ORTHODONTIC TREATMENT IN SYSTEMIC DISORDERS

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Abstract
Often an orthodontist can have a patient with a complicated chronic systemic disease that needs to be considered when providing treatment. Common systemic problems encountered frequently in orthodontic practice in India include infective endocarditis, childhood diabetes, bleeding disorders like hemophilia, hematological malignancies, rheumatoid arthritis, sickle-cell anemia, bronchial asthma and chronic renal failure. For the majority, treatment of orthodontic problems is feasible, but special precautions usually are required. As endocarditis is a life threatening disease, importance and indications for antibiotic prophylaxis is described. In patients receiving chemotherapy for hematological malignancy or having kidney transplant, resistance to infection is decreased. So mucosal irritation must be avoided and periodontal health should be constantly checked. In sickle-cell disease, rest interval should be more to restore microcirculation during tooth movement. In asthma care should be taken to avoid allergic bronchospasms while orthodontic treatment. With appropriate management, successful orthodontic treatment can be done for most patients. Thus an orthodontist can play a positive role in chronically ill patient's well-being.

Keywords: systemic disorders, medically-compromised patient.

Introduction:
The nature of the orthodontic patient base continues to grow, and the practicing orthodontist is now increasingly challenged to assist in the diagnosis and management of patient with unusual medical requirements. While orthodontic therapy has been historically considered to be completely noninvasive, specific orthodontic procedures may place some patients at risk for serious sequelae. It has been estimated that 10-15 percent of children under age of 16 years are affected by systemic long-term disease. Chronic disease presents social and emotional challenges to the patient and his/her family. It has been also shown that conspicuous incisal crowding or spacing like midline diastema represented a social disadvantage compared to normal teeth. Orthodontic treatment in systemically compromised patient can benefit overall psychological outcome along with other medical treatment.

An orthodontist who is treating medically ill patient should be aware of basic nature of systemic disease and its consequences. Treatment plan should be modified according to impact of the particular disease in the oral cavity. Thus an orthodontist can be a positive part of the health care team and can support a family in crisis.

The purpose of this article is to review some commonly occurring systemic diseases and various disease processes and to help produce guidelines that are practicable for orthodontists faced with a child who has systemic disease and requests orthodontic treatment.

Systemic problems commonly encountered in routine orthodontic practice are:
1. Endocarditis
2. Diabetes
3. Bleeding disorders
4. Haematological malignancies
5. Sickle cell anemia
6. Juvenile rheumatoid arthritis
7. Chronic Renal failure
8. Bronchial asthma

Endocarditis
Endocarditis is a life threatening disease, although it is relatively uncommon in India. In one study the number of children hospitalized with infective endocarditis was reported 0.55/1000 hospital admission. Substantial morbidity and mortality can result from this infection despite advances in antimicrobial chemotherapy. As diagnosis of endocarditis is difficult to confirm, prevention of endocarditis is very important. Nowadays diagnosis of IE requires integration of clinical, laboratory and echocardiographic data. A specific and highly sensitive diagnostic schema known as the Duke criteria has been developed to assist diagnosis.
Orthodontic procedures, risk of developing endocarditis and antibiotic prophylaxis:

According to recent guidelines published by American Heart Association, cardiac conditions associated with the highest risk of adverse outcome from endocarditis for which prophylaxis is required with dental procedures are: 6-8

Prosthetic cardiac valve
Previous infective endocarditis
Congenital heart disease (CHD)
Unrepaired cyanotic CHD, including palliative shunts and conduits
Completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first six months after the procedure.
Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization).
Cardiac transplantation recipients who develop cardiac valvulopathy.

American Heart Association recommends that antibiotic prophylaxis should be given, in all cardiac patients with the highest risk of IE mentioned before, in all dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa. They do not recommend prophylaxis at the placement of removable orthodontic appliances, adjustment of orthodontic appliances, placement of orthodontic brackets, and bleeding from trauma to the lips or oral mucosa.

The British Society for Antimicrobial Chemotherapy has given draft for consultation regarding clinical guidelines for the prevention of endocarditis. Nowadays prophylaxis is not recommended solely on an increased lifetime risk of acquisition of infective endocarditis. This group now recommends prophylaxis before dental procedures only for patients who have a history of previous IE or who have had cardiac valve replacement or surgically constructed pulmonary shunts or conduits.

