

Mishaps in Orthodontics: A literature Review

Review Article

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Abstract

In daily orthodontic practice, we usually face two types of emergencies: head gear injuries and oropharyngeal ingestion of orthodontic components. Since, the force applied by head gear is in orthopaedic range (400-1000 grams), severity of injuries increased. Injuries include from simple laceration to oral cavity, face, nose, eyelids to severe eye injuries. The handling of small orthodontic components in the vicinity of the salivation demands particular care on part of the clinician, especially when the patient is supine or semirecumbent. At the point, when considering the potential complications of aspiration versus ingestion, the intuitive conclusion would be that aspiration is associated with a higher morbidity rate. The most common symptoms of laryngotracheal impactions are dyspnoea, cough, and stridor; bronchial foreign bodies cause coughing, diminished air entrance, dyspnoea, and wheezing. Although, most of the foreign bodies entering into gastrointestinal tract pass without incidence, there is danger of serious complications including gut perforation, with subsequent abscess formation, and haemorrhage or fistula and death. The purpose of this article is to present a review of such type of injuries and its management perspectives.

Keywords: Head Gear Injuries; Oropharyngeal Injuries; Management Perspectives.

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Introduction

In daily orthodontic practice, we usually face two types of emergencies: headgear injuries and oropharyngeal ingestion of orthodontic components. In spite of variety of additional devices to control anchorage, facebow still provide anchorage in treatment of variety of malocclusions. There is no any substitute of head gear in restraining growth of maxilla in growing subjects of Class II malocclusion. Unfortunately, many patients get injured by face bow during treatment. Injuries have been associated with catapult

effect of extraoral traction causing facebow coming out, resulting into injury of face, head and neck or due to dislodgement of standard face during sleep [1-5]. The injuries range in severity from minor laceration to loss of eyes. Night time disengagement of face bow is a main causative factor in facebow injuries. Occasionally, orthodontic appliances or part of them can compromise the airway and gastrointestinal tract due to the close proximity of these appliances to oropharynx. Such type of emergencies may lead to some serious complications, as accidental death in children [6, 7]. Incidence of ingestion of foreign bodies of dentistry being 3.6-27.7%, the no. being considerably higher in adults than children [8]. The majority of foreign bodies found in the airway in children younger than 3 years are contributed by food materials [9]. Once a foreign body has reached the stomach, it has an 80% to 90% chance of passing through the gut without problems. Chance of gut perforation is very less (<1%) [10]. The recent trends towards the use of micro implants in orthodontics may raise the risk of ingestion or inhalation of such components. In this article, we are going to present a review of such type of injuries and its management perspectives.

Clinical issues of Facebow injuries

In orthodontics, headgear is used to stop forward growth of maxilla, distalize the maxillary molars and the maxillary skeleton in extreme cases. Since, the force applied by head gear is in orthopaedic range (400-1000 grams), severity of injuries increased. Injuries include from simple laceration to oral cavity, face, nose, eyelids to severe eye injuries.

Details of injuries may be summarised as following: [5]

Group 1

1. Accidental disengagement when the child was playing whilst wearing the headgear.
2. Incorrect handling by the child during the fitting or removal of the headgear.
3. Deliberate disengagement of the headgear caused by another child.

Group 2

Unintentional disengagement or detachment of the headgear while the child was asleep.

