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Orthodontic treatment of patients with medical disorders

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SUMMARY This article will highlight some of the problems encountered when orthodontic treatment is provided for patients who have serious medical conditions. The way in which various disease processes might influence treatment decisions will be described, as well as recommended methods of avoiding potential problems.

Introduction

Many more children are surviving illnesses that previously would have been fatal. It is estimated that 10–15 per cent of children under the age of 16 years are affected by chronic, long-term medical problems (Weiland *et al*., 1992). Orthodontists can encounter children with congenital heart defects, bleeding disorders, or in remission from childhood malignancies, as well as other medical problems. Chronic disease presents major challenges to the child and family, with practical, social, and emotional implications. Children and adolescents with any chronic condition will have unique psychological stresses, in addition to those faced by all children (Perrin, 1993). Developing a healthy self-concept is of paramount importance for children with chronic conditions if they are to succeed in school and later activities (Ludder-Jackson and Vessey, 1996). Unfortunately, developing the self-esteem of children with chronic conditions can be difficult. These children are likely to be teased; some may experience bullying or even ostracism (Vessey *et al*., 1995). Although no studies have specifically investigated chronically ill children, research among those who do not have chronic illness suggests that the correction of malocclusion improves self-esteem (Shaw *et al*., 1980). It seems reasonable to assume that children with chronic medical conditions will also benefit from orthodontic treatment.

Medical conditions commonly encountered in orthodontic patients include:

(1) risk of infective endocarditis;
(2) bleeding disorders;
(3) leukaemia;
(4) diabetes;
(5) cystic fibrosis;
(6) juvenile rheumatoid arthritis;
(7) renal failure.

Children at risk of infective endocarditis

Guidelines on the prevention of bacterial endocarditis published in the United Kingdom (Simmons *et al*., 1993) and the United States (Dajani *et al*., 1997) do not consider the adjustment of orthodontic appliances to be a significant risk. There is however, considerable uncertainty concerning the need for antibiotic prophylaxis when fitting and removing orthodontic bands. Degling (1972) speculated that of all orthodontic procedures, band fitting, and removal offer the greatest insult to the gingival margin.

Endocarditis is a life-threatening disease, although it is relatively uncommon. Substantial morbidity and mortality can result from this infection despite advances in antimicrobial therapy. Primary prevention of endocarditis is therefore very important (Dajani *et al*., 1997). The incidence of endocarditis is not easily measured as there is no statutory requirement to

report cases, and the diagnosis is not always conclusively confirmed.

Most cases of endocarditis are not attributable to an invasive procedure (Dajani *et al*., 1997) and it is not possible to conduct controlled trials to definitively establish that antibiotic prophylaxis provides protection against endocarditis during bacteraemia-inducing procedures.

Who is at risk of developing endocarditis?

High risk—endocarditis prophylaxis recommended (Dajani et al., 1997)

Individuals at high risk of developing severe endocardial infection include those with prosthetic cardiac valves, previous bacterial endocarditis, complex cyanotic congenital heart disease (Fallot's tetralogy), or surgically constructed systemic pulmonary shunts or conduits.

Moderate risk—endocarditis prophylaxis recommended (Dajani et al., 1997)

Includes most other congenital cardiac malformations, acquired valvular dysfunction (rheumatic heart disease), hypertrophic cardiomyopathy, and mitral valve prolapse with regurgitation.

Negligible risk—endocarditis prophylaxis NOT recommended (Dajani et al., 1997)

This category includes cardiac conditions in which the development of endocarditis is not higher than in the general population. The list includes isolated secundum atrial septal defect, surgical repair of atrial or ventricular septal defects, or patent ductus arteriosus, previous coronary artery bypass graft, mitral valve prolapse without valvular regurgitation, innocent heart murmurs, previous Kawasaki disease or rheumatic fever without valvular dysfunction, cardiac pacemakers, and implanted defibrillators.

