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Early age orthodontics in children with special healthcare needs.

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ABSTRACT
"Special needs" refer to those individuals suffering from any developmental disability or with medical complications under high risk or who may require special attention. The condition may be congenital, developmental, or acquired through disease, trauma, or environmental cause and may pose limitations in performing daily self- maintenance activities or substantial limitations in a major life activity. Malocclusion in a very common feature observed in this group of children. Although their parents are highly motivated to improve their children's quality of life, by improving the appearance and the oral function, they are also the least likely to receive orthodontic treatment. The present article discusses various orthodontic treatment modalities for the children with developmental disability, behavioral problems and systemic medical complications.

Keywords: Early age orthodontics, Special healthcare needs, Special Child Orthodontics

I. INTRODUCTION

Socio- emotional development occupies a special domain of child development. It is a gradual, integrative process by which the child acquires the capacity to understand, experience, express and manage emotions and develops meaningful relationships with others. As such it encompasses a large range of skills and constructs, including, but not limited to self-awareness, self-esteem, emotion regulation, friendship and identity development. The key components of a well-balanced aesthetic smile is the consonance between the arcs formed between the incisal edges of maxillary anteriors and the curvature of lower lip. So, the success of designing smile is determined by the extent to which an orthodontist can recreate the aesthetic goals, based on the standards of beauty on set rules of proportions and composition. An ideal occlusion is defined as the perfect interdigitation of the maxillary and mandibular teeth, which is a result of developmental process consisting of jaw growth, tooth formation and eruption. Any deviation from ideal occlusion is termed as a malocclusion. The aimof early treatment of malocclusion are not only to reduce the time and complexity of comprehensive treatment but also to eliminate or reduce the damage to the dentition and supporting tissues that can result from tooth irregularity at a later age. The term "early-age orthodontic treatment" encompasses all interventions and treatments that can be performed during the primary or mixed dentition period, with the purpose of eliminating or reducingdento-alveolar and skeletal disharmonies that can interfere with the normal growth and development of the child.

"Special needs" refer to those individuals suffering from any developmental disability or with medical complications under high risk or who may require special attention. American Academy of PediatricDentistry (AAPD) defines special health care needs (SHCN) as "any physical, developmental, mental, sensory, behavioral, cognitive, or emotional impairment or limiting condition that requires medical management, health care intervention, and/or use of specialized services or programs.The condition may be congenital, developmental, or acquired through disease, trauma, or environmental cause and may pose limitations in performing daily self-maintenance activities or substantial limitations in a major life activity." [(1)]Despite improvement in prenatal identification of congenital anomalies, the absolute number of children with special needs have increased in society. With the higher public profile, today's affluent society has created a general improvement in the quality of life of those children

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that in turn expresses itself in increased demand for aesthetic and normal function.

Orthodontic treatment needs in this population is very high, as up to 74% of individuals with intellectual disability [2], 83% of individuals with Down syndrome [3, 4] and almost 100% of individuals with muscular dystrophies [5] have severe malocclusions. Most commonly found features include Class II, Class III, open bite and more severe malocclusions in the population with special needs compared to those with general population.[2] Despite the increased treatment need in this population, a discrepancy is present with an insufficient uptake of patients with special needs in orthodontic practice. Orthodontic treatment in these patients may require an increased complexity and difficulty of treatment, increased duration of treatment, and limited financial support.[6] Special accommodations may be required for proper management of these patients, and communication difficulties also add to the complexity.[7]

The reasons given by orthodontists regarding why they would not like to treat patients with special needs includes lack of additional strategies to treat them, lack of referrals, problems with cooperation, time constraints in a busy practice, oral health status, and lack of sufficient training. Time constraints was a more commonly given reason by younger orthodontists. [8] The therapeutic obstacles to these children includes– [9]

1. General behaviour is problematic and difficult to deal withdue to reduced understanding, short attention span and limited tolerance.
2. Level of cooperation from them is markedly impaired.
3. Increased incidence of drooling.
4. Exaggerated gag reflex,associated with medical/ dental phobia.
5. Uncontrolled movement and inability to sit quietly.

Also, they require more chairside time, increased number of appointments, treating them with healthy patients is problematic, as they disturb the regular schedule. Also, combining several procedures into single sedation or general anaesthesia requires a multi disciplinary approach in hospital set- up. The aim of pre treatment includes-

1. To raise the patient's level of confidence in dental setup.
2. To assess the patient's and parents' compliance in following the homecare advices.
3. To evaluate the expected cooperation in the upcoming appointments.