The preliminary report from a survey [11] revealed that 4% of respondents had experienced headgear injuries in one or more of their patients and 40% of these injuries were extra oral. However, more than half of the extra oral injuries occurred in the mid face in the region of eyes, eyelids and bridge of nose. In another survey [1], from 4,798 replies, 216 injuries from extra oral traction appliances were reported; of these, 133 were intraoral injuries, 31 occurred to lower face, 5 to upper face but not in proximity to the eyes, and 41 injuries occurred around eyes. Among eye injuries, permanent damage was reported in 7 cases including 5 instances of total blindness in one or both the eyes. Survey done in 1996, participating 1682 dental practitioners showed details of 33 injuries from Kloehn type facebows [12]. Infraorbital abscess and loss of visual acuity due to blinding endophthalmitis was reported as a result of facebow injury [2, 13]. When assessing the failures in safety systems, they can arise from two reasons: 1. Active failures—These are the hazardous acts sometimes committed by the people who are in direct contact with the patient. 2. Latent condition—these are the inevitable 'residual pathogen' within the system and emerge from decision made by designer. Unlike the active failures, latent condition can be identified and treated before an adverse event occurs. This understanding leads to proactive, rather reactive risk management [14]. Traumatic Streptococcus viridans endophthalmitis after penetrating ocular injury happened from orthodontic headgear [15]. Besides these, many more facebow injuries have also been reported [16-18].

Oropharyngeal Clinical Issues of Orthodontic appliances

Almost all the dental cares are delivered in patient's supine position. This position enables easy accessibility of oral cavity as well as improves in the comfort of the patient and clinician. The handling of small orthodontic components in the vicinity of the salivation demands particular care on part of the clinician, especially when the patient is supine or semirecumbent [22].

At the point, when considering the potential complications of aspiration versus ingestion, the intuitive conclusion would be that aspiration is associated with a higher morbidity rate. The symptoms depend on the location of the impaction in the airway. In the event that the object gets trapped above the level of the vocal cords, respiratory trouble can warrant urgent action. Smaller objects usually do not cause obstruction and tend to pass through the vocal cords [20]. The most common symptoms of laryngotrache-

al impactions are dyspnoea, cough, and stridor; bronchial foreign bodies cause coughing, diminished air entrance, dyspnoea, and wheezing [9]. Hoarseness of the voice will accompany obstruction of the larynx or trachea with or without cyanosis, depending on whether the obstruction is partial or complete [21]. Some more serious complications include bronchial stenosis, bronchiectasis, lung abscess, tissue ulceration or erosion, oesophageal perforation with secondary mediastinitis, and pneumothorax.

Although, most of the foreign bodies entering into gastrointestinal tract pass without incidence, there is danger of serious complications including gut perforation, with subsequent abscess formation, and haemorrhage or fistula and death. If foreign body is not visible in supratonsillar recess, epiglottic vallecula or piriform recess, then it has either been swallowed or aspirated [22].

Large objects with sharp edges are liable to become impacted in the oesophagus at the level of the fourth cervical vertebrae [23]. In case of oesophageal obstruction patient may show symptoms of failure to swallow, muscle incoordination, pain on swallowing, haematemesis or vomiting.

The ileo-caecal junction and the sigmoid colon are the commonest sites of perforation to occur. The symptoms vary between abdominal pain, fever, nausea, vomiting, abdominal distension [24]. Some reported oropharyngeal hazards include swallowing an expansion appliance key [25-27], transpalatal arch during its removal [10], a mandibular spring retainer [23, 28], a maxillary removable appliance [29], a fragment of a maxillary removable appliance [30], a piece of archwire [27, 32], a fractured Twin-block appliance [7] and accidental ingestion of a rapid palatal expander [33], a quad helix appliance [34], a component of a fixed orthodontic appliance [35], a gold cast crown during orthodontic tooth separation [36] and presence of orthodontic archwire in the nasal cavity [37], orthodontic bracket lost in the airway during orthognathic surgery [38], dislodgement of an orthodontic bracket into a sagittal split site [39] etc.

Management Perspective

Facebow injuries

Quick withdrawal of appliance is essential if there should arise an occurrence of any damage. A thorough clinical, radiological and pathological examination must be done to avoid serious complications. In order to try and help prevent these injuries and improve safety standard, different manufacturers have introduced several safety devices.

Self releasing headgear and neckgear: The self releasing mechanism in these devices has been designed to prevent or reduce the catapult effect encountered in the recoil injuries [40-41]. The self-releasing extraoral traction systems can reduce the catapult effect to approximately 10mm for the headcap and 25mm for the neck strap [42, 43].

