

Cerebral Palsy: Oral Manifestations and Dental Management

SUMMARY

Cerebral palsy is a set of non-progressive neuromuscular disorders caused by defects in the developing fetal brain. Its prevalence is about 2:1000. Although CP does not directly result in any particular oral abnormalities, some conditions are more prevalent or severe in CP patients than in the general population. The purpose of a paediatric dentist is to promote overall oral health wellness and to motivate parents and other primary caregivers to practice good oral hygiene at home. The aim of this article is to provide a general overview of dental health issues that affect people with CP and to analyze key preventative and practical management techniques for this common comorbidity.

Keywords: Cerebral Palsy, Oral Care, Behaviour Management, Dental Management

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Introduction

The term cerebral palsy describes a group of motor posture and movement disorders that occur at a young age and cannot be cured. It is a disease that involves non-evolving damage to the Central Nervous System (CNS = brain, spinal cord and cerebellum). In most cases, CNS damage during endometrial life is to blame¹⁻³. In other periods, craniocerebral injuries are a common cause. While it has a prevalence of about 2:1000, it increases ten times more in premature infants (20-27 weeks)^{2,3}.

Many specialties (paediatricians, neonatologists, paediatric neurologists, geneticists, physiatrists, neurosurgeons, orthopedic surgeons) are mentioned in the particularly difficult effort of medical rehabilitation, but also many paramedical professions (physiotherapists, occupational therapists, psychotherapists, psychotherapists, psychotherapists, psychotherapists, psychotherapists). The paediatric dentist who recognizes the patient's right to integrate into society in the best possible way also has a place in it².

Etiology

Only 40–50% of cases have an exact etiology that

can be determined, and 30% of cases have no known risk factors.³ The condition or risk factors blamed for cerebral palsy are divided into those that occurred in the prenatal, perinatal, and postpartum periods. It is estimated that 70-80% of cases are associated with prenatal factors, while the lack of oxygen at birth is attributed to a smaller percentage of cases of cerebral palsy (about 10%). For the remaining percentage of cases of cerebral palsy, factors that acted after birth are blamed^{3,4}.

Classification

A generally accepted classification is the Hagberg classification which is based on the clinical picture and the topographic distribution of motor disabilities. Five types of CP are distinguished⁵:

1. Hemiplegia
2. Diplegia
3. Quadriplegia
4. Athetoid CP (outside pyramidal)
5. Ataxic CP

1. Hemiplegia

It is the unilateral motor disability, usually of the spastic type and is distinguished into congenital and

acquired.

a) Congenital hemiplegia

In many cases, etiology of congenital hemiplegia remains unknown and comprises 70-90% of cases³. The main clinical features are unilateral paralysis and spasticity⁵.

b) Acquired hemiplegia

Acquired hemiplegia is the result of many causes and it usually manifests itself in an acute condition (convulsions, coma)⁵.

2. Diplegia

It is the type of CP with bilateral limb involvement where the lower extremities are much more affected than the upper. It is a common type of CP with a percentage of about 41%. It is distinguished into spastic and ataxic.

a) Spastic diplegia

Most children with spastic diplegia are premature and the main clinical feature is the increased muscle tone of the lower extremities^{3,6}.

b) Ataxic diplegia

It constitutes 5-7% of CP cases and, clinically, infants initially show significant hypotension which gradually gives way to spasticity and increased tendon reflexes⁶.

3. Quadriplegia

It is the most severe type of CP which is characterized by bilateral spasticity, more intense in the upper extremities, with severe mental retardation and usually microcephaly. It includes only 5% of CP cases. People with quadriplegia have problems with care and nutrition⁶.

4. Athetoid CP (outside pyramidal)

It includes 10-15% of all CP cases. It is characterized by asynchronous postures and problems in the cooperation of movements and / or in the regulation of muscle tone. There are 2 types:

a) Hyperactive type

It is characterized by generalized, pointless, involuntary movements. They worsen by trying to perform a movement or maintain a posture.

b) Dystonic type

It is characterized by sudden and abnormal changes in muscle tone⁵.

5. Ataxic CP

It is the CP where the symptoms from the cerebellum predominate. It includes 5-15% of CP cases. Most babies are initially hypotonic, but the clinical picture varies⁶.

Oral manifestations

There are no particular oral abnormalities that are specific to cerebral palsy. However, compared to the general population, some conditions are more prevalent or more severe in people with cerebral palsy⁷.

