



Chronic congenital systemic disorder- a hurdle in orthodontic treatment plans: Meta analysis

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ABSTRACT

Aim of the study is to evaluate children taking orthodontic treatment with chronic congenital systemic disorders, and hurdle to orthodontic treatment plan and treatment mechanic during and before orthodontic treatment. Sum of 317 articles were collected from EBSCO, MEDKNOW, OVID MEDILINER, SCOPUS, ELSEVIER AND SAGE, abstract and citation database was collected qualitative articles were selected. 79 full-text articles were reviewed, and met inclusion criteria. Many of the articles have been proposed the following are the features of systemic disorder and orthodontic treatment: Cardiac disease, Hematological disease, Respiratory disease, neural disease, Endocrine disease and renal disease. Orthodontic treatment is elective treatment procedure not compulsive, hence can be successfully carried out with compromised orthodontic objectives.

Key words: orthodontic treatment, cardiac disorder, respiratory disease, endocrine.

INTRODUCTION

In this era of advance medicine has been increased hopes and life durability of children with, previously said to be fatal diseases. Weiland et al 1992 reported that children approximately 10-15 percent are affected with congenital long term, chronic diseases at the age of 16 years[1]. Parnine et al 1993 reported that children with chronic illness are challenge to society, family and orthodontist treating them[2].

Studies done on development of chronic illness in child's healthy, self development, and affecting factors, these studies concludes that teasing schoolmate affects development of psychology [3].

The main aim of orthodontist is to fulfill the need of Jackson's triad, also should have comprehensive knowledge of systemic disorders. Few studies have shown that frequently change in treatment planning associated with systemic disorder patients[1-3].

Many recent studies have shown that systemic disorder like cardiac disease, respiratory, allergy, pregnancy, malignancies and bleeding disorders orthodontic treatment either has to terminate or slowdown depends up on physician[4].

This article provides immense information obtained through meta-analysis. Also provides comprehensive knowledge, tackle systemic disorders if encountered during orthodontic treatment.

MATERIALS AND METHODS

Within the limit of both dental and orthodontist, we have searched those articles/ research work that are used qualitative research methods to scrutinize the meaning and characteristics of systemic disorders and their effects in dentistry /orthodontic treatment planning.

Based on available articles we have been framed the inclusive and exclusive criteria

I. Inclusive criteria.

- a. Qualitative articles were considered.
- b. Article defining meaning and character were included.
- c. Articles published with in fraternity of orthodontics and dental academics.

II. Exclusive criteria.

- a. Articles based on quantitative studies.

In order to perceive accurate result we have included that qualitative research article.

Data collection and analysis

Data collection was done with search on EBSCO, MEDKNOW, OVID MEDILINER, SCOPUS, ELSEVIER AND SAGE, abstract and citation database was collected. From 2008 to till date data was obtained. The key word used was 'Medical diseases and Orthodontic Treatment', 'medically compromised patients during and before orthodontic treatment', in English language.

In order to satisfy our inclusive criteria, obtained articles were scrutinized by two reviewers independently. Mainly research articles were analyzed, relevant articles text, titles and abstracts were reviewed. The research articles were analyzed based on obtained data with Meta –summary (Meta analysis). Secondary and abstract were modified in to comprehensive, made separate category.

RESULTS

A total of 317 extracted articles were collected from the bibliographic database search, 79 full-text articles were reviewed, and 7 met inclusion criteria. From the remained article relevant data were extracted. 20 articles were completely meeting the inclusive criteria. Many of the articles have been proposed the following are the features of systemic disorder and orthodontic treatment:

- (1) Cardiac disease
- (2) Hematological disease
- (3) Respiratory disease
- (4) Neural disease
- (5) Endocrine disease
- (6) Renal disease

DISCUSSION

In current situation there is increased demand of orthodontic treatment regardless of hidden medical disorders. However, early diagnosis may lead to proper management of hidden disease and overcome with hidden hurdles during and after orthodontic treatment. In consideration of readers point separate systematic discussion has been done to provide comprehensive knowledge about compromised disease during orthodontic treatment^{2,3,5}.

CARDIAC SYSTEM [1-8]

In this system there are two main disorders are said to be hidden, infective Endocarditis, Hypertension.

Infective Endocarditis (IE) is a systemic life threatening disease caused due to dwelling of microorganism on inner surfaces of heart valve. The bacterial penetrations into cardiac valves create pus in myocardium.

