

Anaesthesia for Dental and Maxillofacial Surgery in Children*

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Introduction

Commonly performed dental and maxillofacial surgical procedures in children include:

- Dental extractions
- Dental restorations
- Dental exposure and bonding
- Alveolar bone grafts

These will all be considered in more detail in this chapter, together with the management of dento-facial infection and maxillofacial trauma in children. Although sedation and local anaesthetic techniques have been used successfully for dental procedures in children, there will always be a requirement for general anaesthesia for dental and maxillofacial surgery. Many of these procedures are performed in a day-case setting, although inpatient care is sometimes required. The process of general anaesthesia involves preoperative assessment, patient preparation, intraoperative management and postoperative care. Recent guidance recommends that all paediatric dental patients referred for general anaesthesia should be assessed by dental practitioners who are skilled and trained in the treatment of children.

Local anaesthetic techniques are used to supplement postoperative analgesia and to provide haemostasis and will be outlined at the end of this chapter.

General Principles

Although anaesthetic assessment of patients presenting for dental surgery often takes place on the same day, this should occur ideally during a separate hospital consultation. This can be done either as a telephone appointment or, if there are more complex medical issues or a need for a full airway

assessment, through a hospital visit to a specific preoperative assessment clinic:

- Preoperative assessment involves obtaining a comprehensive medical and anaesthetic history, performing a physical examination and reviewing the results of appropriate clinical investigations.
- Parents and carers should be informed of the risks of general anaesthesia and offered alternative treatment where indicated. Written consent should also be taken for the procedure.
- Management strategies for the uncooperative child should be discussed preoperatively.
- In all cases, the child should be adequately fasted. Applying a topical local anaesthetic cream makes intravenous cannulation easier, and sedative oral premedication may also be indicated in some children.
- The availability of anaesthetic, monitoring and resuscitation equipment should comply with national guidelines such as those published by the Association of Anaesthetists of Great Britain and Ireland.

Induction of anaesthesia may be achieved using either the intravenous or inhalational method, with intravenous access obtained at the earliest possible opportunity. Intraoperatively, the main considerations are maintenance of the airway whilst allowing adequate surgical access. The airway device employed is usually determined by the procedure to be carried out. Suitable airway options include flexible supraglottic airway devices (SGA) or tracheal tubes that can be either oral or nasal.

Good communication between the surgeon and the anaesthetist is vital as the airway is shared. The potential for blood or debris in the pharynx should also be considered.

Throat packs are often indicated and must be removed at the end of the procedure before the child's emergence from anaesthesia. Recent

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guidelines advise that both visual and documented evidence should be provided whenever a throat pack is inserted. A clearly established protocol should also be in place to ensure that the throat pack is always removed and that this is witnessed and documented.

Adequate perioperative analgesia should always be administered, with antiemetic agents as indicated. At the end of the procedure, suction of the oropharynx should be performed under direct vision where possible. The patient may then be placed in the left lateral position with head-down tilt unless this is contraindicated. In the period immediately following general anaesthesia for dental or maxillofacial surgery, the child should be managed in the postanaesthetic care unit by a designated member of staff who is trained in both basic and advanced paediatric resuscitation techniques. Supplemental oxygen should be administered until the child is fully awake.

Paediatric dental patients may suffer from conditions that have major anaesthetic implications, such as cardiac disease or epidermolysis bullosa. These will require appropriate modifications to the anaesthetic technique used.

The complications of general anaesthesia for dental and maxillofacial surgery may be minor or major. Minor complications include:

- Postoperative nausea, retching and vomiting, with the latter occurring particularly in association with swallowed blood
- Damage to teeth or soft tissues adjacent to the operative site
- Injury to the neck caused by intraoperative positioning
- Postoperative cough and sore throat following tracheal intubation or because of irritation from the throat pack

Major complications include complete respiratory obstruction from inhalation of foreign material or cardiac arrest secondary to arrhythmias.

Dental Extractions

When complete, the primary dentition consists of 20 teeth, whereas there are 32 permanent teeth. The most commonly used dental identification system divides the dental arch into four quadrants. All primary central incisors are designated tooth 'A' and followed posteriorly in alphabetical order so that all primary second molars are designated

tooth 'E'. All permanent central incisors are designated tooth '1' and are followed posteriorly in numerical order to tooth '8', which is the third molar or 'wisdom tooth'.