All dental procedures involving dentogingival manipulations should be given coverage of antibiotics in these guidelines they do not make any specific recommendations about the use of antibiotic prophylaxis prior to orthodontic band fitting or removal.

Australian Dental Journal recommends antibiotic prophylaxis during initial placement of orthodontic bands. Antibiotic prophylaxis is not necessary in placement of orthodontic devices and adjustment of the same.

Infective endocarditis, orthodontic treatment and bacteraemia:

The prevalence and magnitude of bacteraemia of oral origin are directly proportional to the degree of oral inflammation present. In one study, it has been reported that sixty five percent of orthodontists in America use antibiotic prophylaxis during band fitting and thirty five percentages during removal. There are ten percent chances of incidence of bacteraemia when molar bands are fitted. A case history of an endocarditis patient showed that the only treatment, done in last six months, was adjustment of orthodontic appliances. In a separate study of bacteraemia at debanding and debonding, bacteraemia was found in 6.6 percent of the total patient's studied.

The emphasis for endocarditis causation has now shifted from procedure-related bacteraemia to cumulative bacteraemia. This was extended in a theoretical study of cumulative bacteraemia over 1 year which postulated that ‘everyday’ bacteraemia is six million times greater than bacteraemia from a single extraction. Any bacteraemia occurring during noninvasive dental treatment therefore does not significantly increase the risk of endocarditis.

Orthodontic considerations:

1. Any cardiac pathology should be evaluated in initial medical history. Patients at risk of endocarditis should be treated in consultation with their cardiologist and within the appropriate guidelines. Antibiotic prophylaxis will be required for invasive procedures which involves mucogingival and/or periapical manipulations such as extractions, separation, band placement and band removal. Antibiotic prophylaxis should be given if gingival adjacent to the bands is inflamed and patient is at high risk level of cardiac lesion.

Recommended single dose for patient who can take medicine orally is as follows:

<table>
<thead>
<tr>
<th>SITUATION</th>
<th>AGENT (Single dose:30-60 minutes before procedure)</th>
<th>ADULTS</th>
<th>CHILDREN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>Amoxicillin</td>
<td>2 grams</td>
<td>50 milligrams/kg</td>
</tr>
<tr>
<td>Allergic to Probiotics or Ampicillin</td>
<td>Cephalaxin</td>
<td>2 g</td>
<td>50 mg/kg</td>
</tr>
<tr>
<td>Oral</td>
<td>Clindamycin</td>
<td>600 mg</td>
<td>20 mg/kg</td>
</tr>
<tr>
<td>OR</td>
<td>Azithromycin/Clarihromycin</td>
<td>500 mg</td>
<td>15 mg/kg</td>
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2. Immaculate oral hygiene is must for starting orthodontic treatment. It has been suggested that prior to any orthodontic procedure a 0.2 percentage chlorhexidine mouthwash should be used. During treatment, orthodontist should be particularly vigilant for any deterioration in gingival health. Bonded attachment should be used avoiding banded attachments. Finally, the patient should give a clear commitment to 'maintain a very high standard of oral cleanliness'. The patient should her/himself sign an appropriately worded statement to that effect in the patient's clinical record.

3. In case of surgical exposure of unerupted tooth, it should be exposed and direct traction should be applied. Use of bonded attachment with closure of mucoperiosteum is contra-indicated.

4. The patient and family should be fully involved in the consent process for antibiotic prophylaxis. The potential risk of contracting bacterial endocarditis needs to be explained to the family.

**Diabetes**

Diabetes mellitus affects people of all ages. According to one study done in southern India, prevalence of diabetes (childhood) among those younger than 15 years was 0.26/1000 patients.

Diabetes mellitus (DM) is a metabolic disorder of diverse etiologic factors, characterized by hyperglycemia resulting from deficiencies in the insulin secretion, insulin action or both. It has two types. Type 1 DM the cause is an absolute deficiency of insulin secretion. Type 1 DM is the most common endocrine metabolic disorder of childhood and adolescence with a peak incidence at 10-14 years of age. The cause of more prevalent type 2 DM is a combination of resistance to insulin action and an inadequate compensatory insulin secretory response.

For professionals the method of choice in monitoring the treatment of DM is the determination of the glycosylated hemoglobin concentration (HbA1c). There is a linear rise in HbA1c as the blood sugar increases in DM patients.

