

Review Articles

Dental trauma in anaesthesia

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Dental trauma is the largest single reason for successful malpractice claims against anaesthetists. The purpose of this article is to familiarize the anaesthetist with basic tooth anatomy and pathology and to provide an update on the different types of dental treatment and appliances which one may encounter in anaesthetic practice. Traumatic fractures to teeth are classified into six categories; Class I – fracture into the enamel layer, Class II – fracture into the dentinal layer, Class III – fracture into the pulp of a tooth, Class IV – fracture of the root of a tooth, Class V – subluxation of a tooth, and Class VI – avulsion of a tooth. Treatment for each class of fracture is described as well as certain preventative ideas. Some of the more recent developments in dental therapy such as the butterfly bridge, titanium implants and porcelain laminate veneers are described. Such developments in their turn have led to new and different problems. Care must be taken when using the laryngoscope as these teeth may be more easily fractured or dislodged. Several investigations into malpractice claims found that the oral airway was responsible for up to 55 per cent of dental complications. Prevention of dental trauma begins with an understanding of basic tooth anatomy and pathology and a recognition of the different dental treatments and appliances at the preoperative visit. The value of an appropriate preoperative dental consultation must not be underestimated.

Key words

ANATOMY: teeth; COMPLICATIONS: dental; SURGERY: dental.

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Twenty-nine per cent of all successful malpractice claims against anaesthetists are sought as a result of dental injury.¹ While anaesthetists work daily in and around the oral cavity, they may know very little about teeth and the techniques and appliances used to restore teeth.² An understanding of the normal anatomy and pathology of the mouth may help to protect against legal liability.

Injury to teeth as a result of anaesthetic manipulation may be unavoidable. The purpose of this paper is to familiarize the anaesthetist with basic tooth anatomy and pathology, and to provide an update on the different types of dental treatment and appliances which may be encountered in anaesthetic practice.

Basic tooth anatomy

The tooth is divided into two parts;³ the crown and the root, each consisting of three layers (Figure 1). Enamel is the outer layer which is fragile if not properly supported by viable dentin. Dentin is the second layer which is yellowish in colour, and provides the basic framework for the tooth. The inner layer consists of blood vessels and nervous tissue and is referred to as the pulp. Enamel is not found on the root surface which is covered with softer cementum.⁴

Recognition of the periodontium is important in understanding dental anatomy. This is the tissue which surrounds the tooth and provides support for the tooth. Its components are the alveolar bone which provides support, the periodontal ligament which holds the tooth and the pink gingiva which protect the bone and ligament.^{5,6}

Basic tooth pathology

The most common disease that affects the tooth is dental caries. Bacteria are found to adhere to the tooth. They produce acids which decalcify or dissolve the outer layers leading eventually to an undermining of the enamel.⁷

Treatment of caries involves removal of the decayed portion of the tooth and the placement of a dental restoration (filling).⁸ This restoration does not necessarily strengthen the tooth and may weaken it. Attention should be paid to a patient who has large anterior restorations as these teeth will be more brittle than normal. It is also important to examine along the gingival margins of teeth

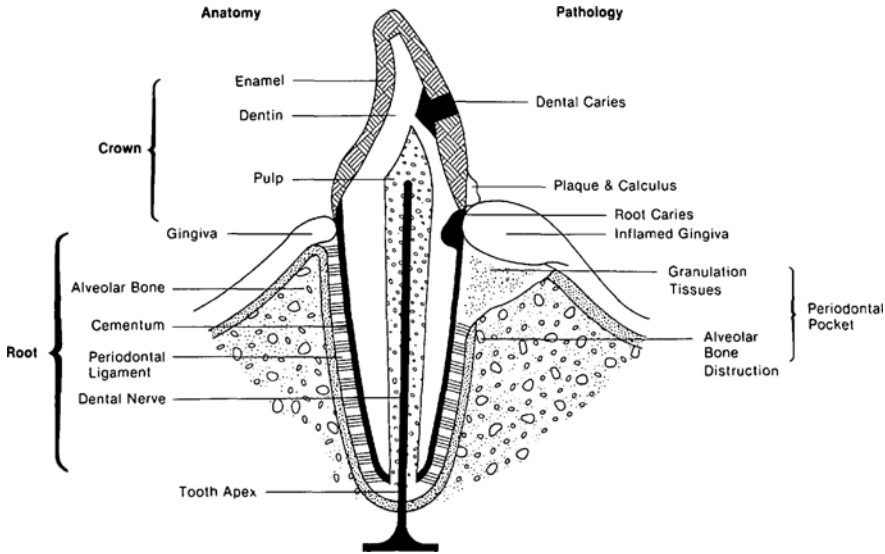


FIGURE 1 The normal anatomy of the tooth is demonstrated on the left side of the diagram. The right side demonstrates tooth pathology. Note dental caries affects the crown of the tooth undermining the enamel layer. Root caries affects the root of the tooth undermining the crown. The formation of the periodontal pocket (the result of periodontal disease) is demonstrated. The loss of boney support for the tooth may be appreciated.