Which orthodontic procedures require antibiotic prophylaxis?

National guidelines

In the United Kingdom the British Society for Antimicrobial Chemotherapy (Simmons *et al*., 1993) recommend the use of antibiotic prophylaxis before the following dental procedures: extractions, scaling, and surgery involving the gingival tissues. They do not make any specific recommendations about the use of antibiotic prophylaxis prior to orthodontic band fitting or removal.

The American Heart Association recommendations state that antibiotic prophylaxis should be given at the initial placement of orthodontic bands, but not orthodontic brackets (Dajani *et al*., 1997).

Are there any risks associated with the use of antibiotic prophylaxis?

Allergic reactions to penicillin are rare, but there is always a remote possibility of life-threatening reactions, such as anaphylaxis or angioedema of the airway. One estimate of the likelihood of this possibility is one to two fatal reactions per 100,000 persons receiving one or more doses of penicillin (Idsoe *et al*., 1968).

The technique of formal decision analysis has been applied to the controversy of antibiotic prophylaxis in patients with mitral valve prolapse by Bor and Himmelstein (1984). They calculated that in 10 million dental procedures performed without prophylaxis 47 cases of endocarditis would be likely to occur (two of them fatal). However, the use of penicillin prophylaxis could lead to 175 fatalities from drug reactions and five cases of endocarditis resulting from antibiotic failure. They concluded that antibiotic prophylaxis is likely to have a net harmful effect for this group of patients.

In addition, there is the risk of encouraging the emergence of antibiotic resistant streptococci following the repeated use of penicillin (Roberts *et al*., 2000).

Infective endocarditis in patients undergoing orthodontic treatment

Biancaniello and Romero (1991) reported the case histories of two children with congenital cardiac defects who developed endocarditis. In both patients the only dental treatment carried out in the 6 months prior to the onset

of endocarditis was the adjustment of their orthodontic appliances. Hobson and Clark (1993) also reported a case where a patient was admitted to hospital with endocarditis 2 weeks after an archwire was changed and an elastomeric chain applied. However, in none of the above cases was conclusive evidence presented to confirm that the patients' orthodontic treatment caused their endocarditis. The real possibility exists that in all these patients the relationship between the orthodontic treatment and the endocarditis was coincidental, rather than causal. A recent review article concluded that the likelihood of orthodontic treatment causing bacterial endocarditis was so low that the need for antibiotic prophylaxis, other than for extractions, is questionable (Roberts *et al*., 2000).

How frequently do orthodontists use antibiotic prophylaxis?

Several surveys have evaluated the antibiotic prescribing habits of orthodontists when treating at-risk patients. One survey in the United Kingdom found that 67 per cent of orthodontists used antibiotic prophylaxis when fitting bands and 50 per cent when removing bands (Hobson and Clark, 1995). Another study in the United States reported that 65 per cent of the orthodontists surveyed used antibiotic prophylaxis during band fitting and 38 per cent at band removal (Gaidrey *et al*., 1985). It is clear from both these surveys that orthodontists perceive the risk of bacteraemia to be greater during band fitting than at band removal.

Is there any evidence that orthodontic procedures cause bacteraemia?

Degling (1972) failed to detect any bacteraemias when fitting or removing orthodontic bands for 10 patients. However, McLaughlin *et al*. (1996) reported bacteraemias in three (10 per cent) out of 30 patients when molar bands were fitted. More recently, a study among 40 patients reported a lower prevalence of bacteraemia of 7.5 per cent at initial banding (Erverdi *et al*., 1999). In a separate study of bacteraemia at debanding and debonding the same authors detected bacteraemias in 6.6 per cent of the 30 patients studied (Erverdi *et al*., 2000). Figure 1 illustrates the maximum reported prevalence of bacteraemia associated with orthodontic banding compared with a variety of oral hygiene measures and dental procedures (Okell and Elliot, 1935; Elliott and Dunbar, 1968; Wilson *et al*., 1975; Peterson and Peacock, 1976; Everett and Hirschmann, 1977; Coulter *et al*., 1990; Schlein *et al*., 1991; Lucarto *et al*., 1992; Giglio *et al*., 1992; Allison *et al*., 1993; McLaughlin *et al*., 1996).