Studies have been reported that the organism found in periodontal pocket were most commonly associate with IE, associated microbial flora were alpha -hemolytic streptococci, *Streptococcus viridians*, *Eikenella corrodens*, *Actinobacillus actinomycetemcomitans*, *Capnocytophaga*, and *Lactobacillus* species.

The guidelines produced by heart association's of United Kingdom and United States reports that IE in orthodontic procedure is very rare, but it is safer to use prophylactic antibiotics during band removing and other dental or orthodontic procedures assaulting gingival and periodontal pocket. Breach in gingival or pocket results in transient bacterimia, which is of short duration.

British orthodontic society and United Kingdom heart association have been classified IE patients based on risk into certain categories show in table 1.

Sl no	CONDITION	ANTIBIOTIC PROPHYLAXIS REGIME
1	High risk patients a. Previous endocarditis b. Prosthetic heart valves c. Complex cyanotic congenital heart disease	Antibiotic Route Dose Timing For procedures under local or no anaesthesia in medium risk patients No Penicillin allergy
2	Medium risk patients a) Congenital heart defects eg VSD b) Acquired valvular disease (e.g. from rheumatic fever). c) Hypertrophic cardiomyopathy mitral prolapse with egurgitation	0-5 years Amoxycillin oral 750mg 1 hr pre-op 5-10 years Amoxycillin oral 1.5g 1 hr pre-op 10+ years Amoxycillin oral 3g 1 hr pre-op Penicillin allergy
3	Low risk patients: a) General population b) Repaired VSD's c) Isolated secundum atrial defects Note that coronary artery bypass grafts are not at risk.	0-5 years Clindamycin oral 100mg 1 hr pre-op 5-10 years Clindamycin oral 300mg 1 hr pre-op 10+ years Clindamycin oral 600mg 1 hr pre-op Note that an additional post-op dose of antibiotic is no longer recommended. Recommendations for high risk patients or GA treatments differ from the above

United States and United Kingdom heart association suggest that patient with High risk of IE is always beneficial to refer physician, but low risk patients need not required any special care.

Regardless of available advance antimicrobial therapy, IE many time considerable associate with morbidity and mortality rate with low IE. Thus it is suggestive of consulting physician and prophylactic antibiotic therapy is always advisable.

The British national antibiotic therapy suggests that any dental / orthodontic invasive procedure should carry out with supplementation of antibiotic prophylaxis with chlorhexidine gluconate gel 1% or chlorhexidine gluconate mouthwash 0.2%, used 5 min before procedure. Should be continued antibiotic prophylaxis two days after the invasive dental / orthodontic procedures.

There were few cases have been reported that children undergoing orthodontic treatment were hospitalized for IE. These cases have undergone archwire change a week ago. However, none of these cases were confirmed that orthodontic treatment was causative. Thus, it was concluded that existing endocarditis was coincidental rather than orthodontic treatment.

Few review articles have been concluded that the very low chance of orthodontic treatment is causative that need prophylactic antibiotic therapy, other than extractions.

Many researchers have been done effort to confirm that the frequency orthodontic procedure that cause IE. These studies were reported that after performing invasive orthodontic treatment procedure (band pinching, quad helix, RME s) only 10% of bacterial flora was found. Thus presence of low percent of bacteria causes only transient bacterimia but not IE.

Role of orthodontist

Orthodontist must take decision performing case by case decision. It is difficult to approach such case, but still case has to refer cardiologist requesting for endocarditis assessment. Meanwhile; have to inform the cause and future detrimental effects associated with fixed orthodontic treatment.

Informed consent and significance of oral hygiene has to explain in relation to IE, few studies have been reported that incidence and extent of bacteremia is always depends upon degree of inflammation present in oral cavity.

Recent study suggests that Prior to any orthodontic procedure 0.2% chlohexidine mouth wash must be used.

D .burdent et al suggests avoiding invasive orthodontic appliance if possible to prevent unnecessary prophylactic antibiotic therapy. If banding procedure is necessary based on risk assessment prophylactic antibiotic must be given. Use of fine finished appliance which cause less, irritation and breach to gingival and periodontal tissue resulting in transient bacteremia.

During orthodontic treatment breach in oral hygiene must be supported and improved by orthodontist with the help of hygienist.

HEMATOLOGICAL SYSTEM [1-9]

Successful hemostasis is the result of a series of events in which platelets and plasma proteins produce clotting. Hurdle in either may result in a clinically relevant clotting disorder (coagulopathy) with bleeding. Thus bleeding disorder can be defined as the qualitative or quantitative deficiencies of platelet count or inadequate levels of plasma clotting factors.

