Review Article

Dental management of children with cerebral palsy - a review

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Abstract

According to American Academy of Pediatric Dentistry (AAPD), special health-care needs (SHCN) is "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." Oral health is an inseparable part of general health. Throughout the lifetime, individuals with SHCN may be at a greater risk for oral diseases. The aim of this article is to discuss the dental management of children with cerebral palsy (CP) in detail. Children with SHCN have a considerably higher prevalence of oral diseases as compared to otherwise healthy children. The role of the pediatric dentist is to improve oral health wellness and to encourage parents and caregivers for good home oral health practice. This article will help the dentist to understand all the aspects related to the dental management of patients with CP and apply it in clinical practice.

Keywords: Cerebral palsy, dental management, special health-care needs

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INTRODUCTION

Children are both emotionally and physically immature and cannot independently meet their social and cultural exceptions. According to AAPD, special health-care needs (SHCN) is "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 either congenital or developmental. It may be acquired through disease, trauma, or environmental cause and may enforce limitations in performing daily self-maintenance activities or substantial limitations in a major life activity. Health care for individuals with special needs requires specialized knowledge which is acquired by additional training, as well as increased attention, awareness, and accommodative measures ahead of what are considered routine.[1] In developing countries, the number of adolescents and youths with disabilities is significantly higher and it is on the rise.[2]

Oral health is an inseparable part of general health.[3] Throughout the lifetime, individuals with SHCN may be at a greater risk for oral diseases.[4] Oral diseases can have a direct and destructive impact on both health and quality of life in children with certain systemic health problems.[5]

Cerebral palsy (CP) is a neurological disorder occurring in approximately 2–2.5/1,000 live births.[6] CP describes a group of permanent disorders. It includes disorder in the development of movement and posture which causes activity limitations that are accredited to nonprogressive

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disturbances that occurred in the developing fetal or infant brain.[7] The motor disorders of CP are often accompanied by disturbances of sensation, perception, communication, behavior, and cognition by epilepsy and also by secondary musculoskeletal problems. Children with CP also suffer from multiple problems and many potential disabilities. It includes mental disabilities, feeding difficulties, hearing impairments, and ophthalmologic impairments.[6]

CP is neither progressive nor communicable.[8] Children with disabilities may present challenges that require special preparation before the dentist and office staff. In addition, parents' anxiety in relation to the problems associated with a child's disabilities frequently delays dental care which causes significant oral disease to develop.[9] Providing oral care to people with CP requires adaptation of the skills we use every day.[8]

This article discusses CP condition in children that a dentist may encounter in practice. If a dentist becomes familiar with the special needs of a child with this disability and with the parents' concerns, the dental management of the child can be quite pleasing.

CLASSIFICATION OF CEREBRAL PALSY

CP is traditionally classified by motor type and topographical distribution. Based on motor type, it includes the terms spastic, dyskinetic, ataxic, hypotonic, and mixed. Based on topographical distribution, the most commonly used terms are hemiplegia, diplegia, and quadriplegia, but the terms monoplegia, paraplegia, triplegia, double hemiplegia, and tetraplegia are also used. The Gross Motor Function Classification System is a five-level, simple ordinal grading system to describe gross motor function in patients with CP.[10]

Motor

Spastic cerebral palsy

As much as 70% of children inflicted by CP fall under this type. Spasticity is hypertonia in which, with increasing velocity of movement, the resistance to passive movement increases (or exhibits a spastic catch), and "varies with direction of the movement, and/or rises rapidly above a threshold speed or joint angle."[11] Spasticity is often a component of upper motor neuron syndrome, along with hyperreflexia, reflex overflow, positive Babinski sign, clonus, and pyramidal distribution weakness (upper extremity extensors and lower extremity flexors). The muscle involved is hypermobile and undergoes exaggerated contraction. Spastic types exhibit pyramidal involvement with upper motor neuron signs, weakness, hypertonia, hyperreflexia, clonus, and positive Babinski.[12]

Dyskinetic (athetoid cerebral palsy)

Only 15% cases of CP are of dyskinetic type. Characteristically, the involuntary movements are twisty or writing (athetosis) or quick jerky. There are abnormal patterns of chewing and swallowing and also of speech.[9] Dyskinesia is characterized by extrapyramidal involvement in which rigidity, chorea, choreoathetosis, and athetoid and dystonic movements are seen. This type of CP is also associated with birth asphyxia.[12]

Ataxic cerebral palsy

Five percent of cases are of this type. The involved muscles are unable to contract properly, thus resulting in partial performance of voluntary movements. The symptoms involve staggered gait and poor kinesthesis.[11]

Hypotonic cerebral palsy

In one of these less common types of CP, there is a flaccidity of involved muscles with their reduced tonicity. Thus, the muscles improperly respond to stimulation. Hypotonic CP is characterized by generalized muscular hypotonia that persists beyond 2–3 years of age that does not result from a primary disorder of muscle or peripheral nerve.[13]

Topographical

Hemiplegic cerebral palsy

Spastic hemiparesis is a unilateral paresis in which the upper limbs are more severely affected than the lower limbs. Spastic hemiparesis is seen in 56% of term infants and 17% of preterm infants. Pathogenesis is multifactorial. Voluntary movements are impaired along with hand functions which are most affected which include pincer grasp of the thumb, extension of the wrist, and supination of the forearm. In the lower limb, the functions affected include dorsiflexion and aversion of the foot. Along with these, there is also increase in flexor tone with hemiparetic posture, flexion at the elbow, wrist and knees.