Sedation cannot be performed for every visit, so it is important to determine if the patient can reach the level at which treatments can be performed with behaviour management techniques only. Oral hygiene is the most important factor that decides whether orthodontic treatment should be provided to a particular child or not. Toothbrushing is mostly not practised by special needs children. A lessened activity of oral musculature, common in multiple debilitating conditions and lack of manual dexterity may contribute to stagnation of food and plaque accumulation. The first step is to educate the parents to identify plaque and gingival inflammation and also teach them the correct brushing technique. It is important to check the gingival status in several occasions, before starting the treatment. Another advantage of parental toothbrushing is that the child gets accustomed to insertion of foreign objects in mouth, by the person he trusts and helps to reduce the child's defence reaction, apprehension and gag reflex. Tentative treatment plan focuses on general diagnosis and clinical examinations, and full diagnostic records are acquired subsequently in sedation appointments. Communication plays a vital role for education of children with special needs to undertake the treatment. For patients who are unable to communicate, conscious sedation, deep intravenous sedation or general anaesthesia are indicated.

The main aim of sedation is not only to reduce pain but to achieve a motionless state in the patient, for extended period of time. For most routine visits for appliance adjustments, "tell show do technique", positive and negative reinforcement are followed. The different available methods of conscious sedation have widened the scope of treatment. Midazolam has anxiolytic, sedative and amnestic effects but it is short acting and not an analgesic, so its combined with nitrous oxide to achieve analgesic and relaxing effects. [10] For long and complicated procedures, general anesthesia is more preferred.

From an orthodontist's point of view, fixed appliances are more difficult to place and are more complicated than removable ones. Adjustments of removable appliances are easy and can be done extraorally. From patient's point of view, maintaining adequate oral hygiene is more difficult with fixed appliances. Accordingly, it is recommended to increase the use of removable appliances with/ without headgears limits the use of fixed appliances. Orthodontic appliances with longer range of actions require less frequent visits and are preferred for these patients. In extraction cases, correction of vertical and antero- posterior

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discrepencies in the earlier part of treatment with same extraoral removable maxillary orthopaedic splint is recommended and only then proceeding to space closure with the use of intra-arch mechanics. The use of Tip edge Appliance versus other types of straight wire brackets is advantageous because it permits insertion of heavier arch wires that are less likely to deform in early stages of treatment. Space closure is much more rapid as it is achieved by sliding mechanics in a broad slot. The orthodontic treatment in these patients should be aimed for an acceptable result rather than orthodontic perfection.

A. EARLY AGE ORTHODONTICS IN CHILDREN WITH SYSTEMIC COMPLICATIONS-

1. CHILDREN WITH JUVENILE DIABETES

Among individuals below the age of 20, approximately 0.24% has diabetes.[11] The points to be taken into considerations before deciding the orthodontic treatment are –

1. Diabetes should be under tight control. Monitor blood glucose before going into active orthodontic treatment.
2. Ensure good oral hygiene and dental health. Exclude periodontitis.

Considerations during the process of orthodontic treatment includes -

1. Apply light physiologic forces for tooth movement
2. Antibiotic prophylaxis before placement of separators and screws
3. Morning meal on the day of orthodontic treatment. If symptoms of hypoglycemia occur, administer IV dextrose, IM glucagon 1mg.

Treatment considerations for orthodontic surgery-[12]

- Conscious 50 g of glucose as a drink, tablet or gel
- Unconscious 20 ml of 50% Dextrose IV or 1 mg of glucagonshould be administered intramuscularly.

When the patient is cooperative oral glucose should be given toprevent recurrent hypoglycaemia. If recovery is delayed, theemergency services should be called.

2. CHILDREN WITH BLEEDING DISORDERS

Patients with mild bleeding disorders usually don't present with difficulties to orthodontists. Patients with haemophilia and related bleeding disorders require special considerations in two areas-

1. Viral infection risk- the factor concentrates used in treatment in these patients are derived from human sources. There exists a risk of transmitting serious transfusion derived viral infections.
2. Bleeding risk- If extraction or other surgical procedure is required, the patients are hospitalized and given transfusion of missing clotting factor in advance.