as root decay may be present. This is found most frequently in the elderly population and will place the crown of the tooth at risk for complete amputation.

Periodontal disease is a painless process which ultimately results in the loss of teeth. The mechanism involves the slow dissolution of the supporting bone and ligament of the tooth.⁵ As this bone loss is never recovered, treatment is aimed at optimizing the existing condition. In the presence of advanced periodontal disease, tooth extraction is usually the treatment of choice in an attempt to prevent it from spreading.

Traumatic fractures to teeth

Dental trauma is traditionally divided into six categories:^{10,11,16} (Figure 2)

1 Class I – Fracture of enamel

This is a relatively innocuous fracture involving the outer surface of the tooth. It is usually painless and may require smoothing of sharp edges or the bonding of a tooth-coloured material to the chipped surface.¹²

2 Class II – Fracture into dentin

This fracture penetrates the second layer of the tooth revealing a yellow colour. It is important to recognize that

the tooth may be sensitive to hot or cold temperatures and the patient should be warned accordingly.

3 Class III – Fracture into the pulp

Fractures at this level are very painful. The pulp contains the tooth's nervous tissue and although a direct pulp cap may be attempted, usually the pulp has to be removed because of extreme sensitivity to hot and cold oral fluids. Ultimately the patient will require endodontic, root canal, therapy¹⁰ followed by the placement of a post and core^{13,15} which then must be covered by a crown^{14,15} (Figure 3).

A crown, cap, is usually fabricated using a gold alloy framework over which a porcelain surface is fused.¹⁵ These facings may be chipped or scraped necessitating replacement. While fracture of the framework is difficult to accomplish, it is possible to dislodge a crown. If this occurs keep the crown as the patient's dentist may be able to replace it.

4 Class IV – Fracture of the root

This fracture is difficult to detect. Invariably it is associated with compromised periodontal support and treatment usually involves extraction of the tooth.¹⁶

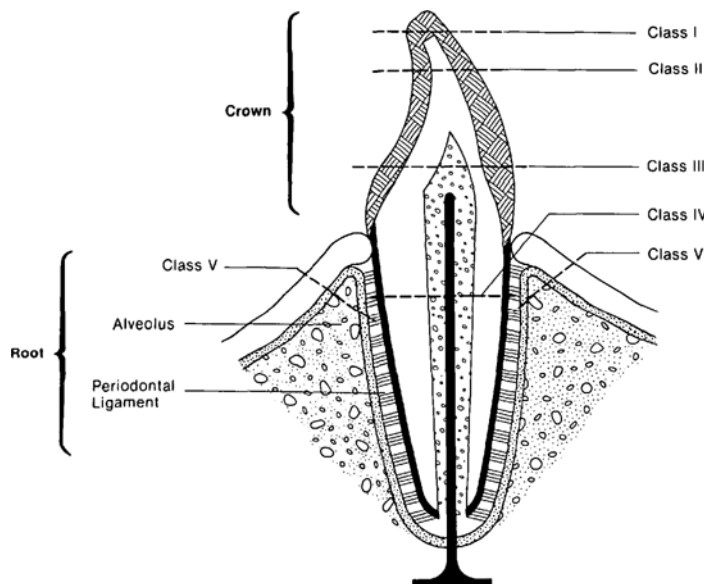


FIGURE 2 The approximate location of the fracture lines for the classification scheme is demonstrated. Note that Class I–III involve the crown of the tooth, Class IV involves the root, Class V usually involves fracture of the Alveolus not the tooth and Class VI is usually not associated with a fracture just an avulsion.

5 Class V – Subluxation of tooth

In this condition a tooth is moved within the alveolar bone. Treatment involves replacement of the tooth to its original position.¹⁶ Once this is achieved it is splinted for two to three weeks. If the tooth has lost its periodontal support extraction is the best solution.