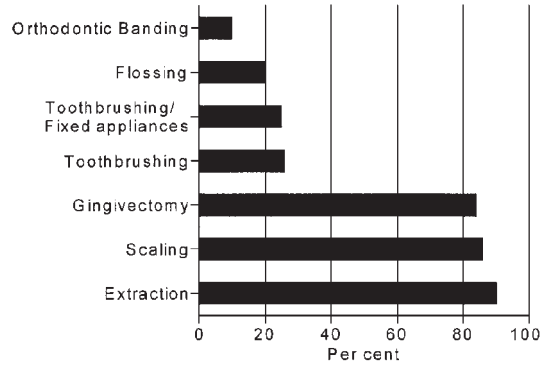

Figure 1 The maximum reported prevalence of bacteraemia for a variety of dental procedures.

What should the orthodontist do?

Unfortunately, it is very difficult to offer a definitive answer to this question. The orthodontist has to make a decision on a case by case approach in agreement with the patient's cardiologist. The risk of endocarditis must be weighed against the risk of an adverse reaction to the antimicrobial therapy prescribed.

1. As an initial step the level of risk of endocarditis occurring must be established. This will involve contacting the patient's cardiologist, although the American Heart Association guidelines offer guidance on the risk categories of various heart defects (Dajani *et al*., 1997).
2. Orthodontic treatment should never be commenced until the patient has exemplary oral hygiene and excellent dental health. The

prevalence and magnitude of bacteraemias of oral origin are directly proportional to the degree of oral inflammation and infection (Pallasch and Slots, 1996). Guntheroth (1984) highlighted the fact that most bacteraemias occur as a result of mastication, tooth brushing, or randomly as a result of oral sepsis. In a recent review of the orthodontic treatment of patients at risk from infective endocarditis, it has been suggested that prior to any orthodontic procedure a 0.2 per cent chlorhexidine mouthwash should be used (Khurana and Martin, 1999).

3. If possible, the orthodontist should avoid using orthodontic bands and, instead, use bonded attachments. Antibiotic prophylaxis is considered unnecessary when bonding brackets or adjusting orthodontic appliances.
4. If banding is necessary the orthodontist must decide if antibiotic prophylaxis is required. This decision should be based on the risk of endocarditis represented by the patient's heart defect (high or moderate risk) and the patient's dental health. Two recent studies have found a relatively low prevalence of bacteraemia during orthodontic banding (McLaughlin *et al*., 1996; Erverdi *et al*., 1999).
5. Prior to giving antibiotic prophylaxis it is important to establish that no known penicillin allergy exists.
6. The latest American guidelines recommend the use of antibiotic prophylaxis for initial banding, but not when removing bands (Dajani *et al*., 1997). It could be argued that the risk of bacteraemia might be higher at band removal when the gingival tissues adjacent to the bands are often inflamed. Erverdi *et al*. (2000) found a low prevalence of bacteraemia at debanding (6.6 per cent), but patients with poor oral hygiene were specifically excluded from their study. Plainly, it would be prudent to consider using antibiotic prophylaxis if the gingivae adjacent to the orthodontic bands are inflamed and the patient has a high-risk cardiac lesion.
7. During treatment the orthodontist should be particularly vigilant for any deterioration in gingival health. Regular supportive therapy from a hygienist is advisable.

Children with bleeding disorders

Patients with mild bleeding disorders do not usually present difficulties to the orthodontist. However, those with severe bleeding disorders can be more problematic. In addition to haemophilia A (Factor VIII deficiency), which affects about 1 in 10,000 males, a number of congenital coagulation abnormalities caused by deficiency of other clotting factors have been recognized. As the prevalence of malocclusion in these children is similar to the rest of the population and the long-term outlook is good, orthodontic treatment is often requested. Patients with haemophilia and related bleeding disorders require special consideration in two areas.

