

**CLINICAL
SECTION**

Ingestion of a quadhelix appliance requiring surgical removal: a case report

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This report presents an unusual case, whereby a 13-year-old Down's syndrome boy accidentally swallowed a removable quadhelix appliance that subsequently required surgical removal. The paper discusses management strategies for patients who have accidentally swallowed components of their orthodontic appliance. It also highlights the need for orthodontists to consider limited objective treatment options for certain patient groups.

Key words: Ingested orthodontic components, surgical intervention, special needs orthodontics

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Introduction

Every orthodontic patient has the potential to accidentally ingest components of their appliance with the recognition that this could cause significant morbidity and potential mortality. However no reported deaths have been recorded in the orthodontic literature from such an event. The following case report describes the accidental swallowing of a removable quadhelix appliance that subsequently required surgical removal.

Case report

A 13-year-old patient with Down's syndrome originally presented at clinic with a Class I incisal malocclusion, a well-aligned lower arch with congenitally absent lower central incisors, crowding in the upper arch, and bilateral crossbites. Compliance was apparent but in view of the boy's special needs a modular treatment approach was applied with regular reassessment. The treatment objectives were tailored to the needs and tolerance of the individual. The crowding was alleviated by extracting both the upper first premolars and the use of expansion, which also corrected the transverse discrepancy. Subsequent alignment of the maxillary dentition was completed with a pre-adjusted edgewise appliance.

The first appliance objective was to expand the upper arch with a removable quadhelix. This decision was made on the basis of the patient's cardiac history requiring antibiotic prophylaxis; the ease with which the quadhelix could be disengaged, activated and reinserted without causing a bacteraemia and perceived patient tolerance.

The quadhelix was fastened by elastomeric separating rings, which were refreshed with new ones when the appliance was progressively expanded. Having been worn uneventfully for five months the removable component of the appliance dislodged from the sleeves welded to the molar bands and was accidentally swallowed while the patient was eating yoghurt for breakfast at school.

The boy and his mother promptly attended the orthodontic department. He presented without any signs or symptoms of respiratory distress or gastrointestinal tract irritation. An erect anterior–posterior chest radiograph was taken to determine the location of the appliance. The radiograph (Figure 1) confirmed that the quadhelix was situated in the region of the lower oesophagus.

The patient was referred to the general surgeon who planned to retrieve the foreign body with the aid of a gastroscopy under a general anaesthetic. The awkward shape of the quadhelix (Figure 2) was a concern and it was predicted that a laparotomy might be necessary.

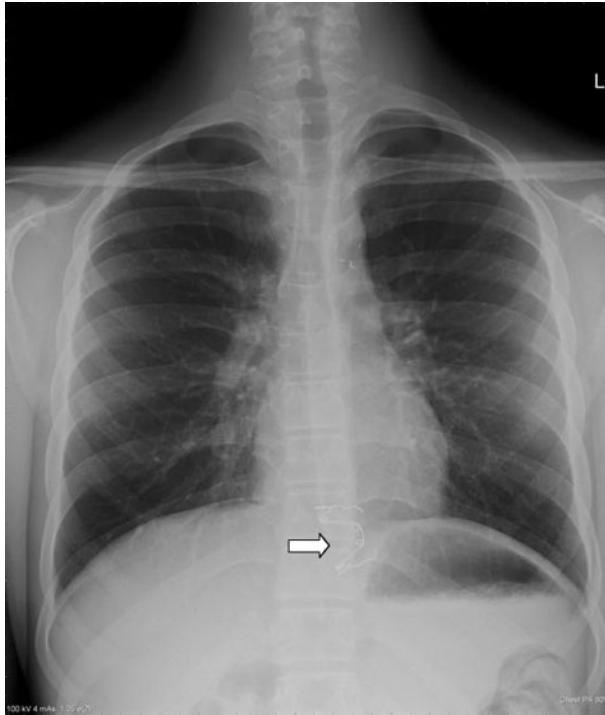


Figure 1 Chest radiograph showing quadhelix (white arrow head) in the lower oesophagus

The gastroscope localized the quadhelix to the level just above the oesophageal–gastric junction (Figure 3). The surgeon deemed that the risk of visceral perforation was high if the quadhelix were to be retrieved in a retrograde manner with grasping forceps. It was therefore mobilized and passed distally into the stomach. A mini-laparotomy was then performed. Access to the stomach was gained via a 5 cm epigastric midline incision and the foreign body was removed from the stomach via a small gastrotomy incision. The stomach

