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## Review Article

# Medical and Dental Implications of Cerebral Palsy: Part 2: Oral and Dental Characteristics: A Review

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## Abstract

Cerebral palsy (CP) is a group of neuromuscular disorders that affects the development of movement and posture, causing activity limitations. CP is classified into three main groups: spastic, dyskinetic and ataxic. Population-based studies from around the world report estimates of CP prevalence ranging from 1.5 to more than 4 per 1,000 live births. CP children suffer from numerous problems and potential disabilities such as mental retardation, epilepsy, feeding difficulties, and ophthalmologic and hearing impairments. Intra orally, Patients with cerebral palsy are reported to have several oral health problems such as poor oral hygiene, bruxism, drooling, traumatic dental injuries, and malocclusion.

A literature search was conducted to identify the key oral and dental manifestations of CP. These findings are discussed and utilized to suggest recommendations for treatment planning in CP patients for the dental practitioner. The findings might also help other medical professionals in understanding the oral health status of CP patients and the importance of liaison with dental professionals.

## INTRODUCTION

Cerebral palsy (CP) is a group of neuromuscular disorders, which affect the development of movement and posture, causing activity limitations. These limitations are attributable to non-progressive disturbances which have occurred in the developing infant brain. Such disturbances include infection, hypoxia,

trauma, and hyper bilirubin anaemia; biochemical and genetic factors may also be involved [1]. The motor disorders of CP are often accompanied by disturbances of sensation, cognition, communication, perception, and/or by seizure disorders [2].

Dougherty, et al., concluded that patients with cerebral palsy have several oral health problems [3]. Neuromuscular

disturbances can affect oral health significantly; they may result in changes of the oro-facial region's structure, and may affect the development of para-functional habits, including feeding problems, difficulty maintaining oral hygiene, and barriers to oral care access.

According to several authors, people with cerebral palsy are reported to have poor oral hygiene, bruxism [4,5] drooling [6,7] traumatic dental injuries [8] and malocclusion [8,9].

Many conflicting reports are observed in the literature with regard to the dental caries experience of this group of individuals: some authors report an increased prevalence of dental caries [5,10,11] while others report that children with cerebral palsy suffered from a greater prevalence of dental caries in the primary dentition than normal children [12]. In contrast to these studies, other studies have found a lower prevalence of caries in children with CP compared to normal populations [13] and others have reported that both children with and without cerebral palsy had similar caries experiences [14].

Periodontal disease has been reported to be common among older children with CP due to poor oral hygiene resulting from oral habits, physical disability, malocclusion, and gingival hyperplasia [15]. In addition, other studies have found high prevalence of gingivitis in CP children compared with healthy children [4,16]. Another study concluded that the prevalence of periodontal disease in the CP group was similar to that of healthy children [17].

## DENTAL PROBLEMS

### Dental caries

Dental caries is defined as "localized post eruptive pathological process of external origin involving softening of the hard tooth tissue and proceeding to the formation of a cavity" [18].

### Aetiology of the dental caries

Dental caries development involves a triad of interrelated factors: bacteria (dental plaque), Fermentable carbohydrates (diet) and susceptible teeth (host) [19]. Recently, time has been considered a fourth factor for the development of dental caries. A modified model of the current understanding of the multi factorial aetiology of dental caries, and the interactions between these factors was presented by Navia (1994) [20].

### Dental caries studies among CP patients

Many conflicting reports are observed in the literature with regard to the dental caries experience of this group of individuals: many authors reported an increased prevalence of dental caries [5,10-12]. In contrast another study reported a lower prevalence of caries in children with CP compared to normal populations [13]. Furthermore, others have reported that both children with and without cerebral palsy had similar caries experiences [14].

Children with CP had higher caries through mixed and permanent dentition stages compared to preschool children [21] and that higher levels were associated with socio demographic, behavioural, and clinical characteristics [22].

## Periodontal disease

Periodontium is defined as "All the elements supporting the tooth, represented by cemented, periodontal membrane, alveolar bone and gingiva constitute the periodontium" [18].

### Definition of the periodontal disease

"Periodontal disease are those pathological processes of an inflammatory and degenerative type that involve the periodontium, they are generally characterized clinically by gingivitis, pocket formation and loss of alveolar bone and eventually loss of teeth" [18].

Healthy children's gingiva and periodontal status is characterized by the gingival margin several millimetres coronal to the cemento-enamel junction (CEJ), and the gingival sulcus maybe 0.5-3 mm deep on a fully erupted tooth [23]. However in teenagers the alveolar crest is situated between 0.4-1.9 mm apical to the CEJ.