Dental extractions are commonly required in children who suffer from dental caries or trauma as well as those who are undergoing orthodontic treatment regimes. Extractions may also be indicated when there are certain dental anomalies such as impacted teeth. Often if a tooth is impacted, the tooth may be extracted to encourage the permanent tooth to erupt. On occasion, a permanent tooth must be extracted, or exposed and bonded if it is in a decent position.

The main indications for general anaesthesia for dental extractions in children are:

- Contraindication to local anaesthesia
- Previous failure of local anaesthesia or sedation
- Lack of patient cooperation owing to immaturity
- Presence of neurodevelopmental disorders, including global developmental delay, autism spectrum disorder, communication disorders, learning disabilities and attention deficit hyperactivity disorder (ADHD)
- Diagnosis of advanced decay
- Requirement for multiple extractions
- Complex surgical procedures

Most dental extractions in children are performed as a day-case procedure or as outpatients; the general principles of day-case anaesthesia should apply for both these patient groups. However, outpatient general anaesthesia requires additional consideration and meticulous patient selection. Conditions requiring special consideration include coagulation disorders or anti-coagulant therapy, syndromes associated with increased anaesthetic risk, haemoglobinopathies and severe behavioural abnormalities.

Preapplication of a topical local anaesthetic cream is useful when intravenous induction of anaesthesia is planned. Preoperative oral analgesia is sometimes prescribed (usually paracetamol and/or ibuprofen). Oral/buccal midazolam or intranasal dexmedetomidine may also be required for the anxious child.

Induction of general anaesthesia is commonly achieved intravenously using propofol, or via the inhalational route using sevoflurane. Regardless of the method of induction, intravenous access is essential in all cases and must be obtained at the

earliest opportunity. Anaesthesia may then be maintained using sevoflurane or propofol. A flexible SGA can be suitable in most circumstances, but tracheal intubation may be necessary particularly in patients who require extensive treatment. If not given preoperatively, paracetamol is administered intraoperatively alongside fentanyl and antiemetics.

Complications related to general anaesthesia for dental extractions include potential airway obstruction caused by the position of the throat pack or mouth prop or the presence of blood or debris. Dislocation of the temporomandibular joint may also occur.

Tachyarrhythmias are uncommon but can follow the use of local anaesthetic agents containing adrenaline, which are usually administered by the dental practitioner and may be injected into the buccal fold of the gum adjacent to the tooth to be treated. Lingual and mental nerve blocks may also be performed intraorally to provide more extensive anaesthesia to the lower incisors. Infraorbital nerve blockade will anaesthetise the upper jaw.

Additional oral analgesia may be required prior to the patient being discharged home.

Dental Restorations

Restorative dental treatment is performed in children to limit or repair the damage caused by dental caries. Such procedures are often performed in children with learning disabilities, who may require extensive treatment necessitating tracheal intubation via the nasal route. This provides unobstructed access to all four quadrants of the mouth and also facilitates the assessment of tooth alignment and occlusion.

Dental Exposure and Bonding

Palatal impaction of maxillary canine teeth is a problem that is frequently encountered in paediatric orthodontic clinical practice. It is possible for any tooth to be impacted, and management requires a joint surgical and orthodontic approach. A commonly adopted treatment strategy is surgical exposure of the impacted tooth, followed by bonding of an orthodontic bracket with a miniature gold chain attached to it. Following this, the child will see their orthodontist, who will attach a rubber band to institute a gentle eruptive pulling force on the impacted tooth.

In children, the surgery usually occurs under general anaesthesia most commonly as a day-case procedure. The general principles of day-case general anaesthesia apply with the additional considerations of managing the airway whilst allowing adequate surgical access.

Tracheal intubation is usually required, most commonly via the oral route, with the possibility of direct laryngoscopy being complicated by irregularly spaced dentition. A south-facing oral Ring-Adair-Elwin (RAE) tube is useful. Flexible laryngeal masks have also been successfully used for this procedure. A throat pack is required to protect the airway from soiling.