Diplegic cerebral palsy

Spastic diplegia is related with prematurity and low birth weight. Nearly, all preterm infants with spastic diplegia exhibit cystic periventricular leukomalacia (PVL) on neuroimaging. PVL is one of the most common ischemic brain injuries in premature infants. The ischemia generally occurs in the border zone at the end of arterial vascular distributions.

Quadriplegic cerebral palsy

Quadriplegic CP is the most severe form involving all four limbs and the trunk; the upper limbs are more severely involved than the lower limbs, associated with acute hypoxic intrapartum asphyxia. However, this is not the only cause of spastic quadriplegia.

Gross Motor Function Classification System

a. Level I – Walks without limitations
b. Level II – Walks with limitations
c. Level III – Walks using a handheld mobility device
d. Level IV – Self-mobility with limitations may use powered mobility
e. Level V – Transported in a manual wheelchair.

DENTAL MANIFESTATIONS

Malocclusion

The prevalence rate of malocclusion has been reported between 59% and 92% in CP patients. Due to the following reasons such as uncoordinated movement of the jaws, lips, and tongue; hypotonia of the orofacial muscles; mouth open posture with postural tongue thrust; and mouth breathing habit majority of malocclusion are classified as Angle's Class II.[14-17] Increased incidence of open bite was present in spastic patients.[16]

Traumatic dental injuries

Children with CP have a high prevalence of Class II malocclusion with prominent maxillary incisors, incompetent lips, and increased incidence of seizures. All these factors predispose the child to dental trauma.[17,18] The risk of traumatic dental injury varies between 10% and 20% and can reach 60%. Along with facial injury, these children are predisposed to fracture of enamel and dentine.[19] Holan *et al*.[18] found significantly increased incidence of dental trauma in CP population (57%).

Bruxism

Bruxism is defined as habitual grinding of teeth. Bruxism is a common problem in children with CP, predominantly in those with severe motor and cognitive deficits.[20] Bruxism is likely to be a self-stimulatory behavior related to abnormal proprioception in the periodontium leading to tooth abrasion and flattening of biting surfaces.[21] Children with CP are predisposed to such abnormal behaviors which include finger sucking and other habits. Sleep disorders in children with CP may predispose to the development of nocturnal bruxism, particularly in those with severe visual impairment.[22] Souza *et al*. found that involuntary movements, the male gender, and gastroesophageal reflux are factors associated with bruxism in children with developmental disabilities.[23] Minear has hypothesized that bruxism habits in CP patients are related to problems with dopamine function and not regulated by local factors, such as malocclusion.[24]

Periodontal disease

Periodontal disease is common in children with CP due to poor oral hygiene. Another factor includes difficulty in conducting daily oral hygiene, intraoral sensitivity, orofacial motor dysfunction, physical abilities, and malocclusion. The prevalence of periodontal disease is higher because of poor manual handiness of the child to perform good oral hygiene measures and anticonvulsant medication-induced gingival enlargement.[9]

Dental caries

Many factors contribute to the development of dental caries, which include biological, economic, cultural, social, and environmental factors.[25] Patients with CP are at increased risk of developing dental caries which affects negatively their quality of life.[26] Children with more severe neurological insult and cognitive and motor deficits are at a greater risk of developing dental caries.[27,28] Ferreira de Camargo *et al*.[29] found that the incidence of caries among children and adolescents with CP is high, but Quintela and Alfredo[30] concluded that individuals with CP have less chance of having caries than the individuals in the comparison groups.

