

Orthodontist's View On Cerebral Palsy

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ABSTRACT

Cerebral Palsy is a neurological disorder affecting the brain development with many etiological factors. The aim of this paper is to determine the orthodontic treatment options available for the treatment of various clinical features of cerebral palsy.

Keyword: Cerebral Palsy, Spastic Palsy, Castillo morales.

INTRODUCTION

Cerebral palsy is a non progressive condition due to brain damage during the developmental stages.¹ It may lead to retardation of overall growth along with structural abnormalities of bones, with difficulty in speech, mastication, and lower intellectual quotient with the prevalence rate of 2-2.5 per 1000 live births.² John Little is credited with the first description of CP in 1843 and he coined the term cerebral palsy in 1889. American Academy of cerebral palsy was formed in 1947. Significant parental and professional support is needed for children affected with cerebral palsy for undergoing orthodontic treatment³. In this article we discuss about their oral features, diagnostic methods and customised orthodontic treatment plan for their betterment of patients safety, comfort and compliance.

Risk factors

Cerebral palsy may occur either prenatally or postnatally⁴. The prenatal risk factors include oxygen deficiency, endocrine disorders, genetic predisposition, haematological problems, teratogenic agents, severe infectious fever during pregnancy, toxic exposure, IUD growth problems.

Perinatally, child born before 32 weeks, inadequate oxygen, birth weight less than 2500 gm, infection, premature separation of the placenta from the uterus, forceps delivery might cause cerebral palsy.

Post natal risk factors include oxygen insufficiency, convulsion in post natal period, cerebral blockage, respiratory disorder, chronic lung infection, heart problems, cerebral injury, inflammation of brain and spinal cord.



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Classification

The classification of cerebral palsy depends on the site of lesion present and is classified into four types: spastic, athetoid, ataxic, mixed.⁵

Spastic CP

It is caused by lesion in the cerebral cortex of the brain in the corticospinal tract or motor cortex and is the most commonly present in about 50% of cases affected with cerebral palsy. Inhibitory neurotransmitter GABA (gamma amino butyric acid) is affected in this type of CP. Spastic cerebral palsy can be mainly divided into three types such as spastic hemiplegia where one side of the body is affected, spastic diplegia where only the lower body is affected with scissors gait and with no involvement of upper body and spastic tetraplegia where the whole body is affected. It may also present itself as monoplegia, paraplegia or triplegia. General characteristics include hypertonic musculature, involuntary movements, problem with chewing and swallowing due to rigid facial muscles, delayed jaw movements, head roll etc. Intraorally patient may present with narrow maxillary and mandibular arch, Class II division II malocclusion (75%) mostly with unilateral posterior cross bite.

Athetoid CP

Athetoid Cerebral palsy is caused by lesion in the extrapyramidal or pyramidal motor tract and basal ganglion with characteristics such as slow, twisted, hypotonic, involuntary movements that occur with severe jerky movements, sucking and swallowing problems due to impaired function of deglutition muscles. It occurs in almost 10% to 20% of cerebral palsy cases. Newborns with severe jaundice and kernicterus may be affected with this type of cerebral palsy. Oral manifestations include Class II Division I malocclusion^{6,7} constricted high palatal vault, tongue poke between teeth and lips.

Ataxic CP

Ataxia is caused due to lesion in the cerebellum with poor equilibrium and grimacing with poor motor skills and also visual and auditory processing.

Mixed type

Mixed type may occur due to the combination of various types of cerebral palsy.

Other common oral findings include malocclusion such as open bite⁸ due to decreased buccinator equilibrium. A study shows that these patients have an average of decreased overbite of 0.5mm, increased overjet of 0.8mm, which manifest an upward and outward positioning of maxillary anterior segment.⁹

Dental traumas may occur due to improper equilibrium of motor function. Patient may have protruded maxillary incisors, incompetent lips, frequent seizures. Patients with athetoid CP might have bruxism with tooth abrasion, temporomandibular dysfunction, masseteric hypertrophy etc due to the trouble with dopamine function and loss of proprioception in periodontium. Bruxism might also occur due to spasticity¹⁰, unbalanced functional activity,^{11,12} backbone dysfunction¹³, poor mandibular posture, neuroleptics etc. Drooling/ptyalism/sialorrhea is seen in about 10-58% of CP due to disruption in coordination of swallowing mechanism or due to hypersalivation,¹⁴ which causes pooling of saliva in anterior part of oral cavity even after 4 years of age.^{15,16} This might lead to dental caries, dental erosion and poor oral hygiene. Drooling can be categorized into mild, moderate and severe drooling according to Blasco *et al.*¹⁷ depending on the extent it reaches. Franklin *et al.*¹⁸ has stated that patient with drooling exhibit lip incompetency, with severe maxillary tooth protrusion. Santos *et al.* in his study has stated that in case of grave neurological damage there will be persistent biting reflex and great threat of oral diseases. Cerebral palsy patients in mixed dentition may also exhibit TMJ problems with mouth breathing.