Before commencing the procedure, the dental surgeon will usually infiltrate an adrenaline-containing local anaesthetic solution, which improves haemostasis and contributes to peri- and postoperative analgesia.

An adequate analgesic regimen is usually provided by paracetamol administered either preoperatively via the oral route or intraoperatively via the intravenous route, together with a non-steroidal anti-inflammatory agent administered in the postoperative period. Opioid analgesics are rarely required, although antiemetic therapy should be routinely administered intraoperatively.

Alveolar Bone Grafts

Surgical repair of a cleft lip or palate in infancy does not usually involve correction of the alveolar cleft defect. This may result in residual oronasal fistulae with disruption of the maxillary alveolus. Alveolar cleft bone grafts unite the alveolar segments and help to prevent collapse and constriction of the dental arch. Support is then provided for teeth adjacent to the cleft and for those that will erupt into the area of the cleft. The graft also leads to closure of the oronasal fistula, augmentation of the alveolar ridge and the creation of a solid foundation for the lip and alar base of the nose.

The alveolar cleft graft is usually performed as an inpatient procedure when the child is between the ages of 6 and 10 years. General anaesthesia is induced via either the intravenous or inhalation route, with tracheal intubation using an oral RAE tube. Bone is then removed from the patient's iliac crest and placed in the alveolar cleft. The surgical procedure is associated with a small risk of bleeding and requires adequate intravenous access with the administration of intravenous fluids perioperatively.

An intraoperative opioid is routinely required, together with paracetamol and a non-steroidal analgesic. This is supplemented by infiltration of local anaesthetic into both the oral cavity and the iliac crest. Postoperative analgesia may be enhanced if a catheter is placed by the surgeon into the iliac wound site and used postoperatively for the intermittent or continuous administration of local anaesthetic solution. Children undergoing this procedure are usually able to tolerate post-operative oral analgesia, including oral morphine.

Dexamethasone and ondansetron are usually administered, together with antibiotics.

Management of Dentofacial Infection

Dentofacial infection is either acute or chronic. Acute infection usually presents as an emergency with pain, pyrexia and often a red swollen face. Chronic infection may present as a buccal sinus or a mobile tooth. The management of dentofacial infection involves removal of the cause together with local drainage and debridement intraorally or extraorally as required.

Dental abscesses are usually localised, but cellulitis and oedema may occur because of spread of infection via lymphatics and tissue planes. Limited mouth opening may be caused by pain or spasm (trismus) of the masseter or pterygoid muscles. Pus may also be present within the airway. If the infection spreads into the retropharyngeal space, securing the airway safely can be difficult.

The anaesthetic considerations are as for dental extractions. Antisialagogue agents administered at induction are sometimes useful to control excessive secretions. If problems with the airway are anticipated, an anaesthetic technique that maintains spontaneous ventilation should be considered. It is important to have an airway management plan in place prior to induction of anaesthesia. This may include the use of videolaryngoscopes and other specialised airway equipment. It is usually possible to achieve adequate mouth opening after induction of anaesthesia; occasionally, however, nasal fiberoptic tracheal intubation is required.

Maxillofacial Trauma

Facial trauma in very young children is commonly the result of falls or accidents, but children may also be victims of assault or road traffic collisions.

It is important to recognise and report any suspicion of non-accidental injury. Blunt trauma tends to cause greater damage to the soft tissues and supporting structures, whereas high-velocity or sharp injuries cause subluxations and fractures of the teeth.

General anaesthesia is often required for the suturing of facial lacerations and the management of maxillofacial fractures. However, each child should be assessed on an individual basis. A cooperative child may be able to have a laceration closed with local anaesthetic alone. Consideration should be given to the possibility of associated injuries that may involve the head, neck, chest and spinal cord. The child should be assessed for head and neck injury and appropriate measures instituted before any maxillofacial intervention. There is also the potential for airway obstruction, aspiration of gastric contents and intraoral haemorrhage.

Management of maxillofacial fractures may require long surgical procedures that are sometimes associated with significant blood loss. There is also a risk of bradycardia due to the oculocardiac reflex. Fractures of the zygomatic arch are associated with limited mouth opening. This is because the fracture can impinge on the temporalis muscle, one of the muscles of mastication. Maxillary fractures are often even more serious and are associated with significant head injury (Table 24.1).