Periodontal disease

Due to poor oral hygiene, periodontal disease is widespread in children with CP⁸. Numerous studies have demonstrated that children with CP are more likely to

experience gingival hyperplasia and related bleeding^{9,10}. Daily oral hygiene challenges, intraoral sensitivity, orofacial motor dysfunction, physical capabilities, and malocclusion are the main contributing factors^{8,11}. The use of antiepileptic medications, particularly phenytoin, is another significant factor¹².

Pediatric dentists should instruct caregivers on proper brushing and flossing techniques and speak with them about daily oral hygiene. It might be advantageous to use an antimicrobial agent like chlorhexidine every day¹³.

Occlusion problems

The prevalence of occlusion problems is reported to be between 59 and 92%. The most frequent presentation is Angle class II cases with overjet and deep bite^{2,14}. The four factors associated with CP were the type of CP, mouth breathing, lip incompetence and elongated face. People with CP are three times more likely to develop anterior open-bite¹⁵. The incidence of anterior open-bite appears to decrease with age. Class II malocclusion and open bite are attributed to facial muscle weakness, tongue thrust, decreased swallowing and frequent mouth breathing².

Because of the increased risk of caries and enamel hypoplasia in children with CP, orthodontic treatment may not be an effective option. The ability of the patient or the caregiver to practice good oral hygiene on a daily basis will determine the outcome of orthodontic treatment¹³. A few technological advancements in dentistry have been made recently that could help disabled dental patients in general, including CP patients who are receiving orthodontic treatment¹⁶. Orthodontic treatment is feasible in CP children after careful patient selection. Success is based on variables like the type and degree of malocclusion as well as the level of patient cooperation¹⁷.

Dental trauma

Class II malocclusion, which includes prominent maxillary incisors and incompetent lips, and increased incidence of seizures are quite common in children with CP. All these factors put the child at risk for dental trauma^{2,18}. Holan *et al.* discovered a high incidence of dental trauma in people with CP (57%)¹⁸ whereas other studies show a lower incidence (9.2-30%)¹⁹⁻²¹. In addition to facial injuries, these children are prone to enamel and dentine fractures^{18,20}.

Dental trauma should be treated and prevented as a priority. Pediatric dentists are in charge of educating the parents, teachers, and caregivers on how to care CP patients in case of a traumatic dental injury as well as on prevention techniques like using mouth guards, padding for hard surfaces, and wheelchair safety^{22,23}.

Bruxism

Bruxism is common in people with CP, especially among those with severe motor and cognitive deficits²⁴. The self-stimulatory behavior of bruxism is likely linked

to abnormal periodontal proprioception, which flattens the biting surfaces and causes tooth abrasion²⁵. There is a claim that people with CP have a high prevalence of bruxism^{21,24,25}. It has been hypothesized that dopamine function issues in CP patients are related to their bruxism habits which are not controlled by aspects like malocclusion or the severity of the condition^{9,24}. Additionally, it is well-known that children with CP are more likely to predisposed in abnormal behaviors like finger sucking and other mouthing habits. As well, nocturnal bruxism may be more likely to develop in people with sleep disorders²⁶.

Restorative treatment, occlusal alteration, the use of oral splints, dental extraction, and pharmacological treatments are all options for treating this parafunctional activity. A multidisciplinary approach, involving pediatricians, psychiatrists, paediatric dentists, and/or oral surgeons, is necessary for the most severe cases²⁷⁻²⁹. Before recommending mouth guards or bite splints to CP patients, it is important to take into account any gagging or swallowing issues because they may make the devices uncomfortable or impossible to wear³⁰.

Caries

Caries is a multifactorial disease in which different biological, economic and environmental factors interact. Children and adolescents with CP have a high prevalence of caries, but the risk factors are the same as in the general population^{2,31}. Dietary habits and motor function of the oral system have a statistically significant influence on. Poor oral hygiene due to mobility difficulties, lack of information and neglect due to the burdensome medical history, is common³¹.

When sugar-free medications are available, these patients should take them and rinse with water after each dose. Pediatric dentists have the responsibility of educating parents about these recommendations and encouraging them to provide healthier options as incentives or rewards instead of cariogenic foods and drinks. Pit and fissure sealants and fluorides are recommended preventative measures¹³.