Diagnosis

Diagnosis of cerebral palsy includes a) neurological and neuromotor assessments; b) neuroimaging; c) neurophysiology tests. MRI and CT scan are also taken to assess any pathology in the brain¹⁹.

IQ level of children affected with cerebral palsy is assessed to improve the special care given to them.²⁰ Patient with an IQ score: 50-55 to 70-75 has mild mental retardation, IQ score of 35-40 to 50-55 as moderate mental retardation, IQ score of 20-25 to 35-40 as severe mental retardation and IQ score of Below 20-25 as profound mental retardation.

Dental Aesthetic Index is used to assess the degree of malocclusion and the need of treatment,²¹ If DAI=<25 there is mild malocclusion or no abnormality and treatment is unnecessary ; if DAI=26-30 there is defined malocclusion and elective treatment is needed; DAI=31-35 there is severe malocclusion and treatment is highly desirable; if DAI=>36, there is debilitating malocclusion, and fundamental treatment is necessary.

Based on their motor abnormality, Palisano *et al*²², in 1997 proposed the gross motor function classification system(GMFCS): (A) Level I – walks without limitations, (B) Level II – walks with limitations, (C) Level III – walks using a hand-held mobility device, (D) Level IV – self-mobility with limitations may use powered mobility and (E) Level V – transported in a manual wheelchair.

In 2004, Graham *et al*²³ described the Functional mobility scale (FMS) to measure the ambulatory performance of child with CP²³. Rating 1– uses wheelchair, Rating 2 – uses walker or frame, Rating 3 –uses crutches, Rating 4 – uses sticks (canes),Rating 5 – independent on level surfaces and Rating 6 – independent on all surfaces.

In 2006 the manual ability classification system (MACS) was designed to categorise the patients effectiveness in handling different objects. The MACS have five category scale and level includes:²⁴

Orthodontic Management of cerebral palsy

Patients affected with cerebral palsy need as modified treatment plan depending on the impact of their condition and the clinical features. These patients require effective formulation and management of treatment plan . Patients affected with hypoplastic teeth might require composite restoration in anterior teeth, chrome alloy crowns in posterior teeth, with mouth guards covering the molars(fig 1)²⁵ to reduce the wear and prevent soft tissue injuries.

Many advanced techniques like Indirect bonding,self ligating brackets,self etching primer,expansion appliances,mini implant anchorage,functional and orthopaedic appliance and ,retention appliance can be used for reducing

the treatment duration and to increase the patient compliance.⁵

Indirect bonding

Indirect bonding is a new and comprehensive technique which was introduced by Silverman & Cohen (1972) ²⁶ in which bonding is done as a laboratory procedure in the patients cast and a special tray is constructed which is then transferred to the patient teeth. Indirect bonding technique is used in patients with cerebral palsy who are less cooperative by eliminating the need for separator placement, band adaptation and cementation procedure, accurate bracket placement,²⁷increased bond strength thereby providing, better patient comfort and hygiene²⁸.

Self etching primer

Self etching primers are agents which combine both priming agent and conditioning into single acidic primer solution²⁹.These are hydrophilic agents which dissolves the smear layer in 3 seconds.³⁰The main feature of the single step etch/ primer bonding systems is that no separate etching and rinsing is required and can be used in patients with drooling problems where complete isolation of oral cavity is impossible.It is less technique sensitive which leads to significant improvement in time and cost-effectiveness.