Mild to moderate bleeding disorder is not a problematic, sever bleeding caused due to clotting factor defect are more complicated. (haemophilia A).

Patients with bleeding disorder must be taken in mainly two areas one is prone for viral infection and during surgical management. Due often transmission of blood, may likely to develop viral infection hepatitis and few cases show positive to HIV.

Recent studies have shown that genetic production of clotting factors have been reduced the risks of viral infections. Parenteral I-deamino-8-D-arginine vasopressin (DDAVP) can be used to raise factor VIII levels 2- to 3-fold in patients with mild or moderate hemophilia.

Several studies have been reported that avoid surgical procedures as possible. However, in orthodontic cases are not contraindicated but non extraction procedure should be given priority.

Role of orthodontist

Maintain the proper oral hygiene so that gingival bleeding can be prevented.

Avoid use of sharp and unfinished orthodontic appliances.

Archwires should be ligated with elastic modules.

Orthodontic treatment duration should be kept as minimal as possible.

BLOOD MALIGNANCIES [2-11]

Leukemia is malignant disease of lymphoid or myeloid progenitor's cell. There are two types, acute lymphoid and acute myeloid leukemia. Among the childhood malignancies 25-30 of intial malignant tumors are seen as acute lymphoid leukemia. More than 80% of children get affected at age of 3-5 years.

Mode of control or treatment is chemotherapy increases the life expectancy up to 3- 5 years from the day of diagnosis. Furthermore, chemotherapy controls disease about 95% in 3 weeks.

Acute myeloblastic leukemia accounts for 20 % of childhood disease, management of such condition is intravenous chemotherapy foe 3-5 months and replacement of bone marrow are the most suitable method of treatment plan.

Role of orthodontist

Orthodontist should have knowledge about clinical presentation of such malignant conditions. Subjective symptoms of acute lymphoid leukemia are oro-pharyngeal lesion and pain in acute lymphoid leukemia.however, main striking feature of acute lymphoid leukemia are absence of local factors, oozing of gums, paller, phyrangitis, and mucosal irritation.

Orthodontist should place a minimal traumatic or atraumatic appliance. Recent studies have been reported that orthodontic appliances causes ulceration as the mucosa is dry due chemotherapy.

In few conditions such as uncontrolled blood malignancy, orthodontic treatment should be considered as secondary or optional unless physician consent. If orthodontic treatment has been started than utmost precaution must be needed to avoid lacerations.

SICKLE CELL ANEMIA (SCA) [1-15]

It is chronic hemolytic anemia caused by genetic mutation of haemoglobin molecule found in red blood cell. This phenomenon results in reduced oxygen carrying capacity of protein haemoglobin. SCA can be clinically diagnosed at the age of 5-6 months.

Few studies have reported that health problem associated with SCA are episodes of pain or may called as sickle cell crisis, bacterial infection and long term stroke. Furthermore, recent studies have been reported that due to absence of labial seal and muscle imbalance increases malocclusion. However, during orthodontic treatment it create chaos with initial orthodontic pain, recurrent infection may leads to undermine tooth resorption.

Role of orthodontist

Orthodontic treatment in SCA is not contraindicated, provided oral hygiene should be maintained to avoid frequency of oral infections. Pause orthodontic treatment during phase of SCA crisis. Furthermore, always prefer light continuous force, if necessary use of orthopedic or extra oral forces allowed with utmost care.

ENDOCRINAL DISORDERS

Diabetes Mellitus (DM)

DM is a metabolic disorder caused due to either pancreas not producing enough insulin or body cells are not responding to produce insulin or diverse etiological factors and characterized by triad of hyperglycemia, increased micturation and increased thirst. If left untreated may result into diabetic ketoacidosis, nonketotic coma are the most common acute complications. Whereas cardiac stroke, renal failure, and foot ulcers, eye damage are long term /chronic common complications.

Recent studies have been reported that there are three types, type I (insulin-dependent diabetes mellitus), Type II (non- insulin-dependent diabetes mellitus), Type III (gestational diabetes).

Pertaining to orthodontic treatment planning orthodontist must have comprehensive knowledge about DM and its deleterious effects on periodontium, growth, and during recording cephalometrics. Several recent studies have reported that delayed maturation, reduced both angular and linear measurements. Furthermore, periodontitis is the most common complication due to significantly reduced number of polymorphonuclear (PMN) and leukocyte function and collagen metabolism. This result into slowdown or impaired neutrophil chemotaxis and macrophage functions leading in to delay wound healing in diabetes patients.