### Periodontal disease studies among cp patients

Gingival health is often reported to be poor due to difficulties in maintaining oral hygiene, as a result of poor neuromuscular control and/or other health priorities [5,24]. In addition, gingivitis can arise as a result of food pouching and mouth breathing, especially in the anterior region of individuals with CP [1]. Furthermore, the increased prevalence of gingival hyperplasia among the CP group is likely to be related to their use of anticonvulsant drugs, calcium channel blockers and immunosuppressive agents [24].

In one study, children with CP were shown to have a greater prevalence of periodontal disease in the primary dentition than children in the control group [24]. However, another studies reported that the prevalence of periodontal disease in CP children was similar to that in healthy children [17]. Periodontal disease has been stated to be common particularly in older children with CP due to poor oral hygiene, problems with oral habits, physical disabilities, malocclusion, and gingival hyperplasia caused by medications for people with cerebral palsy [15]. Mouth breathing worsens the periodontal state, and papillary hyperplastic gingivitis may be seen even in the absence of phenytoin use for seizure treatment [17].

## Malocclusion

Malocclusion plays a significant part in the overall oral health of an individual because it is linked with temporo mandibular disorders (TMD), periodontal disease, and may be complicated by an individual's disability [25-27] Risk for malocclusion can originate from physical, behavioural, or disease factors [28,29].

The prevalence of malocclusion was higher in individuals with disabilities than in controls without disabilities. In addition, malocclusion was more common when the special need of the individuals was mental, rather than physical in origin [30]. In CP Individuals Class II malocclusions were the most common form of malocclusion, along with missing teeth and anterior diastema [31]. In addition, Children with CP have a significantly increased over jet, overbite and are likely to have incompetent lips [8].

Class II malocclusions have been linked to hypotonia of the

orofacial musculature, and forward thrust of the tongue [4,5]. Further, this type of malocclusion predisposes the individual to trauma of the anterior teeth, in addition to poor gait and seizures [3].

### Non-carious tooth surface loss among CP patients

**Types of Tooth Surface Loss (TSL):** Tooth surface loss take either the form of attrition (“wear of the tooth surface as a result of tooth to tooth contact”), or erosion (“irreversible loss of tooth substance brought about by a chemical process that doesn’t involve bacterial action”) [32].

### Aetiology of TSL

**A. Intrinsic acidic sources:** These are of gastric acid origin and may be linked with significant palatal dental erosion. Secondary to gastro-oesophageal reflux (GORD), besides the fact that gastric acid enters the mouth, rumination and vomiting can cause tooth surface loss [33].

**GORD:** GORD is “a condition defined as an involuntary passage of gastric juice against the normal flow of digestive tract” [34,35]. Dental erosion in relation to GORD is a less significant problem in children, perhaps due to a shorter history of GORD, or refluxing is restricted to the oesophagus [36,37].

Higher levels of gastric reflux are seen in children with neurological impairments than healthy children, with over 70% of CP children having abnormal reflux activity [38].

In one study, the prevalence of GORD in children with CP children was found to be 53%, [39] in another, it was 43.5% [40]. In addition, the latter study concluded that the presence of GORD enhances dental erosion considerably in the most compromised of CP quadriplegics individuals, increasing their risk of oral disease. Many studies presented a considerable association between GORD and dental erosion in children with CP [37,41].

This emphasizes the importance of recognizing GORD patients by dental professionals, and referring them to a gastroenterologist. Special attention should be paid to the important relationships between disabled people, caregivers, multidisciplinary teams, along with truthfulness during an oral examination [42,43]. The dental practitioner may be able to minimize erosion in CP patients through preventive measure, such as the application of a fluoridated solution [44].

**Vomiting:** Vomiting may be spontaneous or self-induced, and perhaps linked with a range of medical problems. In addition it must be noted that there has been an increase in the prevalence of eating disorders (bulimia nervosa and anorexia) [37].

**B. Extrinsic acidic sources:** That includes drinks, food, medication, life style and environmental factors [33]. Frequency of, instead of total intake of drinks, may be critical in the erosive process. Titratable acidity and the pH of the drink are significant in assessing a drink’s erosive potential. The erosive potential of chewable vitamin C tablets and iron preparations was highlighted in an early report by Giunta, et al., Such supplements are not widely used among children and adults [45]. There have also been changes in general habits and lifestyle, including the significance of eating healthy food including five pieces of fresh

fruit or vegetables per day, which has been stressed by national campaigns. Further, there has been an increase in the number of individuals who are vegetarian, who are hence exposed to a more acidic diet. The acquired habit of frothing carbonated beverages in the mouth, and frequent and excessive consumption of acidic sport drinks (as part of regular healthy exercise) further adds to acidic intake [37]. Dentists should be alert that there are cultural differences among patients and should question them about any habits that may increase the risk of tooth wear.

