

IN BRIEF

- Disease can affect dental development in children.
- Congenital conditions can interfere with provision of dental treatment.
- Underlying disease and its treatment can affect the timing of dental treatment in children.
- Diseases of childhood influence the choice of anaesthesia.
- Close co-operation with paediatricians is important in managing children with serious conditions.
- Liaison is needed not neglect.

VERIFIABLE
CPD PAPER

General medicine and surgery for dental practitioners

Part 10: The paediatric patient

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Medical problems in children can cause unique difficulties for the safe provision of dental treatment.¹ Such problems can affect the type and timing of dental treatment as well as methods of control of pain and anxiety. In this paper, conditions which influence the choice of anaesthesia as well as those which affect dental development are discussed.

GENERAL MEDICINE AND SURGERY FOR DENTAL PRACTITIONERS:

1. Cardiovascular system
2. Respiratory system
3. Gastrointestinal system
4. Neurological disorders
5. Liver disease
6. The endocrine system
7. Renal disorders
8. Musculoskeletal system
9. Haematology and patients with bleeding problems

10. The paediatric patient

POINTS IN THE HISTORY

Background information

Some conditions are relevant since they affect oral and dental development and will often be discovered in a thorough history. These include disorders of bone such as cleidocranial dysplasia where delayed eruption and multiple supernumerary teeth occur and fibrous dysplasia which can produce malocclusions (see Musculoskeletal paper in this series). Disorders localised to the teeth such as amelogenesis imperfecta provide a challenge to preventive and restorative dentistry. Other disorders such as dentinogenesis imperfecta may be associated with osteogenesis imperfecta and surgery may be hazardous. Referral to an oral surgeon is sensible in such cases. Hypodontia² occurs in ectodermal dysplasia and successful management of this condition often requires co-ordinated specialist treatment. The general dental practitioner, however, has an important role in the management of these patients.

The medical history in a child patient should follow a similar theme to that of an adult but there are differences in emphasis in certain areas. It is useful to obtain information regarding previous levels of compliance with treatment since disorders that interfere with patient co-operation can make routine dental treatment difficult. Conditions such as significant physical and mental disability, severe convulsive disorders and extensive behavioural problems can create difficulties. Tech-

niques such as relative analgesia (RA) can be used with success in some of these patients but there are limits to what can be achieved since a level of co-operation and understanding is required.

Organ transplantation is a procedure which is relatively commonplace today and the number of children with renal, heart, heart/lung, liver and bone transplants will increase. The dental team can play an important role in pre-transplant assessment as it is vital that any focus of infection is eliminated prior to transplantation.

Disorders of different organ systems have been described in the earlier papers in this series. Problems that impact on the younger patient are discussed more fully here.

Cardiovascular conditions

A number of conditions may require antibiotic prophylaxis. Procedures that involve manipulation of the gingival margin can produce a transient bacteraemia which may cause infective endocarditis in 'at risk' children. The current recommendations for antibiotic prophylaxis for children to be treated under local and general anaesthesia are given in the *British National Formulary*.³ Some cardiac defects require antibiotic prophylaxis throughout life, these include pulmonary and aortic stenosis, coarctation of the aorta and ventricular septal defects. A repaired patent ductus arteriosus should not require cover 6 months after the repair and cardiac transplant patients may not need prophylactic antibiotics once the ECG is

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normal. Close consultation with the cardiologist is required.

The patient may have Down Syndrome (trisomy 21). This occurs in 1 in 700 live births. In nearly half of Down's patients, congenital cardiac anomalies are found and thus the need for antibiotic prophylaxis should be considered for bacteraemia producing procedures. There is some degree of learning disability in all these patients and immunological defects predispose them to infection. Down's patients have a higher risk of developing acute leukaemia than the general population.

Respiratory conditions

Asthma affects about 12% of all children. The severity varies from mild to moderate to severe. In mild cases attacks are only occasional and can be precipitated by infection. Between attacks patients are asymptomatic. In moderate cases episodes are severe and recurrent but patients are symptom-free between attacks. Exercise induces bronchoconstriction. When a child suffers from severe asthma, attacks vary in severity but the child is never asymptomatic and the illness affects growth and lung function. A history should always ascertain the degree of severity of the asthma and the efficacy of prescribed treatment.