Role of orthodontist

In uncontrolled insulin dependent DM or in increased HbA1c more than 9% patients are prone for breakdown of periodontium. Hence it is advice to avoid orthodontic treatment, in case of adult orthodontic treatment it is always better to evaluate periodontal status in both type 1 and type 2 DM.

Orthodontist should educate DM patients about potential side effects associate with microangiopathy, that patient may experience iatrogenic odontalgia, sensitivity, pulpitis or in rarely tooth loss its vitality .

Orthodontist should guide not to alter or change drugs prescribed by general physician. Appointments should be given in the morning hours, if treatment prolong for a long time should advice to take usual meal and medications.

THYROID AND PARATHYROID DISORDERS

Hormones secreted by thyroid gland maintain physiologic functioning of brain, heart, and muscle organs aid in utilizing energy for normal functioning. Recent studies reports that altered thyroid function may affect functioning of these organs. Furthermore, alteration may be increase activity of thyroid gland (hyperthyroidism) or decrease activity (hypothyroidism). However, Common cause for thyroid disorders is the autoimmune diseases in which body tissue destroy thyroid tissue resulting into decrease production of hormones.

Hypothyroid patient are susceptible to CNS depressants such as sedative hypnotic, antianxiety agents, and narcotic analgesic. Hyperthyroid patient cannot be sedate because of high metabolic and heart rate. Hence it is always safer to avoid Atropine and scopolamine in such patients. Clinically associated findings in hypothyroid patients are macroglossia, delayed eruption, poor periodontal health and delayed wound healing.

Role of orthodontist

In thyroid disorder patient's clinical procedure should be managed stress free with short duration and to control spread of infection adrenaline should be used. Furthermore, if signs and symptoms of thyrotoxicosis appeared discontinue the orthodontic procedure and patient should be referred to physician.

BRONCHIAL ASTHMA [1-18]

Chronic bronchiole inflammation characterized by episodes of chest tightness, breathlessness, coughing, and wheezing. These patients are susceptible for dental caries as anti-asthmatic drugs cause dry mouth. Some time patient use nebulizer contain corticosteroid induces periodontal inflammation, throat irritations, even some review article concludes that may cause tongue enlargement.

Role of orthodontist

Asthmatic patients managements can be divided into two phase before and during orthodontic treatment. Before orthodontic treatment orthodontist must confirm and avoid possible use airway obstruction materials such as powder polishing, proximal slicing of tooth, and acrylic/ removal retainers. These materials can trigger or act as stimuli for asthmatic attack. Therefore, use of fixed orthodontic appliance with permanent retainers is advisable.

Most significant general rule is that always consider orthodontic treatment is elective procedure not compulsive hence, only asymptomatic or controlled patients can be selected for treatment. Furthermore, appointment should be fixed at late morning or in late afternoon.

During orthodontic treatment procedure orthodontist should make available of emergency drugs, oxygen facemask and must alert to general physician. Furthermore, orthodontist must avoid use of cotton role, improper positioning of suction tips may susceptible to trigger cough reflex.

EXOCRINE DISORDERS [2,5,8,9,19]

Cystic Fibrosis

It is autosomal recessive inherited disease common among Caucasian with one live in 2500 birth. Most commonly affects the salivary gland secretions, bone resorption, oral mucosa. This disorder clinically manifests as non-productive cough that leads to acute respiratory infection, bronchopneumonia bronchiectasis, and lung abscesses. It affects male and female equally with male like to prone / susceptible to infertility due fibrosis of gland.

Cystic fibrosis most commonly affects submandibular salivary glands. It has been seen that significantly reduction in salivary volume may increase risks of decalcification.

Role of orthodontist

General rule, consent physician to know, prognosis and severity of cystic fibrosis patients before begin with orthodontic treatment. Orthodontist must recommend the supplementations and supportive mouth wash and fluoride rinses before and during orthodontic treatment.

JUVENILE RHEUMATOID ARTHRITIS (JRA) [17,18,20]

JRA is autoimmune inflammatory disease of TMJ Characterized by condylar flattening and bone ankylosis of TMJ, rheumatoid nodules, mild fever, anaemia and malaise. Predominantly Occurs in girls at the age before 16 years. Most of the studies have been reported that 30 % of cases a severe skeletal class II jaw discrepancy occurs due to restricted growth of the mandible.