Viral infection risk

Prior to 1985, in the UK, the majority of patients with severe haemophilia who were treated with appropriate concentrates had evidence of infection with either hepatitis C or HIV (Grundy *et al*., 1993). Factor concentrates are derived from human blood donations. Since the mid-1980s methods of manufacture have been developed to remove hepatitis B, C, and HIV from human derived concentrates. However, the continued use of concentrates, despite careful donor selection and screening, and improved methods of manufacture, still carries a small risk of transmitting serious transfusion derived viral infection.

Most patients with moderate to severe haemophilia A require Factor VIII concentrate infusion before oral surgical procedures. The recent introduction of genetically manufactured Factor VIII products and their current widespread use in affected children has further reduced the risk of viral transmission in this age group.

Bleeding risk

Generally, orthodontic treatment is not contra-indicated in children with bleeding disorders. If tooth extraction or other surgery is required in patients with severe bleeding disorders they are usually hospitalized and given transfusions of the missing clotting factor in advance of the

procedure. Where possible a non-extraction approach should be adopted.

Special orthodontic considerations

1. It is desirable to prevent gingival bleeding before it occurs. This is best achieved by establishing and maintaining excellent oral hygiene.
2. Chronic irritation from an orthodontic appliance may cause bleeding and special efforts should be made to avoid any form of gingival or mucosal irritation.
3. Archwires should be secured with elastomeric modules rather than wire ligatures, which carry the risk of cutting the mucosal surface. Special care is required to avoid mucosal cuts when placing and removing archwires.
4. The duration of orthodontic treatment for any patient with a bleeding disorder should be given careful consideration. The longer the duration of treatment the greater the potential for complications (van Venrooy and Proffit, 1985).

Children with leukaemia

Nearly 70 per cent of children currently diagnosed with malignancy will survive for more than 5 years from the time of diagnosis and many will ultimately be long-term survivors. Chemotherapy is now the mainstay of treatment for many of these conditions with surgery and radiotherapy still playing a complementary role (Young *et al*., 1986; Dunn *et al*., 1990).

Approximately 30 per cent of childhood malignancies are due to leukaemia (either Acute Lymphoblastic Leukaemia or Acute Myeloblastic Leukaemia). Leukaemia is a malignant disease of lymphoid or myeloid progenitor cells. Acute Lymphoblastic Leukaemia, which has a peak incidence of 3–4 years, accounts for approximately 80 per cent of all childhood leukaemia

Acute Lymphoblastic Leukaemia is the commonest childhood malignancy accounting for 25 per cent of all childhood tumours. Initial intensive intravenous chemotherapy achieves remission for 95 per cent of patients at 4 weeks from presentation. Further intensive intravenous treatment (consolidation) and later continuing oral medication (maintenance) over a 2-year period achieves a cure in 70 per cent of patients. Specific treatment directed to the central nervous system in the form of cranial irradiation and/or intrathecal methotrexate is also required as part of the therapy.

Acute Myeloblastic Leukaemia accounts for 20 per cent of all childhood leukaemia. Management consists of intensive periods of intravenous chemotherapy lasting over a period of 4–5 months. Bone marrow transplantation has a role to play where there is a suitable sibling marrow donor and has helped to improve cure rates (Hongeng *et al*., 1997).

How does a haematological malignancy influence orthodontic care?

Before diagnosis

Oropharyngeal lesions can be the initial complaint in over 10 per cent of cases of acute leukaemia (Scully and Cawson, 1987). In the absence of local causative factors, orthodontists should be suspicious of patients who present with gingival oozing, pain or hypertrophy, mucosal pallor, pharyngitis, and lymphadenopathy (Sheller and Williams, 1996). In such cases, prompt referral to a physician is necessary to exclude haematological malignancy.