Problems with saliva control

Children with cerebral palsy frequently have poor saliva control due to a variety of factors, such as abnormalities in swallowing, challenges moving saliva to the back of the throat, poor mouth closure, jaw instability, tongue thrusting, poor head control and posture, lack of sensation around the mouth, breathing through the mouth, excitement, and poor concentration³². Health and quality of life are negatively impacted by this outflow, particularly in patients with long-term neurological disorders. Oral salivation is common in CP patients, with a range of 10-58%^{2,31,33,34}. Some antiepileptic medications, such as clonazepam, may make severe drooling worse and cause aspiration syndrome, skin irritation, and articulation problems³⁵.

A trial of an anticholinergic drug, such as glycopyrrolate or scopolamine, is part of the management of this challenging issue, but it is not very effective. Irritability, sedation, blurred vision, and constipation are a few of the side effects. Salivary duct rerouting surgery is an option, but it may result in more aspiration³⁶. The parotid and submandibular glands can be injected with botulinum toxin to lessen excessive drooling³⁷.

Dental erosion

Upper molars, lower molars, and upper incisors are teeth often affected by dental erosion in people with CP. Dental erosion is a common finding in people with CP and has been associated with gastroesophageal reflux disease (GERD)^{38,39}. In another study, the occurrence of dental erosion was linked to swallowing difficulties and recurrent chest infections³⁹. According to Abanto *et al.*, frequent consumption of soft drinks and powdered juices is linked to dental erosion in children with cerebral palsy⁴⁰.

In order to prevent the dentition from suffering irreparable harm, dentists should be able to recognize the early warning signs of dental erosion in CP patients and offer the proper preventive therapy. They should also be able to refer patients for the diagnosis and treatment of GERD^{38,41,42}.

Problems of Temporomandibular joint

Children with CP are significantly more likely to develop signs and symptoms of Temporomandibular joint (TMJ) disorders compared to healthy individuals. This is unquestionably a result of the jaw movement restrictions and an increase in muscle spasticity⁴³. TMJ disorder is defined as having pain, audible noise when the TMJ moves, and irregular mandibular function. CP accelerates the onset of joint and muscle disorders affecting the oro-facial region⁴⁴. Mouth breathing, mixed dentition, the presence and severity of any malocclusions, and male gender have all been identified as risk factors for developing TMJ disorders⁴⁵.

When a soft occlusal splint is used, some TMJ disorders improve more quickly and effectively⁴⁶. It has been shown that 3 mm and 4 mm splints can be used effectively in the treatment of TMJ disorders, are more comfortable, and produce impressive results when compared to 5 mm and 6 mm splints^{47,48}.

Enamel defects

Developmental enamel defects are more common in children with cerebral palsy. The prevalence of defects varied depending on the tooth type and was related to the children's gestational age. Only 23.2% of children with enamel defects were born at a normal gestational age, while approximately 42.4% were born prematurely (37 weeks). In relation to birth weight, there is no statistically significant difference in the prevalence of enamel defects. The majority of enamel defects are symmetrically found in the

first molars and primary incisors⁴⁹. Enamel hypoplasia and enamel opacity are two different types of developmental enamel defects⁵⁰.

Prevention

Taking into consideration that the treatment of patients with CP in dental setting can be challenging, it is of high priority to maintain proper oral hygiene and dietary habits^{51,52}. Oral hygiene requires training and evaluation of the person with CP if it is possible and his caregivers who must be aware of the need for topical application of fluoride^{51,52}. Early dental hygiene and home care should be encouraged. Parents should learn to begin gently brushing their children's primary incisors with a soft toothbrush or a soft cloth every day. The dentist should instruct the parent on proper brushing methods and safe restraint techniques for older kids who are unwilling or physically unable to cooperate^{52,53}. The following are some of the positions most frequently used for children who need help with oral care:

- The child sits or stands in front of the caregiver, who holds the child's head in one hand while brushing their teeth with the other.
- The child lies back on a couch or bed with the head resting on the parent's lap. With one hand, the head is immobilized while the other is used to brush the teeth.
- In younger children with CP, brushing can be done with the knee-to-knee technique, applied by both parents⁵¹⁻⁵³.
- The child sits in the arms of one caregiver who immobilizes him while the other caregiver applies brushing^{51,52}.
- The standing and uncooperative child is placed in front of the caregiver so that he/she can support the child's torso with his/her legs while holding the child's head and brushing their teeth with his/her hands.
- The patient with the greatest degree of difficulty is isolated in a room and seated on the brusher's lap. The patient is then held still by a second caregiver as the brusher performs proper oral hygiene. Parents and possibly siblings will need to perform the home dental care procedures if a child cannot be sufficiently immobilized by one person⁵³.
- To keep the mouth open, the disabled can bite into a makeshift bite block made of wooden tongue depressors tied together with plaster or a towel.
- For cases of people with CP who have the ability to brush, the use of a toothbrush with a special, larger handle is recommended^{51,52}.
- An electric toothbrush can be used effectively to promote independence in children with milder motor disabilities^{42,52-54}.
- Swallowing is often not completely controlled. In this case, small amount of fluoride toothpaste is used.

- Possible use of mouthwash can be done by spraying, while the periodic use of chlorhexidine can be applied in the form of a gel with a cotton swab^{51,52}.

Behaviour Management

When dealing with children with CP, some practical difficulties are frequently encountered, such as anxiety, fear of strangers, cognitive impairments, lack of focus, and communication difficulties⁵⁵. The mental state varies in people with CP. Some people may have a normal mental state while others may have significant mental retardation. Each process should be explained to the child in a way that is as comprehensible as possible^{2,51}.

- Instructions should be short and clear. The direction given should be only one.
- Dental tools should be inserted into the patient's mouth slowly and carefully so as not to cause a vomiting reflex.
- To make an effort to understand the patient's communication methods whether it is verbal or non-verbal communication. Understanding the patient's speech often requires assistance from the caregiver.
- To cultivate a climate of trust and cohesion between the patient and the staff of the office. The same people, the same places and at the same time of the sessions are likely to act positively.
- The Tell-Show-Do technique is very useful when new tools or procedures are introduced. It should be used adapted to the age and mental abilities of the patient^{2,51}.
- A supportive and laid-back attitude can aid in enhancing the child's cooperation¹³.
- The limbs should not be squeezed too hard in abnormal positions. The control of the movements should be done by applying constant and gentle pressure.
- Bright lighting, sounds, sudden movements often trigger involuntary movements. Prior to the stimulus occurring, the patient should be made aware of it^{2,51}.
- The use of nitric oxide is often not possible. Patients with severe CP may not be able to cooperate to receive the oxide mask or require additional intravenous sedation. A smaller percentage of potentially co-operative patients receive protoxide administration.
- The use of general anesthesia should be recommended in the cases of non-cooperative individuals with multiple dental lesions^{2,51,52}, but as part of postoperative care, the child is kept physically restrained until he or she can respond to commands or regain consciousness. According to Loyola-Rodriguez et al., general anesthesia combined with conscious sedation, sevoflurane, and propofol is an excellent way to treat dental problems in children with CP without suffering from the majority of serious postoperative complications⁵⁶.

Treatment

First dental visit

Sessions should not be scheduled late in the day and extra time is needed before the session to discuss with caregivers and the patient. The first or first sessions must be used primarily to build trust between the dentist and patient by allowing for mutual acquaintance and establishing rapport⁵³.

X-ray examination

The use of immobilization devices, parental assistance, and dental auxiliaries may be required to obtain the films. To make it easier to retrieve the film if it falls toward the pharynx, a hole is drilled through the tab and an 18" (46 cm) length of floss is attached through it⁵³.

Patient positioning - Protective immobilization

Many patients with CP respond best to treatment when the dental chair is fully tipped back to ensure the maximum level of safety. The dental chair must be carefully adjusted. In the case of spasticity involving the head and neck, the need to control movements is even more urgent and can lean back against the right shoulder while seated on the knee of a parent or an assistant⁵³.

The following methods can be used to assistive stabilization and postural maintenance:

- The patient's head can be kept stable in the middle of the supine position by a member of the dental staff and rested on the occipital region.
- The upper extremities should be kept facing each other in the middle of the body and the lower extremities as firmly as possible. Immobilizers such as Velcro straps or Papoose board can be used for this restraint^{53,57}. The dental chair's limbs, arms, and foot section are all encircled by Velcro straps. A towel can be draped over the patient's arms or legs to protect their skin. The patient can also be immobilized by a sheet being wrapped around them⁸.
- In some cases of bent lower limbs, cushions should be used which are placed below the knees⁵².
- In cases where it is not possible to transport the patient to the dental chair, the treatment is applied to the patient's wheelchair. Some dental clinics have special bars that receive and move the patient's wheelchair to a suitable position to apply the treatment⁵⁷.