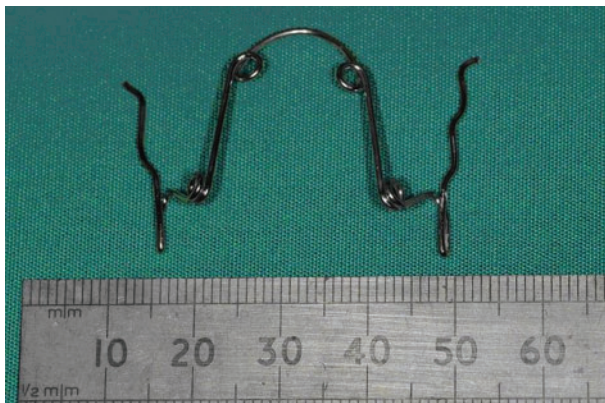


Figure 2 A removable quadhelix appliance to show its awkward shape and relative size

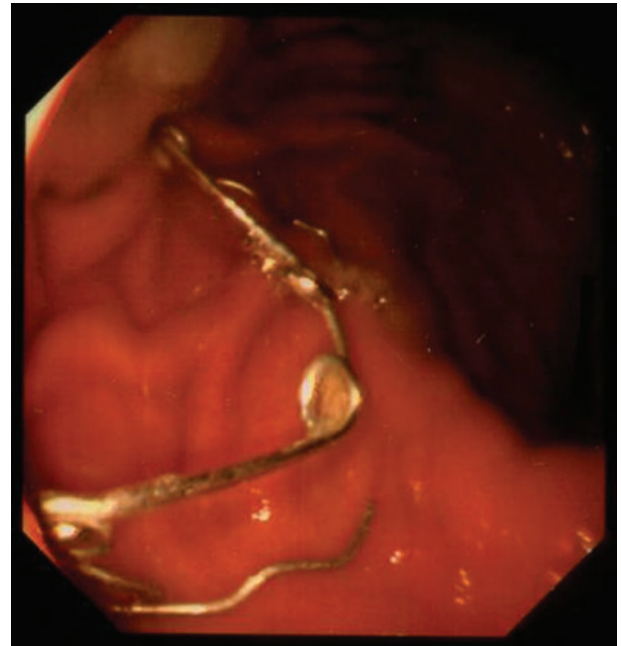


Figure 3 Quadhelix viewed through endoscope at the level of the oesophageal–gastric junction

was closed in two layers with 3/0 polydioxanone sutures (PDS). The mini-laparotomy wound was also closed with 3/0 PDS and the subcutaneous tissues with 3/0 Monocryl.

The patient had an uneventful recovery. Thirty-six hours after surgery he was discharged under parental supervision. A soft diet was advised. His active orthodontic treatment was subsequently concluded using a preadjusted edgewise appliance and an auxiliary E-arch to maintain the expansion. Retention is being monitored and he has recovered well.

Discussion

The management of an ingested foreign body is determined by the size, shape and location of the object.¹ Fortunately, if a foreign body is lost at the back of the mouth, it is more likely to enter the gastrointestinal tract rather than the respiratory tract.²

Objects ingested that are small and blunt, such as orthodontic brackets, would be expected to pass through the gastrointestinal tract completely and uneventfully, usually over a 7–10 day period.^{3,4} The British Orthodontic Society advises that this is likely to occur for smooth and flexible objects that are less than 5 cm in length. In such circumstances, it is advisable to monitor natural evacuation of the foreign body by checking the patient's faeces.⁵ Transit time is

unpredictable and more than 50% of foreign bodies will pass in the stools unnoticed.⁶ The use of aperients to aid evacuation is debatable; it has been suggested that their action may increase the risk of visceral perforation and that a 'wait and see' policy is best adopted.⁷

Large or sharp objects, as seen in this case, can subsequently become impacted and require urgent removal. Foreign bodies most frequently lodge in the upper oesophagus and if they cause obstruction may result in aspiration.⁷ Symptoms of dysphagia, odynophagia, haematemesis or vomiting may indicate oesophageal obstruction or impaction. Sharp objects are more likely to result in perforation. If perforation occurs within the gastrointestinal tract it is most likely to take place in the oesophagus. Other sites of possible impaction and perforation include the pylorus, the duodenum, the duodenojejunal flexure and the ileocaecal region. This may also be seen at sites of previous intestinal surgery or stenosis or in areas of congenital anomalies such as Meckel's diverticulum. Following perforation the presenting features will vary according to the site and may include mediastinitis or appendicitis.^{8,9} Symptoms may be remote from the time of ingestion. A recent case study by Mehran *et al.*¹⁰ reported that patients may not always demonstrate classical signs and symptoms of perforation. They highlight the need to consider gastrointestinal perforation secondary to ingestion of a foreign body as a differential diagnosis for the patient that presents with atypical abdominal pain.