Plastic Neckstraps: These plastic neck straps have been offered as a simple safety device presumably to retain the face bow within the buccal tubes. Since, these straps are not flexible, it cannot accommodate the changing distance between the back of the neck and face bow, and still provide a continuous resistance to the displacement of the face bow from the buccal tubes [44, 45]. The

stiff nature of this simple device makes it unsuitable as a reliable method of retaining the face bow within the tube housing when fitted around the neck.

Shielded face bow: Some face bows have had shielding included on their inner ends in an attempt to reduce the severity or risk of soft tissue trauma. Shielded face bow may reduce the severity of some trauma, but it does not self-retentive, which makes this an undesirable alternative to the standard face bow.

Locking orthodontic facebows: A variety of locking facebow designs were successfully used by a group of patients [46]. The locking facebow design successfully reduced night time disengagement of the facebow to less than 1%, which contrasts very favourably with the 65% disengagement rate [12]. One such type of facebow, is Nitom Locking Facebow which has been designed to be used with fixed, functional and removable appliances.

Locating Elastics: Short strong elastics may be used between hooks on the inner bow and the buccal tubes to reduce the likelihood of disengagement. They may be variable in effect, and may present difficulties for the patient to fit and remove.

Safe ends: These do not prevent the accidental removal of the facebow from the buccal tubes, but provide a blunt end, which may reduce the incidence of penetrating injuries.

Miscellaneous safety products: There are two products in this category:

1. The Nola system is completely different from all the other system. Here, the release mechanism for allowing immediate separation of headgear from face bow is attached to the face bow, unlike all the other system where the release mechanism is attached to the headgear. Attaching the 'Freedom Latch Unit' to the face bow however, is time consuming and attaching the 'Safety Line' is fiddly, but both of these can be done by the technician in advance of the fitting appointment.
2. Masel safety strap is the simplest, quickest and cheapest way of converting any headgear to a safer version. It works by limiting the possible movement of the face bow. The Masel safety strap is added to the patients existing headgear system by sliding it under the neck strap and running it in parallel.

Proactive risk management: Besides these safety devices, extraoral traction should only be prescribed to those patients who are likely to comply with the orthodontists instructions. The use of the equipment should be clearly demonstrated to the patients and the parents. A written consent has to be obtained from the patients or from parents. Use a self-retentive or locking facebow preferably. Outer bow should be approximately 1cm away from cheek.

Written instruction should be issued to all patients and parents to take away with them include:

1. Use mirror at the time of wearing of appliance.
2. Do not wear headgear while playing sports or rough games.
3. Remove the headgear before the inner bow. Never remove or fit the headgear in one piece by pulling the headgear over the face/head.
4. Take hold of facebow until another person has released their hold.

5. Always fit the locking face bow first. Once the face bow is in position, then the self-releasing head cap/neck strap may be fitted, whilst holding on to the face bow, to the prescribed tension as shown by the orthodontist.
6. Do not use excessive force to remove the face bow in case of difficulty in unlocking. The face bow should be left in place and the patient should attend the orthodontic clinic as soon as possible to allow the orthodontist to rectify the problem.
7. If the patient wake up and removes the head cap/neck strap and face bow in middle of the night, they should place it outside the bed before going back to sleep and before removing the face bow the patient must first remove the head cap/neck strap.

Oropharyngeal Injuries

If an object is displaced into the mouth in a supine patient, the patient's head should be turned to one side to encourage the object to fall into the cheek and not the oropharynx [19], or the patient could be turned face down to allow the object to fall out of the mouth [47]. The patient should be asked to cough [48]. The mouth and oropharynx should be examined; if the object is visible, it should be removed with either forceps or high-speed suction.