Nasal fractures are no longer treated with surgery as commonly as before. Often the bones will heal themselves and are not open to the environment, and therefore pose minimal risk of infection.

Local Anaesthesia in Paediatric Dentistry

Local anaesthesia (LA) is used to supplement general anaesthesia for dental and maxillofacial surgery in children. It has a dual purpose. When used with adrenaline, the objective is to aid haemostasis; it also has a longer duration of action, therefore acting as an adjunct to analgesia given intraoperatively. LA is administered by the dental surgeon, the agents most used being lidocaine 2% with adrenaline 1:80,000 in the majority of patients, or prilocaine 3% with felypressin (octapressin). The latter is used when the patient has a history of cardiac issues and adrenaline needs to be avoided.

Table 24.1 Classification of midfacial fractures

Fracture	Type of injury
Le Fort I	Fracture separating inferior portion of maxilla horizontally, extending from piriform aperture of nose to pterygoid maxillary suture area.
Le Fort II	Fracture involving separation of maxilla and nasal complex from cranial base, zygomatic orbital rim area and pterygoid maxillary suture area.
Le Fort III	Complete separation of midface at level of naso-orbital ethmoid complex and zygomaticofrontal suture area. Fracture extends through orbits bilaterally.

The techniques for providing LA in children are similar to those used in adults. However, owing to the reduced bone density of the maxilla and mandible in children, there is more rapid diffusion and absorption of LA solution with a faster onset and shorter duration of block.

The upper teeth receive their sensory nerve supply from the superior alveolar (dental) nerves, which are branches of the maxillary division of the trigeminal nerve. The peripheral fibres of these nerves can be blocked effectively at the apical foramina of the tooth by injection of local anaesthetic into the sulcus adjacent to the tooth requiring anaesthesia. The infraorbital nerve, a terminal branch of the maxillary nerve, can be blocked at the infraorbital foramen, which lies just below the inferior orbital margin, approximately halfway along its length. It can be reached from the upper labial sulcus opposite the canine tooth. The block will also include branches of the anterior superior alveolar nerve and will provide anaesthesia to the anterior maxilla and upper lip. The buccal and labial soft tissues are anaesthetised by LA infiltration to these areas. Anaesthesia of the hard and soft palate requires injection directly into the palate.

The lower teeth receive their sensory nerve supply from the inferior alveolar (dental) nerve, a branch of the mandibular division of the trigeminal nerve. This may be blocked before it enters the mandibular foramen on the medial aspect of the ramus, just behind the lingula, providing anaesthesia to the bone of the mandibular body and the

pulps of the lower teeth on that side of the mouth. This also blocks the mental nerve, a branch of the inferior alveolar nerve, which provides sensation to the lower lip and chin on that side.

There may be incomplete anaesthesia of the central incisor, as there can be some crossover supply from the contralateral inferior dental nerve. The mental nerve alone can be blocked at the mental foramen, providing anaesthesia to the soft tissues of the labial gingivae, the lower lip and chin. Diffusion of anaesthetic agent via the mental foramen will reach the incisive branch which supplies the pulps of the lower first premolar, canine and incisor teeth. There is some communication with the nerve supply on the opposite side. A periodontal ligament injection may be necessary in older children to achieve adequate anaesthesia of a single mandibular tooth.

As with any use of local anaesthetic agents, the possibility of LA toxicity due to accidental intravascular injection should be anticipated. Convulsions, cardiac arrhythmias and hypotension may occur. All members of staff should be aware of the management protocol for LA toxicity, including the availability of intravenous lipid emulsion solution (see Chapter 15, Box 15.1). Tachycardia and arrhythmias may also be associated with adrenaline-containing solutions. Hypersensitivity reactions to local anaesthetics are very rare, although allergic reactions to preservative agents have been described.

Key Points

- Thorough preoperative assessment and patient preparation is essential, particularly prior to outpatient general anaesthesia.
- Management of the airway requires careful consideration as it is a shared airway.
- A throat pack is required for most procedures, and there must be an established theatre protocol to ensure it is removed after the surgical procedure.
- Local anaesthetic techniques contribute to the provision of adequate postoperative analgesia.

Further Reading

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