Oral manifestations are mainly found in patients while DM is uncontrolled or poorly controlled. Several studies have shown that gingivitis is more severe in children with DM. Even in well controlled DM patients have more gingival inflammation, probably because of impaired neutrophil function.

**Orthodontic considerations**:

1. The key for treating orthodontic problems in diabetic patients is good medical control. If patient is not in good metabolic control (HbA1c more than 9%), every effort should be made to improve blood glucose control. Orthodontic treatment should be avoided in patients with poorly controlled Insulin-dependent DM as these patients are particularly susceptible to periodontal breakdown. There is no upper age limit for orthodontic treatment. The practitioner can treat both type 1 and type 2 DM patients

2. There is no treatment preference with regard to fixed or removable appliances. It is important to stress good hygiene, especially when fixed appliances are used. Daily rinses with fluoride mouthwash can provide further benefits. Diabetes related microangiopathy can occasionally occur in the periapical vascular supply resulting in unexplained odontalgia, percussion sensitivity, pulpitis or even loss of vitality. Orthodontist should be aware of this phenomenon and regular vitality check-ups are advised.

3. In adults especially it is important to evaluate periodontal status before initiating orthodontic treatment. If plaque control is difficult to achieve with mechanical aids like toothbrush and interdental aids, chlorhexidine mouthwash should be used. To minimize neutralizing effect of the chlorhexidine molecule, there should be at least a 30 minute interval between tooth brushing and the chlorhexidine rinse.

4. Morning appointment is preferable. If a patient is scheduled for a long treatment session e.g. about 90 minutes, he or she should be advised to eat a usual meal and take the medication as usual. This is important to avoid hypoglycaemic reaction. When a hypoglycemic reaction occurs in the dental office, the orthodontist should recognize the symptoms and act appropriately. Most patients are familiar with these symptoms and can tell orthodontist in time. The cooperative and conscious patient who demonstrates clinical symptoms of hypoglycemia should be given high carbohydrate beverage such as orange juice. Management of the unconscious patient includes airway maintenance, oxygen administration and monitoring of vital signs.

5. Children with diabetes are at nutritional risk and should undergo nutrition screening to identify those who require formal nutrition assessment with development of a nutrition care plan.

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Juvenile rheumatoid arthritis

Juvenile rheumatoid arthritis (JRA) is an inflammatory arthritis occurring before the age of 16 years. Juvenile rheumatoid arthritis is more severe than the adult disease and leads to gross deformity. In one study in India, prevalence of rheumatic fever was 0.09 percent. Incidence of arthritis was observed in 75 percent of the total patients affected by rheumatic infection. One form of this disease which affects girls in late childhood may involve any joint and is associated with rheumatoid nodules, mild fever, anemia and malaise. Temporomandibular joint (TMJ) can be damaged up to complete bony ankylosis. In 30 percent of the cases a severe skeletal class II jaw discrepancy occurs due to restricted growth of the mandible. Classic signs of rheumatic destruction of the TMJ include condylar flattening and a large joint space. It has been suggested that orthodontic treatment for patients with JRA would prevent worsening of TMJ condition by reducing mechanical loads resulting from stabilization of occlusion. This contributes to long-term stability with a functional improvement.

Orthodontic considerations:

1. Regarding load on TMJ in rheumatoid arthritic patients receiving orthodontic treatment, there are different opinions. Profitt et al have suggested that orthodontic procedures that place stress on the TMJ, such as functional appliances and heavy class II elastics, should be avoided if TMJ is involved in rheumatoid arthritis. Burden et al considered use of headgear in moderate mandibular deficiency patients. On the other hand, Kjellberg et al suggested that functional appliances may unload the affected condyle and act as a “joint protector.”

2. If the wrist joints are affected these patients have difficulty with tooth brushing. They require additional support from a hygienist during their orthodontic treatment and the use of an electric toothbrush should be considered. Sugar-free medicines should be preferred to minimize caries.

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.

Bleeding disorders

Hemophilia A is the most commonly occurring bleeding disorder commonly encountered in dental clinic. In addition hemophilia A (Factor VIII deficiency), a number of congenital coagulation abnormalities cause by deficiency of other clotting factors have been recognized.

It has been estimated that 1300 children with hemophilia are born each year and there are nearly 50000 patients with severe hemophilia A in the year 2000 in India. Patients with mild bleeding disorders do not usually present difficulties to the orthodontist. As occurrence of the malocclusion in the children is similar to the rest of the population and the long term outlook is good, orthodontic treatment is not contra-indicated.