Management can be divided into two parts:

Management of aspirated foreign bodies: Management of aspirated foreign bodies depends on the severity of the symptoms. If the foreign body is obstructive and the patient is in respiratory distress, dislodgement of the foreign body should be initially attempted with back blows and the Heimlich maneuver [49]. If these fail to dislodge the object, positive airway pressure needs to be maintained by artificial respiration; if this fails to maintain a patent airway, the object should be bypassed, and an emergency airway established [50]. The approach recommended is via the cricothyroid membrane and should be attempted only by a medical practitioner with the appropriate training. Once an airway has been established, the patient should be transferred to a hospital for emergency medical attention. If the object has passed the vocal cords and there is no obstruction of the airway, the patient should still be referred for immediate medical attention. All foreign objects in the respiratory tract need to be removed, and this should be done as soon as possible because oedema, excessive secretions, and formation of granulation tissue can make localization and removal difficult. The mucosal appearance of the pink acrylic, often used in orthodontics can also make visualization during bronchoscopy of any fragment of inhaled acrylic difficult and, hence, might complicate its removal. Although spontaneous expectoration of inhaled foreign bodies occurs in 1% to 2% of cases, waiting for this to happen with postural drainage is no longer recommended because, if the foreign body is dislodged from its original location, it can obstruct the airway [51].

Management of ingested foreign bodies: The usual time taken for a foreign body to traverse the intestinal tract is 2 to 12 days. If it is suspected that a patient has swallowed a foreign body, he or she should be referred to the appropriate medical specialty, because it might be necessary to electively remove an object with sharp edges to avoid perforation. On occasions, patients have been advised to supplement their diet with a large amount of cellulose, laxatives, which theoretically aid the passage of the object through the gut. For radiolucent objects, ingestion of cotton wool

pellets mixed with small amounts of barium sulphate suspension has been attempted to form a radiopaque bolus around the object, which allows it to be tracked through the gut radiographically [48].

Proactive risk management: The most important thing to prevent dislodgement of the intraoral appliances is retention of appliances. The following precautions, if undertaken by the orthodontist while using orthodontic appliances, might help to reduce the risk of accidental ingestion or inhalation.

1. Cell phones should be switched off in the clinic, where they can distract patients, the orthodontist, and the staff.
2. Place a gauze dental napkin behind the orthodontic appliance to act as a barrier during adjusting small components intra-orally.
3. Tie floss lashes onto expansion keys, transpalatal arches, quad-helices, molar bands, and any other loose components when adjusting them intra-orally. Keys attached to a plastic ring holder are commercially available.
4. Auxiliaries (coil springs) should be temporarily stabilized on the wire with wax during its placement.
5. Ends of the removable appliances (cribs, springs, clasps) should be rounded and avoid use of C-clasp to reduce risk of puncturing alimentary canal.
6. Large span of unsupported wire should be supported with tubing.
7. Micro implants must be adequately attached by steel ligatures to the main appliance through eyelets of the implant (if present).
8. Debonding of the brackets should be done with the base archwire remain attached.
9. Impression should be taken with high viscosity material and tray of correct size and in upright position of the patient.
10. Place a cotton wool roll placed over the end of arch wire even with use of distal end cutter and all instruments should be regularly inspected for signs of failure.
11. Use of different colored acrylics rather than pink is advisable for the construction of removable appliances for easy visualisation of acrylics on bronchoscopy or endoscopy.
12. Nowadays, the use of radio-opaque mixed materials (barium sulphate, lead foil, bismuth glass, barium acrylate, glitter containing acrylics etc) may be useful to locate radiolucent objects but incorporation of radio-opaque materials tends to set up stress concentrations resulting in weakening of the material [52].

Conclusion

Dentistry as such and orthodontics in particular pose a high risk of extraoral appliance injuries and ingestion or inhalation of appliance components. Although occurrence is infrequent, the potential morbidity associated with any incident is too high to ignore. The importance of early recognition of signs of emergencies and urgently referred to the appropriate medical specialty cannot be overemphasized. As members of the medical fraternity, orthodontists must be abreast of basic life support and first aid skills and should be updated after every two years.

We may come to the conclusion that, "Prevention is better than cure" is the best policy for such type of emergencies going to happen.

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Special Issue on

"Long-term effects of orthodontic treatment"

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