Further complications caused by ingested foreign bodies include intestinal obstruction, abscess formation, haemorrhage, fistula and mucosal ulceration.⁷ Prompt removal of foreign bodies impacted in the gastrointestinal tract will therefore decrease morbidity.

The majority of foreign bodies impacted in the upper part of the gastrointestinal tract can be removed endoscopically with a magnet probe or grasping forceps.⁶ Objects that are large or sharp may cause further tissue damage on withdrawal and will require careful surgical removal as in this case. Guidelines for the management of ingested foreign bodies by the American Society for Gastrointestinal Endoscopy, suggest that if a sharp-pointed object cannot be safely removed endoscopically then daily radiographs should be taken to monitor the progress of the object. They recommend that surgical intervention is required for objects that fail to progress for three consecutive days as demonstrated by serial radiographs.¹¹

Inhalation of foreign bodies presents a more serious scenario. Aspiration of a foreign object with partial or complete airway obstruction can be fatal and immediate removal is critical.¹² The patient in distress should be

asked to cough. If this is ineffective then back blows should be administered or, in trained hands, abdominal thrusts (Heimlich manoeuvre). Should these measures fail to dislodge the object and respiratory failure ensues, positive airway pressure should be maintained by artificial respiration and assistance should be summoned without delay as it may be necessary to create a surgical airway.^{13,14} Patients that require abdominal thrusts should be referred to a medical practitioner to exclude internal injuries.¹⁵

The aspiration of small objects may go unnoticed initially, but may later develop serious consequences such as pneumonia or a pulmonary abscess.^{7,12} A history of choking, coughing and wheezing at the time of the event may raise suspicions of this possibility. Small foreign bodies preferentially pass through the right main bronchus since its angulation is more vertical and of greater diameter than that of the left. Once a foreign body is suspected to be lying within the respiratory tract, urgent referral to a respiratory specialist should be made. It may then be removed with the assistance of a flexible bronchoscope or failing that, a thoracotomy.

Accidental swallowing of foreign objects in dentistry frequently appears in the literature. Reports of large objects including dentures and even toothbrushes have been swallowed by patients with normal physical and mental abilities.^{3,16} In this case, the patient's special needs may have contributed to the ingestion of the removable quadhelix.

Conclusions

Although ingestion or inhalation of orthodontic appliances are rare complications of orthodontic treatment, it is highly recommended that missing components are accounted for at each visit.¹⁷ Orthodontic practitioners should be familiar with the early management of ingested foreign objects and competent at making an appropriate specialist referral if required. If there is doubt as to whether a foreign body has been inhaled or ingested then radiographic investigation is performed. A foreign body may not always be identified on the initial investigative radiograph and other views may be required. Some objects have been out of the field on chest and abdominal views but detected in the larynx on neck radiographs.¹⁷ Radiologists are fundamental in locating, monitoring the progress and guiding retrieval for swallowed foreign bodies. They should be given a similar object to the missing component so as to maximize benefit from any investigation.¹⁶

If a patient swallows a foreign object appropriate effective action is required with an expression of care

and concern to prevent patient dissatisfaction and an act of negligence.

This case report highlights the need for orthodontists to consider all treatment options including limited objectives and tailoring them appropriately to patients with learning difficulties and specific physical impairments. They are a unique group and additional support from carers is mandatory in providing ethical orthodontic treatment.¹⁸ It is important to be sympathetic to yet realistic regarding parents' expectations, who may want treatment to meet their aspirations rather than benefit their child. The risk-benefit equation should be weighed up and an acceptable compromise reached. In this case, one can speculate that the quadhelix component became free when the elastomeric rings either became unhooked from their fixtures or the rubber had perished and torn. It is important that the patient or carer regularly check that the rings are correctly sited and if in doubt contact the surgery for investigation and action.

