Dental damage in anaesthesia

Aravind Basavaraju

Kate Slade

Abstract

Dental trauma is a frequently reported complication related to the administration of general anaesthesia and is the most common source of litigation against anaesthetists. General anaesthesia involving direct laryngoscopy, a difficult airway, pre-existing poor dentition and prosthetic dental restoration are major risk factors for dental trauma. Central maxillary incisors are the most frequently damaged teeth. It is good practice to perform a preoperative oral examination, document the findings and communicate the risk of dental trauma to the patient. In the event of dental damage, appropriate timely management will minimize dental morbidity.

Keywords Anaesthesia; complications; dental trauma; laryngoscopy; risk

Royal College of Anaesthetists CPD Matrix: 1C01, 1C02, 1I05, 1F01, 3A01, 3A02

Learning objectives

After reading this article, you should be able to:

- describe the incidence, pattern and medicolegal implications of dental trauma during anaesthesia
- identify the risk factors and outline the steps taken to prevent dental trauma during anaesthesia
- demonstrate a knowledge of safe and effective management of patients sustaining dental trauma following anaesthesia

Incidence and pattern

The reported incidence of dental trauma from large retrospective studies is in the range of 0.02–0.07%.[1] However, prospective studies where dental damage was identified following examination by an experienced dentist, postoperatively, reported figures as high as 38%.[2] The methods by which dental trauma are diagnosed vary and this may account for the wide variation in reported figures. For a tooth injury requiring intervention, the Royal College of Anaesthetists publication on dental trauma during anaesthesia quotes an incidence of 0.02% or 1 in 4500.[3]

Although any teeth can be damaged during anaesthesia, the anteriorly placed maxillary incisors are the most frequently affected teeth. The left is damaged more often than the right, reflecting the fact that a right-handed laryngoscope blade is most commonly used amongst anaesthetists. Most dental injuries are recognized at the time of injury by the anaesthetist and involve a single tooth. Minor inadvertent trauma may be missed and later identified by the recovery or ward staff or the patient themselves.

Ham et al. conducted a retrospective study of 290,415 patients and reported that the ear, nose and throat (ENT) surgical specialty had almost double the overall incidence of dental trauma compared to other surgical specialties.[4] This is unsurprising given the frequent use of rigid oropharyngeal instrumentation in ENT surgery. Table 1 and Figure 1 show the classification and location of dental injury in their study respectively. The general pattern of damage is similar in various studies.

Medicolegal considerations

The incidence of dental trauma is around 0.02% but constituted 11.4% of all anaesthesia claims notified to the NHS litigation authority in England between 1995 and 2007.[5] Although the median cost of claims was £77, considering the frequency of claims the cumulative cost can be significant. Also, dental trauma accounts for the majority of claims against the anaesthetist reported to the Medical Defence Union. With the advancement of dental technology, dental treatment is becoming more complex and expensive and the cost of claims is likely to rise.

Appropriate discussion with the patient and measures to minimize the risk of dental trauma reduce the risk of litigation. However, the anaesthetist could be found guilty of negligence if the consequences of dental damage are not managed appropriately, even if not deemed negligent for the initial dental trauma. Effective communication and documentation of the consent process is paramount to avoid litigation.

Risk factors

Anaesthetic factors

The majority of dental injuries during anaesthesia are reported during tracheal intubation and are most commonly associated with laryngoscopy. This relates to the inadvertent use of maxillary incisors as a fulcrum by the flange of laryngoscope

Classification of 94 cases of dental trauma[4]

Classification	Number (%)
Subluxation	33 (35%)
Crown fracture	18 (19%)
Missing teeth	11 (12%)
Avulsion	7 (7%)
Crown and root fracture	5 (5%)
Enamel fracture	5 (5%)
Other trauma	15 (16%)

Table 1

Aravind Basavaraju *MBBS MD FRCA is Consultant Anaesthetist at the Queen Elizabeth University Hospital, Glasgow, UK. Conflicts of interest: none declared.*

Kate Slade *MBChB FRCA is Specialist Registrar in Anaesthesia at the Queen Elizabeth University Hospital, Glasgow, UK. Conflicts of interest: none declared.*