Treatment

- Use of bite block is necessary in most cases. However, if the session is long, it is important to use the bite block intermittently⁵⁷.
- A steel thimble with a cord or chain attached through a hole drilled close to the edge serves as a simple finger guard that can be used to prevent loss in the mouth. It is best to use a steel mirror that will not

break. When using sharp objects, extreme caution must be taken to prevent injury to soft tissues⁵³.

- Local anesthesia is recommended but its safe use is particularly important.
- Since the patient is unable to rinse properly, a waterspray and some sort of suction device are necessary.
- Maintaining a dry field is a challenge in the dental treatment of people with CP. In order to hold cotton-wool rolls in place, this may be helped by the use of a rubber dam clamp without the rubber dam, which has the benefit of being quick to install and remove. Only a mouth prop should be used in conjunction with it.
- Orthodontic mechanisms, whether welded or mobile and prosthetic work are only recommended when the disability is minor. Otherwise the risk of breakage, injury and swallowing is possible⁵¹⁻⁵³.
- Rehabilitation materials should require as few placements as possible and have high resistance to masticatory forces, which, as a result of neuromuscular diseases and habits, can be exercised with abnormally high intensity and frequency.
- Some patients have self-injuries' habits due to continuous soft tissue bites. To avoid self-harm, they can use a variety of devices.
- The treatment plan for patients with CP is proposed to be simple and as tolerable as possible by the patient.
- Regular re-calls are necessary with a frequency commensurate with the risk category^{51,52}.

Conclusions

When compared to children who are otherwise healthy, children with CP have consistently been found to have poor oral health. Caregivers for patients with special needs are an integral part of the oral health team because oral health is increasingly understood to be the basis for overall health and wellness as well as the main indicator of the effectiveness of dental treatment. The purpose of a pediatric dentist is to promote overall oral health wellness and to motivate parents and other primary caregivers to practice good oral hygiene at home. The practice of oral health at home plays a big role in maintaining dental health, general health, quality of life, and cost-effective health care.

References

1. Pakula AT, Van Naarden Braun K, Yeargin-Allsopp M. Cerebral palsy: classification and epidemiology. *Phys Med Rehabil Clin N Am*, 2009;20:425-452.
2. Dougherty NJ. A review of cerebral palsy for the oral health professional. *Dent Clin North Am*, 2009;53:329-338.