Cystic fibrosis is an inherited disorder of exocrine glands. It occurs in 1 in 2000 births and is inherited as autosomal recessive. Mucus has an increased viscosity and pancreatic insufficiency in childhood occurs. Diabetes mellitus may be a complication and some patients have cirrhosis of the liver. Recurrent respiratory infections may occur resulting in bronchiectasis.

Haematological conditions

Disorders such as anaemia and leukaemia, in addition to interfering with wound healing may also lead to a bleeding tendency and consultation with the haematologist or oncologist is essential before considering surgery on such children.

It is important to enquire about Sickle-cell disease in patients of African, Asian and West Indian descent since the administration of a general anaesthetic to an undiagnosed sufferer can cause severe complications. Deoxygenation during anaesthesia causes the erythrocyte to deform into a sickle shape which causes the cells to aggregate and inhibits blood flow in small diameter vessels. A finger prick Sickledex test, if positive should be followed by haemoglobin electrophoresis. In patients of Mediterranean descent, the possibility of thalassaemia should be borne in mind.

It is important to enquire about possible bleeding disorders. Congenital disorders such as haemophilia and acquired clotting disorders preclude surgical dental treatment outside the hospital environment. The most common hereditary haemophilias (sex-linked recessive) are Haemophilia A (Factor VIII deficiency) and Haemophilia B (Factor IX deficiency). These patients require replacement of the appropriate

clotting factor(s) prior to surgery and usually the provision of antifibrinolytic therapy following treatment. Treatment planning and timing of intervention must be co-ordinated with the haematologist. Children with platelet deficiencies (Fig. 1) may require a platelet transfusion or if the problem is one of idiopathic thrombocytopenic purpura then a pre-operative course of steroids can increase platelet numbers to an acceptable level for surgery (greater than 50×10^9 per litre).

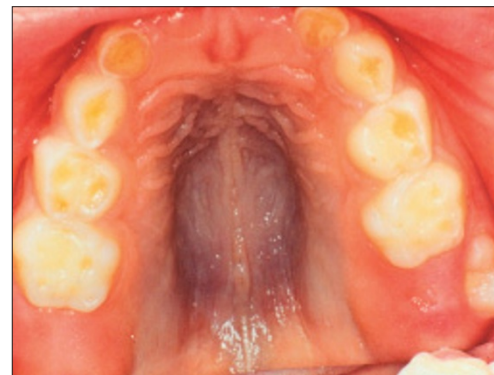


Fig. 1 A palatal bruise in a child taking immunosuppressants. This has led to a low platelet count

Neurological conditions

Enquiry should be made about any history of convulsions since the stress of dentistry may induce fits in epileptic patients. Epilepsy affects 3-5% of the paediatric population and most cases are idiopathic. Attacks may be stimulated by hyperventilation, fever, photic stimulation, withdrawal of anticonvulsants (or poor compliance), lack of sleep, over sedation, over hydration, emotional upset and some medications eg antihistamines. The use of relative analgesia can be of great benefit for children with a history of convulsions in the dental chair.

Cerebral palsy is the leading cause of significant disability in children. Uncontrolled movement and abnormal posture are the main handicaps but other neurological and mental problems can also occur. Epilepsy, visual and hearing impairment are features which may cause difficulties with dental treatment.

A number of children with hydrocephalus have shunts which drain cerebrospinal fluid (CSF) from the brain to other areas of the body thereby reducing intracranial pressure and preventing brain damage. An older form of shunt drained fluid from the brain to the ventricles of the heart (atrio-ventricular) and these require antibiotic prophylaxis prior to bacteraemia-producing treatment. A newer shunt which drains fluid to the peritoneum (atrio-peritoneal) does not require such prophylaxis.