6 Class VI – Avulsion

When the tooth is completely removed from the alveolus, the first task is to find the tooth. Aspiration and obstruction of the airway is a significant risk after avulsion. Once found the tooth must be carefully rinsed being certain to hold it by the crown. Reimplantation of the tooth into the alveolar bone within 20 minutes provides the best prognosis.¹⁶

Restorative dentistry

Replacement of a missing tooth within a dental arch, whether from trauma or other causes, may involve one of four techniques (Figure 4).

1 Removable partial denture¹⁷

This appliance has retaining hooks and may be easily removed from the patient’s mouth by the anaesthetist or

patient before the induction of anaesthesia. This prevents it from being damaged or dislodged during laryngoscopy.

2 Fixed bridgework¹⁵

The bridge uses the principles of crown fabrication to allow the missing tooth to be soldered into the vacant space. This is a solid structure and has complications similar to those mentioned for crowns.

3 Butterfly bridge

The butterfly bridge,^{15,18,21} due to its low cost and ease of fabrication, is used with increasing frequency. It is important for the anaesthetist to recognize this prosthesis as it lacks the inherent strength of a fixed bridge. The wings on the bridge are bonded to the adjacent teeth and may be dislodged easily. It is recommended that a heavy silk suture be placed around one of the wings to retrieve this appliance if it is accidentally dislodged.

4 Titanium implants

Titanium implants¹⁹ are recent innovations and are very strong. If a difficult tracheal intubation is anticipated the appliance may be unscrewed by a dentist and replaced postoperatively.

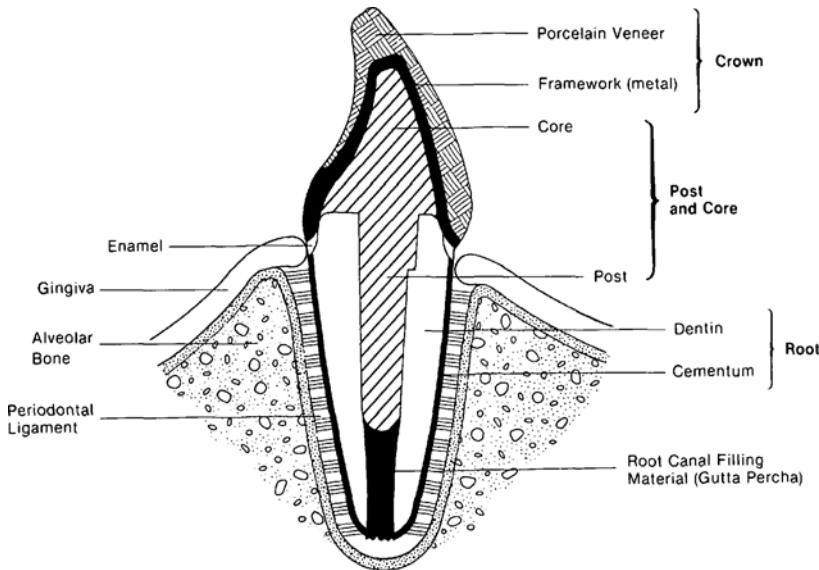


FIGURE 3 Post and core and crown treatment after endodontic therapy. Note that the peridontium remains untouched. Also it is important to understand that the post and core is a separate unit from the crown. They are cemented separately into place.

Aesthetic dentistry

With the advent of bonding a new approach has come to the perfect smile – the bonded veneer or facing²⁰ (Figure 5). This appliance is not prone to dislodgement but may be chipped, cracked or crazed.²¹ Repairing the damage is time-consuming. Patients who have bonded veneers are particularly concerned with the aesthetic appearance of their teeth and require special attention.

Discussion

Trauma to teeth during intubation is recognized²² as a major cause of malpractice claims.²³ Anaesthetists should be careful when using a laryngoscope. Sufficient force may be exerted by the instrument to fracture or dislodge a tooth or a previous dental restoration. The oral airway^{24,25} is also a major cause of injury to teeth. Solazzi and Ward found, in reviewing all malpractice files involving anaesthetists of the University of Washington Affiliated Hospitals between 1971 and 1982, that

"Fifty-five percent of the reported claims are secondary to patients biting down on oral airways, usually during post-anaesthetic transit to or in the recovery room. Early removal of

oral airways and substitution of nasal airways should reduce the incidence of this problem. There were no complications reported with the use of nasal airways."²⁴

Recognition of dentition which is at risk for injury should alert the anaesthetist to seek a preoperative dental consultation. Communication of these risks to the patient should form part of the informed consent. Vulnerable dentition may force the anaesthetist to consider the use of fiberoptic bronchoscopy, lighted stylets or the complete avoidance of tracheal intubation. The use of nasopharyngeal airways instead of oropharyngeal airways may also reduce the risk of dental injury.