Dental erosion

Dental erosion is defined as a progressive loss of hard dental tissue which ultimately results from chemical process.[31] Dental erosion is common in patients with palsy who are predisposed to gastroesophageal reflux disease (GERD). Studies found that 73% of CP patients with dental erosions had a history of GERD.[32] In another study, swallowing difficulties and recurrent chest infections were associated with the development of dental erosion.[32] The first indication of GERD may be the enamel erosion that affects the posterior dentition. Most of the affected teeth observed in the CP group were upper molars (54%), followed by lower molars (58%) and upper incisors (54%).[33] Abanto *et al*. concluded that dental erosion in CP children is associated with recurrent consumption of soft drinks and powdered juices.[34]

DENTAL MANAGEMENT

During dental examination or treatment of children with CP, the following points should be considered:

1. Some practical challenges are commonly encountered which include apprehension, fear from strangers, low intelligence, poor concentration, and communication difficulties when handling children with CP[1]
2. If the child can sit in the chair and open his or her mouth, he or she can be treated as a normal patient. Those children with less physical control need further help[8]
3. The dental chair must be adjusted carefully, and most

of these patients are best treated with the chair tipped well back to give a position of security. The spastic type of a patient having fairly severe head-and-neck involvement will require even more control and support and can be seated on the knee of a parent or an assistant, leaning back against the right shoulder[35]

4. If the patient is using a wheelchair, he/she should be considered to be treated in the wheelchair itself[36]
5. The dentist may not establish much during the first visit that may be used mainly to establish mutual confidence and have a preliminary assessment. Schedule should be early in the day and also to allow sufficient time to establish appropriate interaction during such encounters
6. Occasionally, assistance from the parent and dental assistance and the use of immobilization devices may be necessary to obtain the films[35]
7. The presence of supportive and relaxed approach can help in improving the child's cooperation[36]
8. Head position of patients with CP can be maintained in the midline by the help of Velcro straps, and open mouth can be obtained and maintained with the use of mouth props[1]
9. A dentist should try to be gentle and caring, and he should avoid sudden movements which may trigger muscle stiffening or spasm[8]
10. A finger guard and a use of steel mirror are preferred to avoid injury. Sharp instruments when used should be used with extreme caution so as to prevent injury[8]
11. Canvas straps equipped with Velcro fasteners can be used to restrain the arms and legs, which encircle the limbs and arms and foot portion of the dental chair. To protect the skin of the patient, towel can be placed over the arms or legs. Another effective method of immobilization is wrapping sheet around the patient[9]
12. Preventive approach should be a team effort involving mutual efforts between dentists, hygienist, assistant, patient, family, and other persons who are having impact on patient's life.[9]

ROLE OF PEDODONTIST

Malocclusion

Malocclusion in children with CP usually involves more than just malaligned teeth. Orthodontic treatment may not be a treatment option in children with CP because of the risk of caries and enamel hypoplasia. The success of orthodontic treatment depends on the ability of the patient or the caregiver to maintain good daily oral hygiene.[36]

When considering orthodontic treatment in children with disabilities, the following basic requirements need to be satisfied which include the commitment of both patient and parents, along with adequate oral hygiene and the degree of patient cooperation.[37,38]

In recent years, certain technological improvements are done in dentistry which could benefit disabled dental patients in general, including CP patients who are receiving orthodontic treatment. They include impressions using quickset materials, use of self-etching primer, self-ligating brackets, and use of reversible mini-implant anchorage.[38] Orthodontic treatment is feasible in CP children after careful patient selection. Success depends on factors such as the type and severity of malocclusion and the degree of patient cooperation.[39]

Traumatic dental injuries

Risk factors associated with traumatic dental injuries include falls, collisions, seizures, tooth grinding, accentuated overjet, and a lack of lip seal. In CP patients, there is an uncontrolled movement of the head which increases the risk of dental trauma, since the teeth may strike against hard objects. Thus, lip seal acts as a protective factor.[40]

The treatment of traumatized teeth and the prevention of future trauma should be of primary importance. A pedodontist should educate the parents, teachers, and caregivers in correct emergency care of CP patients after traumatic injury, to search for preventive measures, such as the use of mouth guards, the padding of objects and hard surfaces, and safe transport of these individuals in wheelchairs.[40,41] Also emphasize to caregivers that traumas require immediate specialized attention and explain the procedures to follow if a permanent tooth is knocked out. Suggest a tooth-saving. Also, instruct caregivers to find any missing pieces of a fractured tooth. They are also explained that radiographs of the patient's chest may be essential in case of any fragment aspirated. As compared to general population, physical abuse is reported more frequently in people with developmental disabilities. If any suspect of child abuse or neglected is encountered, Child Protective Services agency should be contacted.[36]

Bruxism

Bruxism is common finding in people with CP. It can be intense and persistent and cause the teeth to wear prematurely. The treatment options for this parafunctional activity include restorative treatment, occlusal alteration, use of oral splints, dental extraction, and pharmacological treatments. The most severe cases require a multidisciplinary approach, including pediatricians, psychiatrists, pediatric dentists, and/or oral surgeons.[42-44]

Sleep disorders may also predispose to the development of nocturnal bruxism, predominantly in those with severe visual impairment.[22] Gagging or swallowing problems must be considered in CP patients before recommending mouth guards or bite splints as it may make them uncomfortable or unwearable. Dental features such as hypotonia and open bite contribute to drooling which affects daily oral care. Early morning appointment before eating or drinking is beneficial for patients with a gagging problem.