Two main areas to be considered in treatment of these patients are chances of iatrogenic viral infection and risk of bleeding during extraction. Medical treatment of choice in bleeding disorders is administration of various factor concentrates. Concentrates are derived from human blood donations. They carry a small risk of transmitting serious transfusion derived viral infections like hepatitis B, C and HIV.

If extractions are required as a part of orthodontic treatment, most patients with moderate to severe hemophilia A are submitted to factor VIII concentrate infusion before extractions. The recent introduction of genetically manufactured factor VIII products has reduced the risk of viral transmission in this age group. If tooth extraction or other surgery like exposure of impacted canine is required in patients with severe bleeding disorders they are usually hospitalized and given transfusion of the missing clotting factor in advance of the procedure. So wherever possible a non-surgical approach should be adopted.

Orthodontic considerations:

1. Excellent oral hygiene is must for preventing gingival bleeding before it occurs. Every effort should be made to avoid any chronic irritation from orthodontic appliance.

2. Archwires should be secured with elastomeric modules rather than wire ligatures, which carry the risk of cutting the mucosal surfaces. Special care is required when placing and removing archwires.

3. Duration of orthodontic treatment for any patient with a bleeding disorder should be given careful consideration. The longer the duration of treatment, greater the potential for complications.

4. Bleeding can be managed by replacement of missing clotting factors, so extractions and orthognathic surgery is not contraindicated if managed carefully.
Hematological malignancies

In India more than 40 percent pediatric malignancies are hematological either leukemia or lymphoma. Leukemias account for 30 percent of all childhood malignancies. Acute leukemia includes two types: Acute lymphoblastic leukemia (75-80 percent) and Acute nonlymphocytic leukemia (15-20 percent). Chronic myelocytic leukemia accounts for 5 percent of all childhood malignancies. Lymphomas include Hodgkin's lymphoma and non-Hodgkin's lymphoma. Both account for 10 per cent with equal incidence.

Before diagnosis:

Oropharyngeal lesion can be the initial signs in 10% of acute leukemia. In the absence of local causative factors, orthodontist should be suspicious of patients who present with gingival oozing, pain or hypertrophy, pharyngitis and lymphadenopathy. In such cases prompt referral to a physician is necessary to exclude hematological malignancy.

After Diagnosis:

In most cases orthodontist will see a patient who has already been diagnosed with a hematological malignancy. Those receiving chemotherapy have an increased potential for infection which is the leading cause of morbidity in immunocompromised patients. The orthodontist should be aware of the implications of preexisting infection. Developing dental tissues are particularly sensitive to radiation. Chemoradiation often causes developmental anomalies. Careful consideration should be given to the patients having severe root shortening while planning the treatment.

Orthodontic considerations:

1. If orthodontic treatment has not been stared, it should be delayed until the patient has completed chemotherapy and is on long term remission. As orthodontic treatment is an elective procedure, patient's physician should be consulted.

2. If orthodontic treatment has been already started the orthodontist should contact the patient's physician possible for prognosis. As the time of diagnosis of malignancy is very stressful for the patient and family, orthodontist should be aware of its psychological implications.

3. Intense chemotherapy weakens regenerative capacity of mucosa. Minor irritation can lead to opportunistic infection and subsequent severe complications. It is advisable to remove all orthodontic fixed appliances before starting chemotherapy as a safety procedure. Patient and the family may be reluctant to accept the advice to stop orthodontic treatment. This is particularly true if the dental esthetics is still poor, crowding is present or extraction spaces are open. This problem should be handled sensitively. The orthodontist should inform patient, parents, physician and family dentist regarding the fact that stopping of the treatment is in the best interest of the patient. The orthodontist should explain patient that this is a temporary situation only.

4. Apart from smooth appliances such as band and loops and fixed lower lingual arches, all fixed appliance parts should be removed. Removable appliances and retainers that fit well may be worn as long as tolerated by the patient who shows good oral care. If band removal is not possible vinyl mouth guards or orthodontic wax should be used to decrease tissue trauma.

5. To counter xerostomia during cancer therapy use of sugar free chewing gum, candy, saliva substitutes, frequent sipping of water, and/or moisturizers is recommended.