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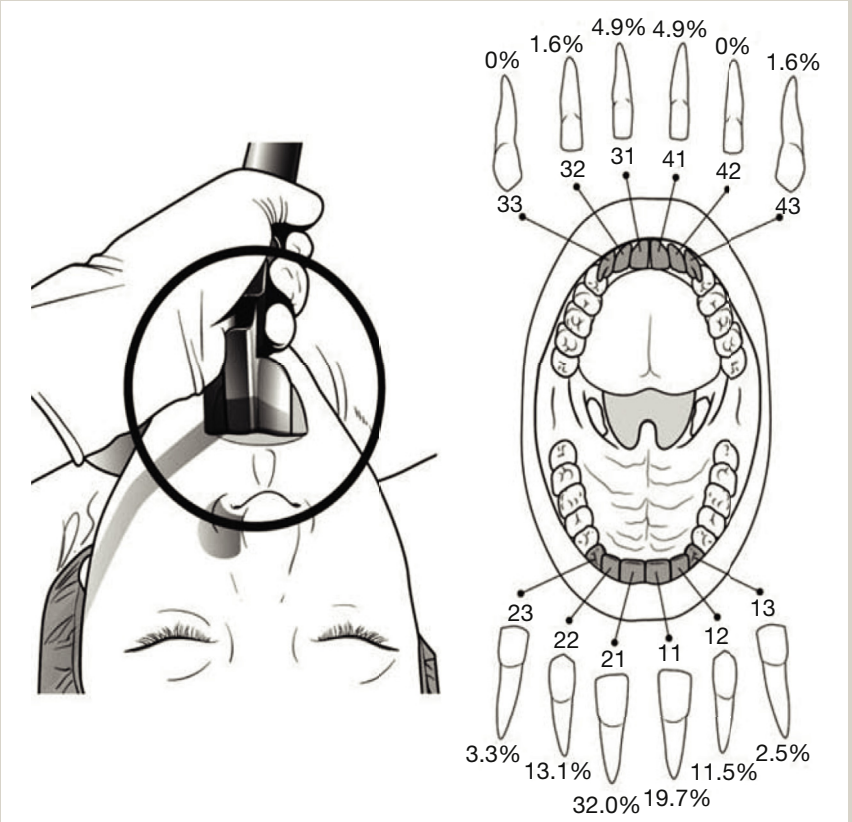
Locations of teeth commonly injured during tracheal intubation



Teeth are labelled with the two-digit World Dental Federation notation system. Reproduced from Ham *et al*.[4] with permission.

Figure 1

blade during laryngoscopy, more so in case of difficult intubation where greater force is exerted in an attempt to visualize the larynx. Patients who are difficult to intubate are 20 times more likely to suffer dental trauma.[6] The central incisors due to their anterior location are exposed to the forces of oral instrumentation including direct laryngoscopy. They are anchored to the bone usually by a single root and have a small cross-sectional area rendering them susceptible to damage by external forces.

However, around one in four dental trauma occur during emergence from anaesthesia related to biting or clenching of teeth on an oropharyngeal airway, laryngeal mask airway (LMA) or suction catheter.[7] Perioperative dental damage usually occurs due to a combination of pre-existing dental pathology and an external force. Dental trauma can occur at the hands of both novice and experienced anaesthetists, as well as with difficult and easy intubations. Vigilance must be exercised.

Dental factors

The arch of incisors are able to generate biting forces in the range of 150–200 N[8] along their axis and healthy teeth are robust and designed to withstand these forces.

Teeth are vulnerable to damage when their structural integrity is compromised by dental caries or periodontal disease and are restored or replaced by artificial material. Teeth are also vulnerable when excessive force is applied, which the teeth and their roots are not designed to withstand. Patients with pre-existing dental pathology are five times more likely to suffer dental trauma.[9] Primary teeth have shallow roots rendering them susceptible to avulsion. Many systemic diseases and drugs affect the structural integrity of teeth making them susceptible to damage. Table 2 summarizes the risk factors for dental trauma.

Prevention

Prevention of dental trauma begins with identifying the risk factors and modifying them if possible. A brief preoperative dental history and focused oral examination is helpful to identify dental pathology predisposing to dental trauma. Details of a recent visit to the dentist may provide valuable information about the health of the teeth.