After diagnosis

In most cases, orthodontists will encounter patients who have already been diagnosed with a haematological malignancy. Those receiving chemotherapy have an increased potential for infection, which is the leading cause of morbidity in immunocompromised patients. A probable oral origin of infection has been identified in nearly one-third of neutropenic individuals who develop septicaemia (Bergmann, 1988). The orthodontist should be aware of the implications of a pre-existing infection in a patient about to undergo chemotherapy.

Developing dental tissues are particularly sensitive to radiation (Näsman *et al*., 1997).

Chemoradiation therapy used on paediatric oncology patients often causes dental developmental anomalies, including tooth agenesis, localized enamel defects, and root shortening (Goho, 1993). The severity of these abnormalities depends on the stage of dental development and the radiation load delivered (Möller and Perrier, 1998). Careful consideration should be given to the advisability of orthodontic treatment in patients with severe root shortening.

Orthodontic management of patients with haematological malignancies

The orthodontist should always contact the patient's physician for an appraisal of the prognosis. Since orthodontic treatment is nearly always an elective procedure, it should be delayed until the patient has completed chemotherapy and is in long-term remission. If any potential source of dental infection is identified, the patient's dentist should be contacted and treatment provided promptly.

If orthodontic treatment has already commenced

Again, the orthodontist should contact the patient's physician for an appraisal of the prognosis. The time of diagnosis is very stressful for the patient and the family. Orthodontists, like other health care professionals, should be sensitive to the emotional implications of a diagnosis of haematological malignancy. In deciding what to do, the orthodontist should remember that intense chemotherapy, sometimes coupled with radiotherapy, reduces the regenerative capacity of the mucous membranes (Weckx *et al*., 1990). This can mean that, in patients undergoing chemotherapy, minor mucosal irritation from orthodontic appliances can result in severe ulceration. Subsequent oral infection by opportunistic organisms is not uncommon and can have serious consequences. An additional complication in these individuals is xerostomia, which can result from the chemotherapy or the radiation treatment given before a bone marrow transplant.

The patient's comfort and safety during chemotherapy are enhanced if all orthodontic appliances are removed.

Patients and their families may be reluctant to accept the advice to stop orthodontic treatment. This is particularly true if the dental aesthetics are still poor or extraction spaces are still present. This problem needs to be handled sensitively. Consultation should ideally involve the patient, parents, physician, family dentist, and the orthodontist, and everyone informed that stopping orthodontic treatment is in the best interests of the patient (Sheller and Williams, 1996). The orthodontist should emphasize that this is only a temporary cessation of orthodontic treatment, and once chemotherapy has been completed and the patient is in long-term remission orthodontic treatment can be recommenced.

Children with diabetes

There are two major forms of this condition (Little *et al*., 1997): type I, insulin-dependent diabetes mellitus (IDDM) and type II, non-insulin-dependent diabetes mellitus (NIDDM).

The prevalence in the UK, Western Europe, and North America is about 3–4 per cent of the population. Approximately 15 per cent of all diabetics have IDDM. Although diabetes can occur at any age, the peak incidence of IDDM is 10–12 years. NIDDM is most common after middle age. The orthodontist should be aware of the significance of diabetes in relation to susceptibility to periodontitis. It is recognized that diabetes is a risk factor for periodontitis, although all diabetics are not equally at risk. IDDM, which may have an abrupt onset, is caused by the destruction of 80–90 per cent of the insulin producing pancreatic islet cells. Beta cell destruction occurs in genetically susceptible subjects as a result of an autoimmune process. These individuals are dependent on exogenous insulin to prevent ketosis. NIDDM can be controlled by diet and is related more often to a reduction in insulin production. The variability of metabolic control among diabetics appears to be a significant factor in their susceptibility to periodontitis.

