequelae, even death.
- The present authors set out current best-practice principles in the management of these injuries.

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