The proposed guidelines for the prevention of endocarditis in dentistry¹⁹ are included in the scope by NICE to resolve conflicts in existing protocols regarding prophylaxis of people undergoing interventional procedures. These are expected to be issued in March 2008.²⁰ If approved, antibiotic prophylaxis for dental treatment may be restricted to patients who have had a previous endocarditis, or cardiac valve replacement surgery or those with surgically constructed systemic or pulmonary shunts or conduit.¹⁹ The patient described here did not fall into one of these categories and under this guidance would no longer require the administration of antibiotics for procedures causing muco-gingival manipulation. This would affect the decision to use a removable quadhelix. A fixed option would be preferable, affording more security against the risk of dislodgement. For similar situations where individuals still require antimicrobial chemotherapy the dilemma on the most suitable appliance to achieve treatment objectives remains.

References

1. Stricker T, Kellenberger CJ, Neuhaus TJ, Schwoebel M, Braegger CP. Ingested pins causing perforation. *Arch Dis Child* 2001; **84**: 165–66.
2. Sfondrini MF, Cacciafesta V, Lena A. Accidental ingestion of a rapid palatal expander. *J Clin Orthod* 2003; **37**: 201–2.
3. Kharbanda OP, Varshney P, Dutta U. Accidental swallowing of a gold cast crown during orthodontic tooth separation. *J Clin Pediatr Dent* 1995; **19**: 289–92.
4. Webb WA. Management of foreign bodies of the upper gastrointestinal tract. *Gastroenterology* 1988; **94**: 204–16.
5. British Orthodontic Society. *Advice Sheet 9. Guidelines for the management of inhaled or ingested foreign bodies*. London: BOS, 2003.
6. Arana A, Hauser B, Hachhimi-Idrissi S, Vandenplas Y. Management of ingested foreign bodies in childhood and review of the literature. *Eur J Pediatr* 2001; **160**: 468–72.
7. Milton TM, Hearing SD, Ireland AJ. Ingested foreign bodies associated with orthodontic treatment: report of three cases and review of ingestion/aspiration incident management. *Br Dent J* 2001; **190**: 592–96.
8. Antao B, Foxall G, Guzik I, Vaughan R, Roberts JP. Foreign body ingestion causing gastric and diaphragmatic perforation in a child. *Pediatr Surg Int* 2005; **21**: 326–28.
9. Lam PY, Marks MK, Fink AM, Oliver MR, Woodward A. Delayed presentation of an ingested foreign body causing gastric perforation. *J Paediatr Child Health* 2001; **37**: 303–4.
10. Mehran A, Podkameni D, Rosenthal R, Szomstein S. Gastric perforation secondary to ingestion of a sharp foreign body. *JSLs* 2005; **9**: 91–93.
11. Eisen GM, Baron TH, Dominitz JA, *et al.* Guideline for the management of ingested foreign bodies. *Gastrointest Endosc* 2002; **55**: 802–6.
12. Quick AN, Harris AM. Accidental ingestion of a component of a fixed orthodontic appliance—a case report. *SADJ* 2002; **57**: 101–4.
13. Hinkle FG. Ingested retainer: a case report. *Am J Orthod Dentofacial Orthop* 1987; **92**: 46–49.
14. Dibiasse AT, Samuels RH, Ozdiler E, Akcam MO, Turkkahraman H. Hazards of orthodontics appliances and the oropharynx. *J Orthod* 2000; **24**: 295–302.
15. Resuscitation Council (UK). *Paediatric Basic Life Support in Resuscitation Guidelines 2005*. London: Resuscitation Council (UK), 2005; 69–83. Available at: <http://www.resus.org.uk/pages/pbls.pdf>
16. Absi EG, Buckley JG. The Location and tracking of swallowed dental appliances: the role of radiology. *Dentomaxillofac Radiol* 1995; **24**: 139–42.
17. Abdel-Kader HM. Broken orthodontic trans-palatal arch-wire stuck to the throat of orthodontic patient: is it strange? *J Orthod* 2003; **30**: 11.
18. Becker A, Shapira J, Chaushu S. Orthodontic treatment for disabled children—A survey of patient and appliance management. *J Orthod* 2001; **28**: 139–44.
19. Gould FK, Elliott TSJ, Foweraker J, *et al.* Guidelines for the prevention of endocarditis: report of the Working Party of the British Society for Antimicrobial Chemotherapy. *J Antimicrob Chemother* 2006; **57**: 1035–42.
20. National Institute for Health and Clinical Excellence. *Prophylaxis for infective endocarditis, 2007*. Available at: <http://www.nice.org.uk/page.aspx?o=408798> (accessed 22th February 2007).