In a study of 263 diabetic and 108 non-diabetic children and adolescents, Cianciola *et al.* (1982) found a prevalence for periodontitis of 9.8 per cent in IDDM (Type I) compared with 1.7 per cent in non-diabetics. That study also found a relative increase in the prevalence of periodontitis with age; 39 per cent of subjects with diabetes who were more than 18 years old had periodontitis. Rylander *et al.* (1987) compared the periodontal condition of 46 insulin controlled young diabetics with 41 healthy young adults. The diabetic group was found to have significantly more sites with clinical attachment loss of 2 mm or more. They reported significantly more gingival inflammation in those young diabetics with retinopathy and nephropathy compared with diabetics with no complications.

Orthodontic considerations

1. Orthodontic treatment should be avoided in patients with poorly controlled IDDM as these individuals are particularly susceptible to periodontal breakdown. Some patients with IDDM who are being treated with large doses of insulin will have periods of extreme hyper- and hypoglycaemia (brittle diabetes), even with the best medical management.
2. Even in well-controlled diabetics there is more gingival inflammation, probably due to the impaired neutrophil function. During treatment, the orthodontist should monitor the periodontal condition of patients with diabetes. In addition, lengthy orthodontic appointments should be arranged in the morning, following the patient's insulin injection and a normal breakfast. Prior to commencing treatment for patients with diabetes they should be counselled about their greater propensity for gingival inflammation when wearing fixed appliances and the importance of diligently following the oral hygiene instructions given.

Children with cystic fibrosis

Cystic fibrosis is an autosomal recessive disorder of the exocrine glands. It is the commonest inherited disease among Caucasians with an incidence of one in 2500 live births (Jaffe and Bush, 1999). The main clinical manifestations of cystic fibrosis relate to changes in the mucous glands of the pulmonary and digestive systems. Males and females are equally affected. Males tend to live longer and are usually infertile. The lungs are invariably involved and there is a non-productive cough that leads to acute respiratory infection, bronchopneumonia, bronchiectasis, and lung abscesses. The disease pursues a relentless course and, until recently, the life expectancy was not much more than the second decade. Heart and lung transplants have proved successful in a small group of patients with respiratory failure (Grundy *et al.*, 1993). The current median survival for subjects with cystic fibrosis is 30 years (Jaffe and Bush, 1999).

Orthodontic considerations

1. Before contemplating orthodontic treatment for patients with cystic fibrosis the patient's physician should be contacted to determine the severity of the problem and the likely prognosis.
2. General anaesthesia should usually be avoided and any orthodontic extractions should be delayed until an age when extraction under local anaesthesia is feasible. Local anaesthesia combined with inhalation sedation has an important role to play in the management of these children.
3. It has been suggested that for the majority of these children only limited orthodontic treatment should be contemplated (Grundy *et al.*, 1993). However, life expectancy varies and orthodontic management will depend on the general prognosis of each individual case.
4. It should also be remembered that salivary glands, particularly the submandibular glands, are often affected by cystic fibrosis. Salivary volume can be reduced and there may be an increased risk of decalcification during orthodontic treatment, due to changes in saliva or dietary alterations (van Venrooy and Proffit, 1985). Appropriate preventive measures must be instigated from the outset including dietary advice and daily fluoride mouthrinses.

Children with juvenile rheumatoid arthritis

Juvenile Rheumatoid Arthritis (JRA) is an inflammatory arthritis occurring before the age of 16 years and now embraces Still's disease (Grundy *et al*., 1993). It is a variable condition with several clinical subgroups. Although uncommon compared with adult rheumatoid arthritis, at its worst, JRA is considerably more severe than the adult disease and leads to gross deformity. One form of this disease which affects girls in late childhood, may involve virtually any joint and is associated with rheumatoid nodules, mild fever, anaemia, and malaise (Scully and Cawson, 1987). Damage to the temporomandibular joint (TMJ) has been described, including complete bony ankylosis. It has been suggested that restricted growth of the mandible resulting in a severe Class II jaw discrepancy occurs in 10–30 per cent of subjects with JRA (Walton *et al*., 1999). Classic signs of rheumatoid destruction of the TMJ include condylar flattening and a large joint space.