Special orthodontic considerations-

It is desirable to prevent gingival bleeding before it occurs. This is achieved by

- Maintaining proper oral hygiene. Chronic irritation from orthodontic appliances may cause bleeding, so these should be avoided.
- Self-ligating brackets are preferable to conventional brackets.
- Archwires should be secured with elastomeric modules rather than ligature wireswhich causes mucosal irritation. Care should be taken while placing and removing archwires.[13]
- If extractions or surgery cannot be avoided, the management ofpatients with haemophilia relies on careful surgical technique,including an attempt at primary wound closure and thefollowing regimen to:

1. increase Factor VIII production with 1-desamino-8-D-arginine vasopressin (DDAVP).
2. replace missing Factor VIII with cryoprecipitate, FactorVIII, fresh frozen plasma or purified forms of FactorVIII.
3. antifibrinolytic therapy with transexamic acid or epsilon-amino caproic acid (EACA).[14]

- N Nerve-block anaesthetic injections are usually contra-indicated unlessthere is no alternative and prophylaxis is provided toprevent the risk of a haematoma forming.
- Fixed appliances are preferable to removable appliances as the latter can cause gingival irritation.
- The duration of orthodontic treatment should be kept to a minimum to reduce the potential for complications.

3. CHILDREN WITH THALASSEMIA

Thalassemia is a quantitative abnormality of haemoglobin and is caused by mutations which results in reduced production of either α or β chains and precipitate serious complications that may require advanced or complex treatment for dental and orthodontic conditions. For example, increased erythroid hyperplasia or extramedullary haematopoiesis over the years worsen malocclusion. Routine blood transfusion, iron deposition in the gingiva and teeth causes teeth discolouration and gingival inflammation. The term "orthodontic complications" refer to craniofacial

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deformities, jaw abnormalities, malocclusion and other conditions that may require orthognathic surgery.

Commonly seen features in these patients are Class II malocclusion, flaring and spacing of maxillary anterior teeth, increased overjet and open bite. Compensatory erythroid hyperplasia occurs in cranial and facial bones due to increased iron absorption.

The orthodontic treatment of facial deformities improves their appearance, occlusion and functional health. Functional appliances and extra oral appliances are used in them to correct dentofacial deformities and cause tooth movements. However cortical bone thinning may hasten tooth movements among these patients, so lighter forces must be used.Also prophylactic antibiotics should be used before any surgical procedures.

4. CHILDREN WITH RENAL FAILURE

Chronic renal failure may result in complete loss of kidney functioning. As the disease progresses, conservative medical management may be insufficient and dialysis or kidney transplantation may be required. In children with chronic renal failure, growth can be retarded and tooth eruption may be delayed. General considerations include-

Surgical procedures are best carried out under local anaesthetic. The anaemia and the potential electrolyte disturbances that can predispose the patient to cardiac arrhythmias can complicate general anaesthesia. Haemostasis is impaired as a result of platelet dysfunction Impaired drug excretion leads to the need for care with drug prescriptions.

It has been suggested that orthodontic treatment forces should be reduced and the forces re-adjusted at shorter intervals.[(15)]

Three types of patients may be referred for orthodontic treatment with renal failure-

1. **Patient with chronic renal failure but not dialysis dependent**- the orthodontistshould consult the patient's physician and orthodontic treatment must be deferred if renal failure is advanced and dialysis is imminent. If the disease is well controlled, then orthodontic treatment may be taken up.
2. **Orthodontic care for patients on dialysis**- the protocol is same as the above situation.

If possible, there may be merit in starting orthodontic treatment prior to kidney transplantation before immunosuppression creates problems with gingval overgrowth.

3. **Children who have received their kidney transplant**- renal transplant units use combinations of immunosuppressants to prevent graft rejection and calcium channel antagonists. These patients exhibit gingival overgrowth. Fixed orthodontic appliances can produce a dramatic response in gingival tissues. The following approach should be followed-

1. Prior to treatment, all patients should be examined to assess the extent of drug induced gingival overgrowth.
2. Oral hygiene status should be very good and the use of 0.2% chlorhexidine mouthwash should be recommended in these patients to control plaque accumulation.
3. If gingival overgrowth is present, orthodontic treatment should be delayed until excessive gingival tissues are surgically removed and patients should be informed beforehand about it.
4. The treatment time with fixed appliances should be kept to a minimum consistent period with a high standard of occlusal result.

5. CHILDREN WITH JUVENILE RHEUMATOID ARTHRITIS

It is an inflammatory arthritis occurring before the age of 16 years. Although rare, but its considered to be more severe than the adult form resulting in gross deformity- damage to temporomandibular joint including complete ankylosis, condylar flattening and a large jaw space. It has been suggested that restricted growth of mandible resulting in severe class II jaw discrepancy occur in 10- 30% of the patients (Walton et al, 1999). The orthodontic considerations include-

- If the wrist joints are affected, patients will have difficulty in brushing and thereby maintaining proper oral hygiene. Use of powered toothbrush and support from a dental hygienist is essential during the orthodontic treatment period.
- The orthodontic appliances that place stress in the TMJ like the functional appliancesshould be avoided if there is rheumatoid involvement of TMJ. Instead headgears should be used if patients havemoderate mandibular deficiency.