Location and state of any dental restorations and prostheses, loose teeth and cracks should be noted. Evidence of dental caries and periodontal disease such as brown or black staining, holes or pits in teeth, red swollen gums, abscesses and sinuses should be

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Risk factors predisposing to dental trauma during anaesthesia

Dental factors	Dental disease — dental caries and periodontal diseases
	Prosthetic and restorative dental treatment — caps, crowns, veneers, root canal therapy, bridges and implants
Anaesthetic factors	Laryngoscopy and endotracheal intubation
	Predictors of difficult airway/laryngoscopy — Limited mouth opening (Mallampatti >3), limited head and neck mobility (<90°), prominent maxillary incisors, receding mandible, laryngeal view >3
	Use of oropharyngeal airway as a bite block
	Aggressive oropharyngeal suctioning
	Light anaesthesia (clenching of teeth)
	Shivering (clenching/ grinding of teeth)
	Insertion and removal of oral gastric tube, endoscope and Doppler probe
Patient factors	Children 5—10 years (mixed dentition)
	Adults 50—70 years (increase in prevalence of periodontal disease)
	Obesity
Dental anatomy	Isolated tooth, crowding of teeth, abnormal position
Systemic diseases	HIV, diabetes mellitus, osteoporosis, smoking, gastro-oesophageal reflux, radiotherapy, Sjögren's syndrome (increased risk of periodontal disease)
Drugs	Antipsychotics, antidepressants and antihypertensives (cause xerostomia which predisposes to periodontitis)

Table 2

recorded. Dental infection may adversely affect the surgical outcome of the planned surgery by being a source of infection.

In the absence of a standardized way of recording the state of dentition, a schematic diagram representing the four quadrants of teeth can be used to document the findings on the anaesthetic chart in a clear and objective manner.

Ideally all patients with vulnerable teeth should be evaluated by their dentist for remedial or restorative dental work to prevent damage. However, this goal may be difficult to achieve because of surgical urgency and some patients have a chronic history of poor oral health and are unlikely to improve in the preoperative period. An airway assessment is essential to detect features of difficult laryngoscopy.

Depending on the risk of dental trauma, an anaesthetic plan is formulated. A regional technique or general anaesthesia with LMA can be chosen to avoid laryngoscopy if surgery is amenable to these techniques. Proper head and neck positioning with a sound laryngoscopy technique will help to minimize force on the maxillary incisors. Alternative techniques for endotracheal intubation which can be used are fibreoptic intubation, intubation using a paraglossal technique to minimize contact with incisors, and indirect video-laryngoscopy which provides a better view of the larynx with less force on maxillary incisors.[10] It is the author's practice to leave removable dentures and plates inside the mouth during induction of anaesthesia as this helps with face-mask ventilation, and to remove them before laryngoscopy to prevent damage and dislodgement.

Mouth guards or tooth protectors dampen the pressure on the teeth, and are available in universal and custom-made forms. The universal mouth guards are bulky, may slow or hinder visualizing the larynx and are not entirely reliable. Custom-made mouth guards may provide better protection but are impractical in non-elective situations. Safety of the patient is the priority in choosing any technique or device to prevent dental trauma.

Electroconvulsive therapy causes strong contraction of jaw muscles which can generate a large biting force. Care should be taken to protect the teeth by using an appropriate bite block or mouth guards.

Oropharyngeal suctioning and insertion and removal of mouth gag, endoscope, gastric tube and Doppler probe should be undertaken with care. Using an oropharyngeal airway as a bite block in patients with vulnerable anterior teeth is risky. A gauze roll with a tie or a wooden tongue depressor with gauze rolled on and placed between the molars can be used instead. Premolar and molar teeth have a wider cross-sectional area, have multiple roots anchoring them to the bone and are located in the posterior part of mouth, hence their lower susceptibility to trauma during anaesthesia.

Avoid pulling on the endotracheal tube or LMA forcefully during extubation. Maintain normothermia to prevent shivering and clattering of teeth. High-risk patients should be extubated by the anaesthetist involved rather than delegating to an inexperienced junior or recovery nurse.