Orthodontic considerations

1. If the wrist joints are affected these patients can have difficulty with tooth brushing. They may require additional support from a hygienist during their orthodontic treatment and the use of an electric toothbrush should be considered.
2. Some authors have suggested that orthodontic procedures that place stress on the TMJs, such as functional appliances and heavy Class II elastics, should be avoided if there is rheumatoid involvement of the TMJs (Proffit, 1991). Instead, consideration should be given to using headgear to treat children with rheumatoid arthritis who have moderate mandibular deficiency. However, others feel that functional appliances may unload the affected condyle and act as a 'joint-protector' (Kjellberg *et al*., 1995).
3. It has been suggested that in cases of severe mandibular deficiency mandibular surgery should be avoided, and a more conservative approach using maxillary surgery and genioplasty should be considered (van Venrooy and Proffit, 1985).

Children with renal failure

Chronic renal failure may be due to a variety of causative factors, which lead to a loss of kidney function. Initially, treatment may involve dietary restriction of salt, protein and potassium depending on the degree of renal failure. As the disease progresses, conservative medical management may be inadequate, and either artificial filtration of the blood by dialysis or transplantation of a kidney is required. In children with chronic renal failure growth can be retarded and tooth eruption delayed (Jaffe *et al*., 1990).

Orthodontic considerations

Three types of patients with renal problems may be referred for orthodontic treatment:

Patients with chronic renal failure who are not dialysis-dependent. The orthodontist should consult with the patient's physician, and orthodontic treatment should be deferred if the renal failure is advanced and dialysis is imminent. If the patient's disease is well controlled orthodontic treatment can be considered.

Orthodontic care for patients on dialysis. Most children in the UK wait less than 18 months for a kidney transplant. The majority of children receive their dialysis at home using the continuous ambulatory peritoneal dialysis (CAPD) technique. Again, the orthodontist should discuss any proposed orthodontic treatment with the patient's physician. There is no major contraindication to orthodontic treatment in these children. Indeed, if it is possible, there may be merit in commencing orthodontic treatment prior to kidney transplantation before immunosuppression creates problems with gingival overgrowth.

Children who have received their kidney transplant. Renal transplant units use combinations of immunosuppressant drugs such as Azathioprine, Prednisolone, Cyclosporin, Tacrolimus and Mycophenolate Mofetil to prevent graft rejection. These patients may also receive calcium channel antagonists such as Amlodipine or Nifedipine. Children with renal

transplants often exhibit drug-induced gingival overgrowth as a consequence of their long-term medication (Cyclosporin and/or calcium channel antagonists). There is large individual variation in the extent of gingival hyperplasia seen in these patients. Orthodontic appliances, especially fixed appliances, can produce a dramatic response in the gingival tissues even when no gingival overgrowth is present before orthodontic treatment.

The following treatment approach is recommended:

1. Prior to commencing orthodontic treatment all renal transplant patients should be examined to assess the extent of drug induced gingival overgrowth.
2. Orthodontic treatment should not commence until the oral hygiene is very good and the use of 0.2 per cent chlorhexidine mouthwash is advisable in these patients.
3. If gingival overgrowth is present orthodontic treatment should be delayed until the excessive gingival tissue has been surgically removed and the patient can demonstrate an adequate level of plaque control.
4. As far as possible, the treatment time with fixed appliances should be kept to a minimum consistent with a high standard of occlusal result.
5. These patients should be seen on a regular basis by a hygienist during the course of their orthodontic treatment.
6. In some patients recurrence of gingival overgrowth may be a problem. Surgical removal of excessive gingival tissue is sometimes necessary during orthodontic treatment. The patient and parents should be warned of this in advance.

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