The use of functional appliances is controversial. Some authors say that functional appliances and class II elastics put increased stress on the TMJs and should be avoided; however, some suggests that functional appliances protect the joints by relieving the affected TMJ, the aim being to move the mandible into the normal anterior

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growth rotational pattern thus correcting the skeletal Class II relationship.[16]

- In case of severe mandibular deficiency, mandibular surgery should be avoided. Amore conservative approach using maxillary surgery and genioplasty should be considered.[17]
- A bite splint can be provided to unload the joint during acute periods of inflammation. A distracted splint has also been suggested to modify mandibular growth in the same way as conventional functional appliances.

6. CHILDREN WITH INFECTIVE ENDOCARDITIS

The orthodontic considerations that should be taken in children with infective endocarditis includes-

- The level of risk of endocarditis must be noted by contacting the patient'scardiologist. Orthodontic treatment should never be planned until the patient has exemplaryoral hygiene and dental health as the prevalence of bacteraemia is directly proportional to degree of oral inflammation and infections.
- Patients with risk of infective endocarditis, must be treated with 0.2% chlorhexidine mouthwashprior to undertaking orthodontic treatment.
- If possible, use bonded attachments instead of bands.
- Antibiotic prophylaxis is unnecessary when bonding brackets and adjusting the appliances.Prior to giving antibiotics, it is important to establish that no known penicillin allergy exists.

The latest American guidelines indicate that antibiotic prophylaxis is required duringplacing of bands and not during removing. However, chances of bacteraemia might be higher at band removal when the gingival tissues adjacent to the band are inflamed.

- During treatment, the orthodontist must keep a check on any deteriorationof gingival health. Regular supportive therapy from dental hygienist is advisable.

7. CHILDREN WITH LIVER DISEASES

The main effects of liver disease can be categorized into:

- coagulation disorders,
- drug toxicity;
- disorders of fluid and electrolyte balance;
- problems with drug therapy;
- infections like hepatitis B, C, D.

General treatment considerations include- [18]

- Hepatic impairment can lead to failure of metabolism of some drugs and result in toxicity, thus care should be taken while prescribing the medicines.
- Patients undergoing liver transplantation will receive immunosuppressive drugs that can cause gingival hyperplasia and poor oral hygiene.

In these patients, small low profile brackets are recommended and the excess composite should be removed from around the margins. Bands should be avoided if possible and bonded molars are more desired. Essix based retainers should be relieved around the gingival margins to maintain alignment. Bonded retainers should be avoided in these patients.[19]

- Haemostasis will be affected which should be kept in mind when planning treatment.
- Patients with Hepatitis- universal cross-infection control precautions should be taken. All members of the team should be immunized against HBV. A booster is required in those with anti-HBs level less than 100.

8. CHILDREN WITH EPILEPSY

Epilepsy is a common symptom of an underlying neurological disorder. the various causes precipitating epilepsy includes- Brain damage due to injury, infection, birth trauma or a cerebrovascular accident which accounts for 25%. The rest 75% have a familial trend. Epilepsy can also develop in some genetic syndromes such as Down's syndrome or in Sturge-Weber syndrome.[20]

General orthodontic considerations in these patients include-

- Most epileptic patients are able to undergo conventional orthodontic care in the primary care setting. The orthodontist should ensure that the patient has taken their anti-epileptic medicationand has eaten normally before each appointment.
- The pedodontist should ensure the patient is receiving regular preventive dental care to avoid/minimize dental disease.
- Patients should be aware of the risk of soft tissue and dental injuries as a result of a seizure.
- Gingival overgrowth associated with phenytoin especially in patients with high plaque score and a genetic link. Gingivectomy is recommended to remove hyperplastic tissues that interfere with appearance or function.

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- Removable appliances need to be used with caution having maximum retention as they can be dislodged during a seizure. [21]
- Trauma can also result in subluxation of the temporomandibular joints and tooth devitalization, fractures or avulsion. If patients with Class II division 1 relationship experiences an aura, they should carry a soft mouth guard with palatal coverage and extending into the buccal sulci, to use at such times.
- Status epilepticus falls among medical emergency and there should be given a benzodiazepine from the emergency drug kit.