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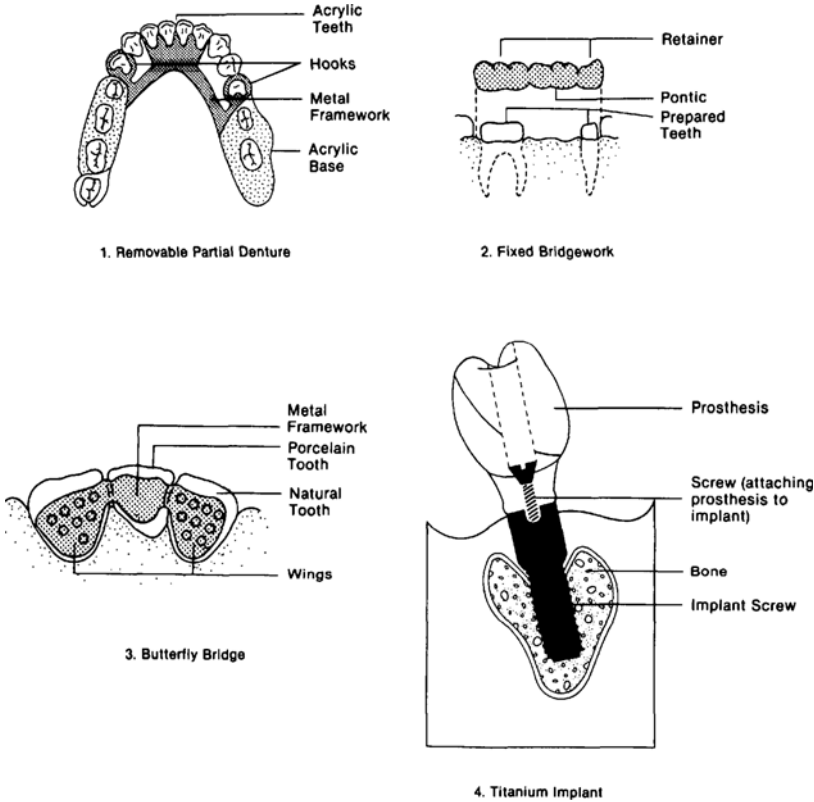


FIGURE 4 Types of restorative dentistry.

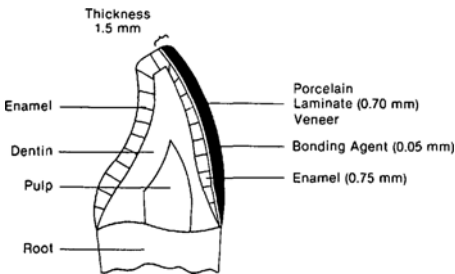


FIGURE 5 Porcelain laminate veneers. Note the normal thickness of enamel (1.5 mm) is reduced in half so the veneer may be fabricated and bonded to the tooth.

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Résumé

Les traumatismes dentaires sont à l'origine du plus grand nombre de réclamations contre les anesthésistes. Nous faisons d'abord un bref rappel de l'anatomie et des pathologies dentaires puis nous voyons les différents types de traitements et d'attirails dentaires qu'on peut rencontrer. Il y a six degrés de fracture dentaire: I, seul l'émail est impliqué; II, la dentine est compromise; III, la fracture s'étend à la pulpe dentaire; IV, la racine est fracturée; V, il y a subluxation; VI, l'avulsion est complète. Nous discutons du traitement approprié à chaque type de fracture et de la façon de les prévenir. L'apparition des implants de titanium, des ponts-papillons, et de la porcelaine laminée a amené son cortège de nouveaux problèmes. Entre autres, ces dents sont plus fragiles et il faut faire d'autant plus attention avec le laryngoscope. L'utilisation d'une canule oro-pharyngée semble par ailleurs responsable de près de 55 pour cent des accidents. La prévention des traumatismes passe par une bonne connaissance de l'anatomie et de la pathologie dentaire et par la reconnaissance en pré-opératoire des différents traitements subis. A cet égard, une consultation avec les dentistes pourrait souvent être utile.