Periodontal disease

Periodontal disease is common in children with CP. Important factor associated with periodontal disease is the use of antiepileptic drugs, particularly phenytoin.[35,45] Gingival hyperplasia is predictive for periodontal diseases.[22] The pedodontist should talk to caregivers about daily oral hygiene and demonstrate proper brushing and flossing techniques to them. And emphasize on regular approach to oral hygiene. Daily use of an antimicrobial agent such as chlorhexidine may be beneficial. Chlorhexidine applied using a spray bottle or toothbrush is equally efficacious as rinsing may not work for a patient with swallowing difficulties.[36]

Dental caries

Dental caries is prevalent among people with CP, predominantly because of inadequate oral hygiene. In general, many factors contribute to the development of dental caries, which include biological, economic, cultural, environmental, and social factors.[26]

The pedodontist should advice caregivers to make a patient to drink water often, take sugar-free medicines when available, and rinse with water after taking any medicine also to give alternatives to cariogenic foods and beverages. Recommend preventive measures such as fluorides and pit and fissure sealants.[36]

Dental erosion

Dental erosion is common in patients with CP, generally who are predisposed to GERD. Dentists should be able to diagnose early signs of dental erosion in CP patients and provide appropriate preventive therapy and also referral for the diagnosis and treatment of GERD so as to avoid irreversible damage to the dentition.[26,46]

HOME DENTAL CARE FOR CEREBRAL PALSY PATIENTS

1. Home dental care for children with CP should begin in infancy. The dentist should teach the parents and caregivers to gently cleanse the incisors daily with a soft cloth or an infant toothbrush[8]
2. For children who are physically unable to cooperate, the dentist should teach the parents or caregivers correct toothbrushing techniques[8]
3. Most common technique recommended is horizontal scrub method as it is easy to perform and can yield good results[9]
4. For children with disabilities, electric toothbrushes have also been used effectively[46]
5. Parents should always help the child to brush his/her teeth, and the head of the child must always be supported[46]
6. Almost all of the medications which are prescribed to children contain sucrose. Thus, a child on oral medications must get their teeth cleansed after each medication.[46]

SEDATION AND ANESTHESIA IN CEREBRAL PALSY PATIENTS

Children with CP may be uncooperative and difficult to handle and during dental treatment, so sedation and anesthesia are frequently needed in such situations.[47] It is essential to obtain an accurate medical history and dental history. An evaluation for preexisting medical conditions must be performed before any therapeutic measure.[8] History of respiratory difficulties and seizures represents a meticulous challenge. Assessment by the concerned specialty which includes pediatrics, anesthesia, and/or neurology is often needed prior to the required procedure.[48] Many drugs can be used to induce sedation and anesthesia including benzodiazepines, nitrous oxide, narcotics, propofol, and adjunct drugs, such as an antisialagogue.[49]

Nitrous oxide and oxygen through a nasal mask are other medications that will help in sedating the patient. Most children with CP and severe mental disability do not tolerate initial face mask prior to intravenous (IV) sedation. On many occasions, those who have the mild-to-moderate range of disability will let a nasal mask be placed first if it is shown to them and if its function is explained. In milder cases, nasal or face mask can be utilized to avoid the fear and anxiety which is associated with IV insertion. Oxygen saturation should be monitored by pulse oximetry, and the airway should be protected throughout the procedure decreasing the likelihood of hypoxia.[8] A throat shield should always be used in children with CP to protect the airway as there is an increased risk of aspirating dental filling materials and debris while preparation of the tooth or even an extracted tooth. Postoperative care includes keeping the child with physical restrains until he or she is able to respond to verbal commands or become fully consciousness. IV cannulas and monitor should be

detached as soon as possible as they increase the child's fear and anxiety.[50] Loyola-Rodriguez *et al*.[50] concluded that general anesthesia with the use of sevoflurane and propofol and conscious sedation is an excellent means of providing dental treatment in children with CP without most of the major postoperative complications.

CONCLUSION

Children with SHCN have a considerably higher prevalence of oral diseases as compared to otherwise healthy children because of the lack of oral health knowledge, access to care, and preventive measures such as fluoride supplements and pit and fissure sealants. The early diagnosis of CP is important in terms of optimizing therapeutic interventions.

The most important aspect for successful treatment in children with CP is attitude and skills of dentists and dental team. The oral health of children with SHCN has always been found poor when compared to otherwise healthy children. Oral health is increasingly recognized as a foundation for general health, wellness, and a primary indicator for the success of dental treatment. The caregivers for special needs patients must become knowledgeable and competent in home oral health practice. The role of the pediatric dentist is to improve oral health wellness and to encourage parents and caregivers for good home oral health practice. Home oral health practice is a significant factor in general health, dental care, quality of life, and controlling health-care costs.

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