9. CHILDREN WITH RESPIRATORY DISORDERS

Orthodontic considerations in patients with respiratory disorders include-

- The chronic use of corticosteroid inhalers can lead to localized decreased resistance to opportunistic infections likeoro-pharyngeal candidiasis.[22] To avoid this, patients should be advised to gargle with water after the use of their inhaler especially if wearing removable acrylic appliances.[23]Also, regular use of inhaled corticosteroids can predispose adrenal crisis if subjected to stress. The patient's physician should be contacted before treatment to evaluate the severity and prognosis of the problem.
- The pedodontist should ensure the patient carry their inhaler. Patients may not be comfortable in the supine position if they have difficulty in breathing and in them the objective is to prevent acute asthmatic attacks. Treatment can be deferred if patients have poorly controlled asthma. Morning appointments areprefered, short waiting and treatment times can reduce stress and anxiety.
- Orthodontic extractions should ideally be carried out under local anaesthesia (LA) with or without relative analgesia (RA) and not General Anaesthesia (GA). If GA is required the patient must be in optimal health with no respiratory infection. RA with nitrous oxide and oxygen is preferred over intravenous sedation (IV) as it can be rapidly reversed. The patients with drug-induced xerostomia are at a higher risk of decalcification. Oral hygiene maintenance, supplemental topical fluorides, and vigilance for dental disease are necessary to counteract the side effects.
- Patients with asthma should be prescribed non-steroidal antiinflammatory drugs (NSAIDs) with caution as many asthmatic patientsare allergic to aspirin. [24]

B. EARLY AGE ORTHODONTICS IN SPECIAL CHILDREN

Behaviour management plays a key role in the management of these children. A number of pre-treatment appointments should be scheduled in order to – [25]

1. Raise the patient's level of confidence in the dental office,
2. Assess the patient's and guardian's compliance in dental homecare, and
3. Evaluate the amount of cooperation that will be forthcoming

Communication is vital for the education of our orthodontic special needs patients. For those patients who have difficulties in communication and a relative inability to cooperate, we can offer conscious sedation, deep intravenous sedation, or the use of general anaesthesia. The choice of the technique used should be the simplest and safest available that is appropriate for the needs of the specific task to be performed. "Tell, Show, and Do," behaviour modification and positive and negative reinforcement, is adequate to achieve the goals of the respective visits.

In the unusual circumstances standard orthodontic protocols must be adapted to suit the individual problems seen in the patient. The treatment to be taken up should have a more realistic approach, when conditions are compromised due to adverse factors, then treatment must be redirected toward more limited goals, more suited to the circumstances that the patient's condition dictates.

Impression taking is difficult in these children due to exaggerated gag reflex. Thus, alternate adjunctive modalities must be used, preferably in a step-by-step approach, from nitrous oxide conscious sedation alone (the simplest), or combined with other pharmacological agents, as mentioned above. When considering radiographs, the panoramic view is considered to be the basic overall scan that may be used for the orthodontic assessment. However most of them do not sit still for long time. In these cases, multiple intraoral periapical radiographs may suffice.

The use of a Tip Edge appliance versus other types of straight wire brackets is advantageous because it allows insertion of heavier arch wires that are less likely to deform in the early stages of treatment. Space closure is much more rapid since it is performed by sliding mechanics in a broad slot. In case of banding, molar bands should be placed before the sedation or GA session,

when possible. High quality bonding must be assured to avoid subsequent rebonding without sedation. Sandblasting is recommended, but only with a rubber dam and high-vacuum suction to prevent aspiration of aluminium oxide powder. Recently, primers that increase the strength of bonding even in wet environments are particularly useful in patients with hyper salivation.

Relapse is a common problem associated with these patients as in many a case, the etiology of malocclusion is not eliminated in these children as for example macroglossia in Down's syndrome may affect the stability. The parents and caregivers should be warned about these beforehand. [25]

Post treatment satisfaction in these children is not only seen in terms of positive facial or dental changes affecting the appearance, but also marked improvement in oral functions, swallowing pattern, drooling, speech, and even mastication.

II. CONCLUSION

In orthodontics, choosing the correct treatment plan is the keyvariant that determines its success. The best treatment that can be offered to a patient is prevention. Not only it lessens the complications of future treatment but also makes the treatment more cost effective. Aesthetic harmony is synonymous with skeletal, dental, neuromuscular and temporomandibular harmony. Orthodontic treatment, not only depends upon the clinician, but also the patient's point of view. Thus, a pedodontist must work in close cooperation with an orthodontist to apply preventive and early interceptive orthodontic and aesthetic principles. It also improves the interpersonal relationship and strengthens self-confidence within the practitioner.

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