Management of dental trauma

Dental trauma has significant impact on people's quality of life. It causes impairment or loss of function and can affect their facial appearance and self-esteem. Significant morbidity or even mortality can result from aspiration or ingestion of dislodged or broken dentition. Therefore it is imperative to recognize and manage dental trauma appropriately.

Immediate management

The immediate task is to locate, retrieve and account for all missing dental fragments and prostheses.

Fragments in the upper airway can be retrieved using Magill's forceps. X-ray of head, neck and chest in antero-posterior and lateral views or a computed tomography scan may be necessary to locate the missing dentition. A dental prosthesis made of acrylic resin is not radio-opaque and therefore will not be visible on X-ray. A digital exploration may be necessary to locate the fragment. Rigid bronchoscopy and oesophagoscopy will be necessary to retrieve objects from the tracheobronchial tree and oesophagus respectively. The majority of smooth dental fragments enter and pass through the gastrointestinal tract uneventfully.

In high-risk patients, an oral examination is prudent after oral instrumentation to look for any evidence of dental trauma. Any broken dental fragments should be preserved and the patient referred to a dentist. A local departmental protocol for the management of dental trauma will expedite treatment and minimize dental morbidity.

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The management of dental trauma depends on the type of trauma and whether the damaged tooth is primary or secondary. The guiding principle for primary teeth is to minimize damage to underlying permanent teeth. With permanent teeth the aim of treatment is to preserve and re-establish the vitality of periodontal ligament and pulp which are necessary for the survival of the tooth.

Primary teeth

Fractures: confined to the enamel are not painful and warrant a routine dental referral. Fractures involving the dentine, pulp and root are painful and need prompt assessment by a dentist. If at all possible it would be best if a dentist could assess the patient prior to recovery, as a badly fractured primary tooth would best be extracted before the patient is awake.

Luxation: Treatment would usually be extraction of the tooth.

Avulsion: Primary teeth should not be replanted to prevent damage to developing permanent teeth.

Permanent teeth

Fracture: Small fractures restricted to the enamel should be referred to a dentist for routine assessment. More significant enamel and dentine, or enamel/dentine/pulp fractures require urgent assessment and treatment by a dentist to try to preserve the vitality of the tooth.

Luxation requires prompt dental referral for repositioning and stabilization of the teeth.

Avulsion is a dental emergency. Avulsed teeth need to be replanted as soon as possible to try to maintain tooth vitality. The main factor affecting success of replantation after traumatic extraction is the time elapsed. If replantation is performed within 30 minutes, success rates for revascularization are as high as 90%. Contraindications to replantation are immunocompromised health and severe uncontrolled seizures. Contaminated teeth should be gently rinsed in saline. The root portion should not be touched or cleaned by rubbing or wiping as this may damage the cell population responsible for successful replantation. The tooth is inserted into its socket and held for several minutes. A suture can be placed to hold an unstable tooth in the socket until dental support can be accessed. If replantation is not possible, the avulsed tooth should be stored in saline or milk or specific tooth storage media such as Hank's balanced storage medium and an urgent dental opinion should be sought.

A comprehensive and accurate note of the events and discussion with the patient should be documented in the anaesthetic record and the patient's notes. Local critical incident reporting should be completed for all dental damage. Trainee anaesthetists should inform their consultant and seek their involvement in speaking to the patient.

Anaesthetists have a duty of candour to inform the patient of the events leading to the incident, once they are adequately conscious. Privacy and the presence of experienced nursing staff are helpful. Offering an apology for the incident is prudent and is not the same as an admission of liability.

The anaesthetist involved should make appropriate dental referral and arrange follow-up. The patient should be provided with adequate pain relief, clear written instructions and a point of contact for any further correspondence and advice.

Conclusion

Dental trauma during anaesthesia can cause significant patient distress and is a common cause of complaint against anaesthetists. Understanding the perioperative causes and risk factors should help to inform a safe anaesthetic plan designed to minimize dental trauma. Effective communication and proper documentation of consent for risk of dental trauma during anaesthesia will diminish the chance of litigation. Prompt recognition and timely dental treatment will minimize the effects of dental trauma. ◆

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