Role of orthodontist

Many researchers have given their different opinion regarding role of orthodontic treatment in JRA. To our understanding treatment modality of JRA we have been divided in to two groups. Group first suggestive that orthodontic treatment prevent worsening condition use of joint protector". by occlusal corrections. However, group two suggests that orthodontic treatment may impart excessive stress on TMJ and may worsen the condition.

In case of restricted mouth opening, it is safe to use electric brush along with support of oral hygienist to maintain oral hygiene.

Most of the studies and review articles suggest that cases of severe class II due to mandibular deficiency should be treated more conservative approach using maxillary surgery and genioplasty should be considered rather than mandibular surgery.

RENAL DISEASE [1-21]

It is progressive loss of kidney function can be identified by blood test for creatinine . creatinine is byproduct of muscle metabolism , increase level of creatinine in blood indicate that decrease capability of glomerular filtration rate of kidneys to excrete waste products.

Two forms of renal disease acute and chronic. Acute renal failure is reversible condition with adequate treatment and chronic renal disease is often non reversible.

The most possible etiology is diabetic mellitus, long term uncontrolled hypertension, and polycystic kidney disease. Few studies have reported family history mainly with polycystic kidney disease and few drugs like ibuprofen, acetaminophen.

Role of orthodontist

Orthodontic treatment can be done under the consent of patient's physician. These patients are on steroids, dialysis. If the patient is on dialysis orthodontic treatment is not advisable. If the patient undergoing transplants are on immunosuppressant drugs, these drugs were used not to reject to transplant.

CENTRAL NERVOUS SYSTEM DISORDERS [1-23]

EPILEPSY

Epilepsy is a underlying neurological disorder caused due to Brain damage due to injury, infection, birth trauma or a cerebrovascular and associate genetic syndromes such as Down's or in Sturge-Weber syndrome.

Role of orthodontist

Removable orthodontic appliances should be minimal. In fixed orthodontic appliance cases consent general physician to audit the prognosis. In patient with experiencing frequent episodes of epileptic attack, he/she should be advace to carry soft mouth guard covering with palate and buccal sulci.

As a general rule, patient should assure that he has taken anti-epileptic drugs. Clinically orthodontist should observe associated side effects of phenytoin sodium drug in oral cavity (gingival hyperplasia).

MULTIPLE SCLEROSIS

Trauma or damaged myelin sheath get inflamed resulting into disturbance in both sensory and neural transmission. Mostly women are affected than men in 2:3 rations, mortality and, morbidity rate depends up on degree of damage and type and sub type of inflammation. Most possible oral symptom includes pain and numbness in face and oral cavity.

Role of orthodontist

Treatment and appointment timing should be according to patents comfort. Most of the studies have suggested that removable orthodontic appliance and use of class II intermaxillary elastics are contraindicated.

If spasmodic pain intiate on dental chair patient should be allowed to walkout till pain subsides and treatment objective should be cutshort / tailored off in to compromise orthodontic treatment planning.

ALLERGIES [2,6,11,21,23]

In dental office most often patients and dentist accounts for latex allergy and as for orthodontic patient's concern nickel alloy bracket and wire material allergy has been seen.

Role of orthodontist

Orthodontist should be aware of latex and nickel allergic reactions. Latex allergy can cause contact dermatitis, if the symptoms are persisting it is safer to refer physician. Use of latex free products in dental clinics /office is advised.

Nickel allergy rarely occurs and most of the orthodontic patients tolerate these appliances. If hypersensitivity reaction occurs sever than nickel free brace are advised to use.

PREGNANCY¹⁻²⁶

Pregnancy-associated hormonal alterations can cause change in gingival status resulting into pregnancy gingivitis, pregnancy diabetes. These conditions cause uncontrolled bone resorption and formations. Furthermore, avoid X-rays or drug therapy and extractions in first trimesters; however these procedures can be performed safe in second trimester.

Role of orthodontist

Oral hygiene should be maintained during orthodontic treatment and patient should be educated regarding the hormonal alterations and safe period for orthodontic treatment.

The given appointment should be short and allow patient frequently to change positions on dental chair.

It is safe to avoid long, stressful appointments and surgical procedures should be delayed until the postpartum period

CONCLUSION

Systemic disorder alters the treatment modality and objective of medically compromised patients. However it depends upon comprehensive knowledge of orthodontist regarding systemic disorders and possible orthodontic treatment modality to gain fruitful results. Hence it is immense significant to recognize the systemic disease processes and significance of different systemic diseases.

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