6. Orthodontic treatment may start or resume after completion of all therapy and after at least 2-year event free survival when risk of relapse has been decreased and patient is not on immunosuppressive drugs. A thorough assessment of any dental developmental disturbances caused by cancer therapy must be done before initiating orthodontic treatment. American Academy of Pediatric Dentistry recommends following strategy to provide orthodontic care for patient with dental sequelae.

   a. Appliances that minimize root resorption should be used.

   b. Light force should be used.

   c. Treatment should be terminated earlier than normal.

   d. The simpler method for treatment needs should be chosen.

   e. Lower jaw should not be treated.

However specific guidelines for orthodontic management including optimum force and pace remain undefined.

Sickle-cell anemia

Sickle-cell anemia is defined as a hereditary type of chronic hemolytic anemia caused by genetic mutation of the hemoglobin molecule. In one study of hospitalized pediatric patients in India, prevalence of
Clinical manifestations of sickle-cell anemia are extremely variable from asymptomatic patients to patients constantly plagued by painful episodes. The sickle-cell anemia may have periods of acuteness better known as vasococlusive crisis or recurrent painful crisis, originally denominated "sickle crisis". Occurrence of this is due to ischemic injury to the tissues after the obstruction of small blood vessels by the sickled red blood cells. This occludes blood circulation leading to necrosis and severe pain. This lasts for 3-10 days.

The orthodontist should know the importance of complete blood supply to whole dentition and bone after application of intraoral and extraoral forces.

The increase in number of malocclusions in patients with sickle-cell disease can be related to muscular imbalance, absence of labial sealing or changes in the osseous base.

**Orthodontic considerations:**

1. Because of the disease process, patients are commonly submitted to yearly blood repossession. Such procedure exposes them to the risk of contamination by blood diseases. Although orthodontic treatment is not contra-indicated for such condition, necessary care should be taken to prevent other infection from contaminating clinical setting, staff and the orthodontist himself.

2. The clinical appointments should be arranged during the chronic phase of the disease because orthodontic proceeds can not be performed during periods of crisis or acuteness. In cases where painful symptoms appear during acute crisis, the use of acetyl salicylic acid should be avoided because this drug changes the platelet's adhesion capacity, induces intestinal and gastric ulceration and causes frequent hepatic lesions.

3. The orthodontic should pay attention to the possible pulpal necrosis involving healthy teeth and the changes in the bone turnover during orthodontic movements with heavy forces. These may lead to mandibular painful episodes and the greater susceptibility to infections.

4. Orthodontic treatment planning should be adjusted to restore the regional microcirculation by increasing the rest intervals as well as to reduce the movements of the teeth and the forces applied on them. Elective surgeries, such as the extraction of asymptomatic teeth for orthodontic indication, are contra-indicated.

5. Intense orthodontic or orthopedic forces such as extraoral anchorage or maxillary distraction should be managed with more care.

**Chronic renal failure**

Chronic renal failure (CRF) is an irreversible condition that eventually progress to endstage renal failure. It may be due to a variety of causative factors, which lead to a loss of kidney function. It is an important cause of morbidity and mortality in children worldwide. In the absence of national registry in India, there is paucity of information regarding prevalence of CRF in children.

In children with chronic renal failure, growth can be retarded and tooth eruption delayed. Early effect is enamel hyperplasia due to a defect of enamel development and mineralization.

The orthodontist can have three types of patients with CRF:

1. Patients with CRF and are not dialysis dependent—If the renal failure is advanced and dialysis is imminent, orthodontic treatment should be deferred.

2. Patients with CRF and on dialysis—if consent from the physician is positive, there is no contraindication for orthodontic treatment before the kidney transplant procedure.

3. Children with kidney transplant—They often exhibit drug-induced gingival overgrowth as a consequence of their long term medication (cyclosporine and/or calcium channel antagonists). Orthodontic appliance, especially fixed appliances, can produce a dramatic response in the gingival tissues even when no gingival overgrowth is present before the orthodontic treatment.

**Orthodontic considerations:**

1. If gingival overgrowth is present, orthodontic treatment should be delayed until the excessive gingival tissue has been successfully removed and patient can demonstrate an adequate level of plaque control.

2. As far as possible, the treatment time with fixed appliances should be keep to a minimum consistent with a high standard of occlusal result. Orthodontic treatment should not be commenced until the oral hygiene is very good and the use of 0.2 percent chlorhexidine mouthwash is advisable in these patients.