Self ligating brackets

Self ligating bands can be defined as ligatureless bracket system that has a mechanical device built into the bracket to close off the slot. They can be classified as active and passive appliance and exert a constant force on the teeth with low friction by the presence of a metal clip which reduces the need for frequent adjustments due to secure full bracket engagement,anchorage conservation, reduced duration of archwire ligation etc.³¹

Mini implant anchorage

Mini implants are can be used in cases where absolute anchorage is needed in order to obtain various tooth movement .It delivers a promising result in severe malocclusions which exceed the limitations of conventional orthodontic procedure. Miniscrews are placed in the cortical bone as temporary anchorage device and enabling more accurate,predictable and effective tooth movement. It can be used in patients with cerebral

palsy due to the need of minimal patient compliance resulting in maximal anchorage control.³²

Expansion appliance

In case of narrow maxillary arch, rapid maxillary expansion is used. Patients affected with cerebral palsy with transverse maxillary defect such as posterior cross bite and reduced arch perimeter can be corrected by widening the maxillary suture by applying one turn per day. Overcorrection of the discrepancy is needed to gain more space for tongue movements, improvement in swallowing speech etc. The appliance is usually left in the mouth for 3 months without debonding for retention.^{33,34}

Functional appliance

Cerebral palsy patient can be given palatal training appliances which promotes tongue movements and swallowing. These appliances have made up of acrylic with a wire extending posteriorly for stimulating the soft palate. These devices act as an intermediate step, for patients considering the need of surgery.³⁵

ISMAR appliance (fig 2) is a combination of monobloc and functional regulator. It activates the sensorimotor system and regulates the orofaciopharyngeal functions. It engages both the mandible and the teeth which results in forward movement of the mandible leading to airway widening and reduced eccentric and involuntary jaw movements. The device consists of monobloc with tongue shield and four vestibular pads which prevents tongue thrusting and normalization of lip and cheek tonicity. ISMAR is given after 5 years of age and is used during night. Ismar needs a mandibular advancement of 1-2 mm and bite opening of 2-4 mm. Advantages include decreased oral sensitivity, unwanted tongue movements and oral hypersensitivity.³⁶

Castillo morales appliance

Drooling might pose a major problem during the banding and bonding process of orthodontic treatment. Initial treatment includes diet modification, medications, oral exercises, biofeedback etc.¹⁴ In severe cases of sialorrhea anticholinergic drugs, surgery or radiation therapy might be needed.³⁷

In 1970, Castillo Morales developed an intra oral removable appliance for controlling drooling (fig 3) which has a palatal acrylic plate, clasp and a labial bow. A rolling bead is placed in the posterior aspect of the appliance. Due to the abnormal muscle function, position of the tongue differs in these patients. So the bead is placed depending on the patient's swallowing pattern thereby controlling drooling.³⁸

Twin block appliance

Twin Block functional appliance is growth modification appliance which is used to induce condylar cartilage growth leading to increased mandibular length.³⁹ The tonic stretch muscle reflex activity is altered in jaw closing muscle which improves mastication and chewing muscle activity. It can also be used along with expansion appliance in case of transverse discrepancy.³³

In case of hypertonicity of tongue muscles, patient may present with a clinical feature of tongue thrusting, malaligned teeth with lip hypotonicity. Due to the decreased neuromuscular coordination between the intraoral and extra oral muscles, injuries such as cheek, tongue, lip biting and hand and finger chewing might be present. Treatment option includes a removable appliance with a combination of acrylic trays, mouth guards and lip bumpers. The appliance consists of a 0.040" SS wire which extends from mandibular anterior buccal to lingual area. The acrylic buccal and lingual flange was constructed to extend within 2mm of vestibular depth. The appliance allowed continued eruption and occlusal development.⁴⁰ **Orthopaedic appliance**

Orthopaedic appliance such as head gear⁴¹ can be used in cases of skeletal Class II malocclusion for limiting the anterior maxillary displacement, for molar distalization and extrusion etc. Chin cup appliance is used along with functional appliance to inhibit the posterior dentoalveolar growth and the backward and downward rotation of the mandible which results due to functional appliance therapy. They decrease mandibular plane angle and the vertical growth pattern of the patient with cerebral palsy.⁴² Katashiba et al found that chin cup with lighter force and long duration cause more skeletal correction than compared to heavier force with short duration.

Retention appliance

The success of orthodontic treatment depends on the retention of the treatment results. Patient with cerebral palsy can be given removable retainers but needs good patient compliance. Bonded lingual retainers or Essix retainer⁴³ which covers the entire dentition and the alveolus can be given to maintain the proper occlusion.⁴⁴

patients and the caregivers whose aim is to lay a strong foundation for the physical, social, functional and psychological wellbeing of the patient. These patients require a customized and a creative treatment protocol which reduces the physical damage and increases treatment outcome. Thus careful selection of the appliance, timing, treatment protocol is very much mandatory before proceeding with the orthodontic treatment.

CONCLUSION

Orthodontic Treatment for cerebral palsy patient should be a teamwork between parents,

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