3. McIntyre S, Taitz D, Keogh J, Goldsmith S, Badawi N, Blair E. A systematic review of risk factors for cerebral palsy in children born at term in developed countries. *Dev Med Child Neurol*, 2013;55:499-508.
4. Gladstone M. A review of the incidence and prevalence, types and aetiology of childhood cerebral palsy in resource-poor settings. *Ann Trop Paediatr*, 2010;30:181-196.
5. Bax M, Goldstein M, Rosenbaum P, Leviton A, Paneth N, Dan B, et al. Proposed definition and classification of cerebral palsy. *Dev Med Child Neurol*, 2005;47:571-576.
6. Dabney KW, Lipton GE, Miller F. Cerebral palsy. *Curr Opin Pediatr*, 1997;9:81-88.
7. Practical oral care for people with cerebral palsy. Bethesda, MD: NIH Publication No. 09-5192. National Institute of Dental and Craniofacial Research, 2009.
8. Khokhar V, Kawatra S, Pathak S. Dental Management of Children with Special Health Care Needs (SHCN) – A Review. *Br J Med Res*, 2016;17:1-16.
9. Minear WL. A classification of cerebral palsy. *Pediatrics*, 1956;18:841-852.
10. World Health Organization. International classification of functioning (ICF), disability and health. WHO- FIC information sheet, Geneva, 2010.
11. Gunel MK, Mutlu A, Tarsuslu T, Livanelioglu A. Relationship among the Manual Ability Classification System (MACS), the Gross Motor Function Classification System (GMFCS), and the functional status (WeeFIM) in children with spastic cerebral palsy. *Eur J Pediatr*, 2009;168:477-485.
12. Jan MM. Clinical review of pediatric epilepsy. *Neurosciences (Riyadh)*, 2005;10:255-264.
13. Mani SA, Mote N, Kathariya M, Pawar KD. Adaptation and Development of Dental Procedure in Cerebral Palsy. *Pravara Med Rev*, 2015;7:17-22.
14. Winter K, Baccaglioni L, Tomar S: A review of malocclusion among individuals with mental and physical disabilities. *Spec Care Dentist*, 2008;28:19-26.
15. Miamoto CB, Ramos-Jorge ML, Pereira LJ, Paiva SM, Pordeus IA, Marques LS. Severity of malocclusion in patients with cerebral palsy: determinant factors. *Am J Orthod Dentofacial Orthop*, 2010;138:394e1-e5.
16. Musich DR. Orthodontic intervention and patients with down syndrome. *Angle Orthod*, 2006;76:734-735.
17. Abeleira MT, Outumuro M, Diniz M, Garcia-Caballero L, Diz P, Limereset J. Orthodontic treatment in children with cerebral palsy. In: *Cerebral Palsy – Current Steps* (ed. MK Gunel), 2016: 129-140pp.
18. Holan G, Peretz B, Efrat J, Shapira Y. Traumatic injuries to the teeth in young individuals with cerebral palsy. *Dent Traumatol*, 2005;21:65-69.
19. Costa MM, Afonso RL, Ruvière DB, Aguiar SM. Prevalence of dental trauma in patients with cerebral palsy. *Spec Care Dentist*, 2008;28:61-64.
20. Santos MT, Souza CB. Traumatic dental injuries in individuals with cerebral palsy. *Dent Traumatol*, 2009;25:290-294.
21. Ferreira MC, Guare RO, Prokopowitsch I, Santos MT. Prevalence of dental trauma in individuals with special needs. *Dent Traumatol*, 2011;27:113-116.
22. Dubey A, Ghafoor PA, Rafeeq M. Assessment of traumatic dental injuries in patients with cerebral palsy. *J Indian Soc Pedod Prev Dent*, 2015;33:25-27.
23. DiGaudio KM, Msall ME. Guidelines for safe transportation of children in wheelchairs. *Am J Dis Child*, 1991;145:653-655.
24. Ortega AO, Guimarães AS, Ciamponi AL, Marie SK. Frequency of parafunctional oral habits in patients with cerebral palsy. *J Oral Rehabil*, 2007;34:323-328.
25. Lindqvist B, Heijbel J. Bruxism in children with brain damage. *Acta Odontol Scand*, 1974;32:313-319.
26. Jan MM. Melatonin for the treatment of handicapped children with severe sleep disorders. *Pediatr Neurol*, 2000;23:229-232.
27. Cash RC. Bruxism in children: Review of the literature. *J Pedod*, 1988;12:107-127.
28. Zhu X, Zheng SG, Zheng Y, Fu KY, Zhou YS, Yu C. The related factors of bruxism in children. *Zhonghua Kou Qiang Yi Xue Za Zhi*, 2009; 44: 15-18.
29. Harris D. Factitious buccal lesion secondary to bruxism in a child with cerebral palsy. *Emerg Med J*, 2006;23:e4.
30. Wasnik M, Chandak S, Kumar S, George M, Gahold N, Bhattad D. Dental management of children with cerebral palsy - a review. *J Oral Res Rev*, 2020;12:52-58
31. Roberto LL, Machado MG, Resende VL, Castilho LS, Abreu MH. Factors associated with dental caries in the primary dentition of children with cerebral palsy. *Braz Oral Res*, 2012;26:471-477.
32. National Guideline Alliance (UK). Cerebral palsy in under 25s: assessment and management. London: National Institute for Health and Care Excellence (NICE), 2017: pp: 249-266.
33. Hegde AM, Pani SC. Drooling of saliva in children with cerebral palsy-etiology, prevalence, and relationship to salivary flow rate in an Indian population. *Spec Care Dentist*, 2009;29:163-168.
34. Tahmassebi JF, Curzon ME. Prevalence of drooling in children with cerebral palsy attending special schools. *Dev Med Child Neurol*, 2003;45:613-617.
35. Siegel L, Klingbeil M. Control of drooling with transdermal scopolamine in a child with cerebral palsy. *Dev Med Child Neurol*, 1991;33:1013-1014.
36. Toder D. Respiratory problems in the adolescent with developmental delay. *Adolesc Med*, 2000;11:617-631.
37. Ohito FA, Opinya GN, Wang'ombe J. Traumatic dental injuries in normal and handicapped children in Nairobi, Kenya. *East Afr Med J*, 1992;69:680-682.
38. Gonçalves GK, Carmagnani FG, Corrêa MS, Duarte DA, Santos MT. Dental erosion in cerebral palsy patients. *J Dent Child (Chic)*, 2008;75:117-120.
39. Su JM, Tsamtsouris A, Laskou M. Gastroesophageal reflux in children with cerebral palsy and its relationship to erosion of primary and permanent teeth. *J Mass Dent Soc*, 2003;52:20-24.
40. Abanto J, Shitsuka C, Murakami C, Ciamponi AL, Raggio DP, Bönecker M, et al. Associated factors to erosive tooth wear and its impact on quality of life in children with cerebral palsy. *Spec Care Dentist*, 2014;34:278-285.
41. Cardoso AM, Gomes LN, Silva CR, Soares Rde S, Abreu MH, Padilha WW, et al. Dental caries and periodontal disease in Brazilian children and adolescents with cerebral palsy. *Int J Environ Res Public Health*, 2014;12:335-353.
42. Jan BM, Jan MM. Dental health of children with cerebral palsy. *Neurosciences (Riyadh)*, 2016;21:314-318.