3. In some patients recurrences 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.
Bronchial Asthma

Asthma is described as a chronic inflammatory disorder manifesting with episodes of chest tightness, coughing, labored breathing and wheezing, all of which are related to bronchiole inflammation. Symptoms can last for a few moments or for as long as a day leading to inflammation and subsequent fibrosis.

In a study prevalence was found between three and four percent in north Indian population\(^{46}\)

The strongest identified risk factor for the development of asthma is atopy, an inherited tendency to exhibit allergic reactions, and people with a family history of allergy have and increased predilection for developing asthma. Common precipitating allergens include tobacco smoke, dust mites, animal fur, cockroaches, pollens, molds and other airborne irritants (including acrylic and other aerosolized dental materials).

Airway inflammation and hyper reactivity are the main clinical features in asthma. Treatment depends upon severity of the underlying pathophyslogic condition. Usually it involves bronchodilators, inhaled corticosteroids, theophylline and anticholinergic.

**Typical oral health conditions in asthma:**

1. Patients with asthma have a greater rate of caries development than do their nonasthmatic counterparts because of antiasthmatic drugs-induced xerostomia.\(^{46}\)
2. The use of nebulized corticosteroids can result in throat irritation, dysphonia and dryness of mouth, oropharyngeal candidiasis and, rarely, tongue enlargement.\(^{51,52}\)
3. The common habit of mouth-breathing in asthmatic patients and immunological factors lead to gingival inflammation.\(^{53}\)

**Orthodontic considerations:**

Management in orthodontic care can be divided in three parts- before orthodontic treatment, during treatment and after treatment.

Before treatment:

1. When an asthmatic dental patient seeks care, the clinician must assess his or her risk level by taking an oral history of the illness: ascertaining the frequency and severity of acute episodes, reviewing the patient's medications thoroughly (as they provide an indication of disease severity) and determining the patient's specific triggering agents. Preventing a sudden episode of airway obstruction is essential when treating an asthmatic patient\(^{54}\)

2. As a general rule, elective orthodontics should be performed only on asthmatic patients who are asymptomatic or whose symptoms are well controlled. to minimize the risk of an attack, the patient's appointment should be in the late morning or the late afternoon.\(^{55}\)

3. Orthodontist needs to be aware of the potential for dental materials and products to exacerbate asthma. These items include dentifrices, fissure sealants, tooth enamel dust (during interproximal slicing) and methyl methacrylate\(^{56,57,58}\). Therefore Fixed appliances and bonded retainers without acrylic are preferable.

4. Anxiety is a known asthma trigger\(^{59}\). For most patients, asking for a simple confirmation that they have taken their most recent scheduled dose of medication can prevent stress. Oxygen and bronchodilator should be available during treatment.

5. Before sending patient to any invasive work to another specialist, he should be informed about the medical history. Dental local anesthetics with vasoconstrictors should be used with caution in asthmatic patients, as many vasoconstrictors contain sodium metabisulfite, a preservative that is highly allergenic.\(^{60}\)

During treatment:

1. It has been found that improper positioning of suction tips, fluoride trays or cotton rolls could trigger a hyperreactive airway response in sensitive subjects\(^{61}\). Eliciting a coughing reflex should be avoided.

2. Prolonged supine positioning, bacteria-laden aerosols from plaque or carious lesions and ultrasonically nebulized water can provoke asthma triggers in the dental setting.\(^{62}\)

3. In case of acute attack following steps should be taken\(^{54,55}\):
   - Discontinue the procedure and allow the patient to assume a comfortable position.
   - Maintain a patent airway and administer bronchodilator via inhaler/nebulizer.
   - Administer oxygen via face-mask. If no improvement is observed and symptoms are worsening, administer epinephrine subcutaneously (1:1,000 solution, 0.01 milligram/kilogram of body weight to a maximum dose of 0.3 mg)
   - Alert emergency medical services. Maintain a good oxygen level until the patient stops wheezing and/or medical assistance arrives.
After treatment:
Owing to chances of allergy, offending NSAIDs include ketorolac, ibuprofen and naproxen sodium should be avoided after banding and bonding. Analgesic of choice is acetaminophen.

Conclusion:
An orthodontist needs to recognize the systemic disease processes and significance of different systemic diseases while doing orthodontic treatment. Careful selection of the treatment objectives, timing of treatment and type of appliance is must in each patient with medical disorder. Good patient cooperation, consent before treatment, proper referral when required and constant monitoring of the progress of the treatment are necessary to minimize physical damage and to maximize treatment outcome.

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