Renal conditions

Renal disease in children mainly comprises the so-called nephritic syndromes which may progress to chronic renal failure (CRF). Progression to CRF leads to the need for dialysis and

Common conditions

Asthma affects 12% of children and epilepsy affects 5% of the paediatric population.

possibly transplantation. CRF patients may cause difficulties with management due to corticosteroid and other immunosuppression therapy. Potential problems include:

- Impaired drug excretion
- Anaemia
- Bleeding tendencies
- Associated anticoagulant therapy
- Hypertension
- Infections eg hepatitis B
- Renal osteodystrophy

Hepatic conditions

Chronic liver disease with impaired hepatic function is uncommon in childhood (Fig. 2). Problems can be categorised into:

- Coagulation disorders
- Drug toxicity
- Disorders of fluid and electrolyte balance
- Problems with drug therapy
- Infections



Fig. 2 Severely bilirubin stained teeth that started mineralising pre-liver transplant at age 2.5 years. The second permanent molars are normal

Endocrine conditions

Insulin controlled diabetic children who require a general anaesthetic should be treated as in-patients because the starvation required before the procedure would render them hypoglycaemic. Hospitalisation will enable them to be stabilised pre- and post-operatively on an intravenous drip that will control both sugar and insulin. There is no contraindication to treatment in general dental practice under local anaesthetic or local anaesthetic with RA as long as the treatment time does not interfere with a normal snack intake. Extra carbohydrate can always be taken in liquid form prior to a procedure.

Drug therapy

Although there have been positive moves towards the provision of sugar-free medication⁴ cases are still seen in which the progress of dental caries has been exacerbated by drug therapy (Fig. 3). This can be due either to the direct effect of sugar-based medicines or by an indirect action such as xerostomia. Medications which



Fig. 3 Caries due to prolonged use of sweetened liquid oral medicines

can produce xerostomia in children include antihistamines and major tranquillisers.

A summary of salient points in the history of a child dental patient are shown in Table 1.

It should not be forgotten that abuse of drugs during pregnancy can produce oro-facial defects in children. For example, cleft lip and palate are seen in the foetal alcohol syndrome and cigarette smoking can cause reduction in crown size of primary teeth. Cocaine misuse by mothers has been associated with tongue-tie in their offspring.⁵

Craniofacial disorders

Certain inherited or acquired craniofacial disorders eg temporomandibular joint ankylosis, should be enquired about since access to the mouth may be limited causing difficulties with treatment. In some cases surgical correction of the deformity is necessary before intra-oral procedures can be performed.

Examination

The degree to which it will be possible to achieve compliance with dental treatment can be obvious very quickly in a consultation. The child may have a condition that interferes with their ability to co-operate.

In cleidocranial dysplasia there may be delayed eruption and multiple supernumerary teeth whilst in fibrous dysplasia and cerebral palsy a malocclusion may be present as mentioned earlier. The disorder may specifically affect the teeth eg amelogenesis imperfecta or a systemic condition may be associated with an abnormal dentition. Dentinogenesis imperfecta may be associated with osteogenesis imperfecta or hypodontia with ectodermal dysplasia. There may in addition be extensive caries that has been exacerbated by drug therapy.

Patients with Down Syndrome tend to have an open mouthed posture with a protruding tongue which can cause difficulties with dental treatment. Tooth development and eruption is retarded. An anterior open bite is common, as is a class III malocclusion. The incidence of cleft lip and palate is increased in these patients. Periodontal disease is severe and has an early onset but caries incidence, by comparison, is surprisingly low.

In cystic fibrosis there are recurrent chest

Table 1 Points in the history of a paediatric patient

- Previous levels of compliance with treatment
- Asthma
- Diabetes
- Cystic Fibrosis
- Conditions needing antibiotic prophylaxis (see text)
- Sickle Cell Disease
- Thalassaemia
- Bleeding disorders
- Epilepsy
- Shunt in hydrocephalus – antibiotic prophylaxis in atrio-ventricular type
- Cranio-facial disorders
- Renal disorders
- Hepatic conditions
- Drug therapy

infections and often a productive cough. Many patients also have nasal polyps and recurrent sinusitis which may preclude the use of RA due to the poor nasal airway. The salivary glands may be enlarged. The enamel may be hypoplastic and eruption dates may be delayed. Medication may produce oral signs, for example the pancreatic replacement drug pancreatin may produce oral ulceration.

The possibility of child abuse is an important phenomenon which should always be borne in mind if findings on examination appear to be inconsistent with the history. An injury where there has been a long delay between the incident and attendance for treatment is a cause for suspicion. Injuries which do not 'fit' with the history and multiple injuries, particularly those which appear to be of different ages are also cause for concern. Child abuse, whilst more common in the lower social classes, is by no means confined to these groups. Local area Child Protection Committee Guidelines will be available to guide the dental practitioner in their referral.