43. Vaughan CW, Neilson PD, O'Dwyer NJ. Motor control deficits of orofacial muscles in cerebral palsy. *Neurol Neurosurg Psychiatry*, 1988;51:534-539.
44. Fernandes MV, Ervilha UF, Maifrino LBM, Bartkevicius A, Santos MTB. Temporomandibular disorders in cerebral palsy: literature review. *J Morphol Sci*, 2015;2:104-107.
45. Miamoto CB, Pereira LJ, Paiva SM, Pordeus IA, Ramos-Jorge ML, Marques LS. Prevalence and risk indicators of temporomandibular disorder signs and symptoms in a pediatric population with spastic cerebral palsy. *J Clin Pediatr Dent*, 2011;35:259-263.
46. Seifeldin SA, Elhayes KA. Soft versus hard occlusal splint therapy in the management of temporomandibular disorders (TMDs). *Saudi Dent J*, 2015;27:208-214.
47. Abekura H, Yokomura M, Sadamori S, Hamada T. The initial effects of occlusal splint vertical thickness on the nocturnal EMG activities of masticatory muscles in subjects with a bruxism habit. *Int J Prosthodont*, 2008;21:116-120.
48. Akbulut N, Altan A, Akbulut S, Atakan C. Evaluation of the 3 mm thickness splint therapy on temporomandibular joint disorders (TMDs). *Pain Res Manag*, 2018;2018:3756587.
49. Lin X, Wu W, Zhang C, Lo EC, Chu CH, Dissanayaka WL. Prevalence and distribution of developmental enamel defects in children with cerebral palsy in Beijing, China. *Int J Paediatr Dent*, 2011;21:23-28.
50. Martínez A, Cubillos P, Jiménez M, Brethauer U, Catalán P, González U. Prevalence of developmental enamel defects in mentally retarded children. *ASDC J Dent Child*, 2002;69:151-155.
51. Casamassimo PS, Seale NS, Ruehs K. General dentists' perceptions of educational and treatment issues affecting access to care for children with special health care needs. *J Dent Educ*, 2004;68:23-28.
52. Ferguson FS, Cinotti D. Home oral health practice: the foundation for desensitization and dental care for special needs. *Dent Clin North Am*, 2009;53:375-378.
53. Parkin SF, Hargreaves JA, Weyman J. Children's dentistry in general practice. *Br Dent J*, 1970;129:27-29.
54. Doğan MC, Alaçam A, Aşici N, et al. Clinical evaluation of the plaque-removing ability of three different toothbrushes in a mentally disabled group. *Acta Odontol Scand*, 2004;62:350-354.
55. American Academy of Pediatric Dentistry. Definition of special health care needs. *Pediatr Dent*, 2016;38:16.
56. Loyola-Rodríguez JP, Aguilera-Morelos AA, Santos-Diaz MA, Zavala-Alonso V, Davila-Perez C, Olvera-Delgado H, et al. Oral rehabilitation under dental general anesthesia, conscious sedation, and conventional techniques in patients affected by cerebral palsy. *J Clin Pediatr Dent*, 2004;28:279-284.
57. Santos MT, Manzano FS. Assistive stabilization based on the neurodevelopmental treatment approach for dental care in individuals with cerebral palsy. *Quintessence Int*, 2007;38:681-687.

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