GENERAL AND LOCAL ANAESTHESIA, SEDATION AND MANAGEMENT CONSIDERATIONS IN THE PAEDIATRIC DENTAL PATIENT

The possibility of local anaesthetic toxicity is more likely in children than adults due to their smaller size. A dose of 1/10th of a cartridge per kilogram as a maximum is recommended;⁶ this means that two cartridges is the maximum in a healthy 20 kg 5-year-old. The use of local anaesthetics should be reduced in children with liver disorders. The use of any drug, including local anaesthetics in children with severe hepatic dysfunction should be discussed with the supervising physician. The use of local anaesthetics containing vasoconstrictors eg epinephrine (adrenaline) should be avoided when injecting into an area with a compromised blood supply such as a mandible which has been irradiated for the treatment of childhood malignancy.

Intraligamentary techniques of local analgesia should not be employed in children who are at risk of infective endocarditis when dental treatment which does not require the provision of antibiotic prophylaxis is being performed. This is because the administration of an intraligamentary injection itself produces a bacteraemia.⁷ Intraligamentary anaesthesia is the technique of choice however in the mandible for children with bleeding disorders such as haemophilia when restorative dental treatment is required.

In patients with sickle cell disease, if practicable, LA with or without RA is preferable to GA. If a GA is required in a patient with the sickle trait, careful oxygenation must be ensured. Patients with the disease itself may need a pre-anaesthetic transfusion so that the level of haemoglobin A is at least 50%.

The use of transcutaneous electronic nerve stimulation has been shown to be effective in reducing injection discomfort in children,⁸ how-

ever this should be avoided in epileptic children and those with cardiac pacemakers.

Children with mild or moderate asthma, if asymptomatic at the time of treatment, do not need prophylaxis pre-treatment. If oral medication is being taken, this should be continued to prevent rebound bronchospasm. If the asthma is severe there is greater risk of bronchospasm being induced by GA or the stress of surgery. If GA is required the child must be in optimal condition ie no evidence of respiratory infection and an in-patient facility should be available.

In children with cystic fibrosis, sputum clearance is assisted by regular physiotherapy. Amoxicillin or flucloxacillin are used (often long-term) as prophylaxis against chest infection. If respiratory function is poor, GA is contraindicated. Tetracycline, which is a very effective broad spectrum antibiotic may need to be given when children develop multiple drug sensitivity.

Diabetes and cirrhosis can also cause difficulties with dental treatment provision. In children with diabetes, infections and surgical procedures which create stress or alter food intake may disturb diabetic control ie diabetic children are best managed under LA if possible. Any infection should be treated vigorously. In children with cirrhosis, routine dental treatment is not usually a problem. A physician should be consulted if GA or surgery is needed due to the possibility of bleeding tendency, anaemia and the possibility of drug toxicity.

Intravenous sedation is unsuitable for use in children since the response is unpredictable. Relative analgesia is the technique of choice. Relative analgesia has been shown to be an acceptable and cost-effective alternative to general anaesthesia in children having minor oral surgery.⁹ The contraindications to the use of RA include respiratory disorders. Acute upper respiratory tract infections necessitate postponement of treatment whereas chronic obstructive airways disease is an absolute contraindication. Children who suffer from myasthenia gravis should not be treated with RA outside a hospital environment since they are at risk of respiratory arrest and even in the hospital setting consultation with the physician is essential before considering anything other than local anaesthesia. Children with severe behavioural problems and those who suffer from claustrophobia are not suited to RA as they may not be able to tolerate the nasal mask. Certain surgical procedures in children, such as labial frenectomy, are not possible under RA as the mask denies access to the surgical site.

Oral sedation is not in widespread use for children in the UK to facilitate dental treatment. As with any other drug, allergy to an oral sedative obviously precludes its use. Drugs which are used in the UK include benzodiazepines, chloral hydrate derivatives and promethazine. Hepatic or renal impairment is a contraindication to use of outpatient oral sedation. Similarly the concurrent administration of any central nervous system

Local anaesthesia

Toxic doses of local anaesthetics are more likely in children compared with adults as a result of their smaller size

depressant prevents the use of oral sedation. In addition, chloral hydrate derivatives and promethazine should be avoided in the presence of cardiovascular disease. Polypharmacy is best avoided in any sedation technique.

Children who have had a previous episode of infective endocarditis must be referred for specialist care for bacteraemia-producing procedures. This is because the use of intravenous antibiotics (which is required for these individuals) is not recommended in general dental practice. The potential for endocarditis is not a contraindication to endodontic treatment of the permanent dentition where cleansing, shaping and adequate obturation of root canals can be achieved, but the provision of endodontic treatment in the primary dentition of children at risk of endocarditis is contraindicated.

In patients with Down Syndrome the possibility of cardiac anomalies should be borne in mind. These anomalies may require antibiotic prophylaxis for procedures which may produce a bacteraemia. Immunological impairment means that respiratory infections are more likely and there may be additional congenital abnormalities of the respiratory tract. The hypoplastic mid-face may cause difficulties with endotracheal intubation. General anaesthesia may also be complicated by the possibility of atlanto-axial subluxation when extending the neck if care is not taken. These patients, when institutionalised, have increased likelihood of hepatitis B carriage.

Some of the cardiac conditions requiring antibiotic prophylaxis were mentioned earlier. In such patients careful attention must be paid to treatment planning as the maximum use must be made of each antibiotic administration. A balance needs to be struck between the length of each treatment visit and minimising the number of antibiotic exposures.

Individuals who have disorders likely to adversely affect wound healing should be treated with prophylactic antibiotics. These include children with decreased resistance to infection. Metabolic disturbances such as uncontrolled diabetes and long-term use of corticosteroids also affect wound healing. Well controlled diabetic patients should be considered 'normal' in relation to healing. Haematological problems such as anaemia, leukaemia and cyclic neutropaenia also affect healing ability. Children on immunosuppressant therapy and those being treated with anti-metabolites or local irradiation are also at risk of post-surgical infection. The objective of prophylactic use of antibiotics is to achieve optimal drug concentration in the initial blood clot. Timing of antibiotic administration is aimed at having optimal blood levels of the antimicrobial at the end of the surgical procedure (ie when the clot forms) as opposed to the prevention of distant infection (eg endocarditis) when the antibiotic concentration has to be optimal at the time of initial gingival manipulation (usually at the start of the surgical procedure). Consultation with the supervising paediatrician is essential prior to the use of antibiotics in children with significant renal or hepatic impairment.

The use of anti-metabolites to treat childhood malignancies such as leukaemia is not a contraindication to dental treatment but it does affect its timing. Consultation with the appropriate paediatrician is again important in order that essential treatment can be performed at the optimal time during cyclical anti-cancer therapy when platelet and white cell counts are acceptable. This treatment is best completed in a hospital setting whilst the patient is undergoing chemotherapy.¹⁰

The production of a healthy mouth should be the 'accepted norm' before transplant surgery and consultation with the transplant team and physicians is essential to determine the influence of the organ deficit on dental treatment. The transplanted heart reacts differently to the normal heart to epinephrine.¹¹ This is apparent after the use of epinephrine-containing dental local anaesthetics.¹² It is sensible to use dose reductions or even avoid use of this vasoconstrictor in the child who has had a cardiac transplant. The need for antibiotic prophylaxis is only present in the early post-heart transplant period but the management of all transplant patients is complicated by maintenance drug therapy. Steroid therapy may necessitate the administration of a steroid boost prior to stressful procedures and the possibility of adrenal crisis must be borne in mind. The use of post-transplant immunosuppressant therapy can increase the risk of haemorrhage and post-surgical infection. Post-transplantation therapy with drugs such as ciclosporin and nifedipine leads to gingival overgrowth similar to that seen with epanutin. Regular oral hygiene review is essential and repeated surgical visits for gingival recontouring may well be required.

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CONCLUSIONS

Advances in medical care (especially in the treatment of childhood malignancy and organ transplantation) mean that dentists are increasingly likely to encounter medically compromised children. The keys to successful treatment are:

- Accurate medical history
- Close liaison with medical colleagues and not neglect
- Rigorous preventative programmes
- Dental intervention at times appropriate to medical care
- Regular follow up

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Wound healing

A number of conditions affect wound healing in children. In those at risk, prophylactic antibiotics should be prescribed

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