**Bruxism:** Bruxism is defined as a movement disorder of the masticatory system that is characterized by, among others, teeth grinding and clenching during sleep and wakefulness [46,47].

The aetiology of this para functional activity is multi factorial, and may include spasticity, [48] unbalanced oral myofunctional disturbances, [49] dysfunction of the backbone with the head projected forward, [50] malocclusion [51] sleep disorders, [52] or lack of control of the mandibular posture [53]. Many of the aforementioned conditions are common in children with CP [49].

The prevalence of bruxism ranges from 25.0% to 69.4% amongst children with developmental disabilities such as CP [49,54,55]. While a higher prevalence rate has been reported in CP children, [56] other studies have found no significant differences between groups [57]. Bruxism in CP patients has been associated with athetosis, [58] spastic quadriplegia, sucking habits, posterior cross bite, [59] gastroesophageal reflux, [57] and Level III of the Gross Motor Functional Classification System [60]. Bruxism, as well as dental caries, has negative influences on the quality of life in this group of individuals [61]. GORD, involuntary movements, and male gender were reported to be associated to bruxism in children with developmental disabilities [61].

### Traumatic dental injuries among cp patients

Incidence of dental trauma among CP populations was found to be as high as 57% in one study, [62] while other studies have reported prevalence rates between 9.2% and 20% [59,63,64]. One study suggests that the prevalence of dental trauma among CP patients attending rehabilitation centres was similar to that of non-disabled individuals who receive less treatment [64].

Certain factors predispose CP populations to dental trauma such as high prevalence of class II malocclusion with prominent maxillary incisors, incompetent lips, struggles in ambulation, and increased incidence of seizures [3]. The most common type of injuries was were fractures of enamel and dentine [3,65,66].

### Enamel defects among CP patients

Enamel defects may be defects of enamel matrix formation, mineralization, or maturation with reduced or changed amounts of enamel formed by insult to the ameloblast cells [67].

Metabolism of the ameloblasts is disturbed by systemic, local environmental stresses, genetic factors, or a combination of these, resulting in tooth defects. Therefore, the tooth enamel frequently acts as a depository of information on systemic insults, which are received during development. Such effects may begin before or after birth; consequently deciduous, permanent, or both teeth may be involved [65]. In one study a high prevalence of developmental enamel defects among CP children was reported.

The prevalence of defects varied with the tooth type, and was associated with gestational age of the children. Moreover, most of enamel defects were located symmetrically in the primary incisors and first molars in the upper jaw [68].

### Temporomandibular joint (TMJ) problems

There is an increased incidence rate of TMJ problems among CP populations, comprising of tenderness upon palpation, pain on opening/chewing, limited or diverged mandibular movement, crepitation, and luxation of the condyle, and hearing problems. However, there are fewer TMJ symptoms in CP individuals who have normal occlusion (no class II) [66]. Further, the hazard indicators for signs and symptoms of temporomandibular disorders are the existence of CP, severity of the malocclusion, male gender, mouth breathing and mixed dentition; children with CP had a significantly greater chance of developing these signs and symptoms.

**Drooling:** Drooling occurs in up to 30% of cases of children with CP, [69] and is not usually connected to an increase in the production of saliva, if there is no aggravating lesion is present (dental caries or throat infection). Drooling is commonly secondary to mouth opening and/or swallowing difficulties resulting from pseudobulbar palsy; besides which, it is not socially acceptable and can lead to aspiration, skin irritation, and articulation difficulties [69].

However, it is difficult to manage this problem effectively. Firstly anticholinergic medications such as glycopyrrolate decrease salivation by blocking parasympathetic innervation, but have the side effects of irritability, sedation, blurred vision, and constipation [70]. Scopolamine, another anticholinergic agent (available as a skin patch), and surgical re-routing of salivary ducts (which may potentially lead to increased aspiration) are further available options.

Recent studies suggest that botulinum toxin injection into the parotid and submandibular glands may be effective in the reduction of extreme drooling.

### CONCLUSION

Children with CP suffer from various medical problems and orofacial abnormalities.

The establishment of dental care for these individuals presents unique challenges to the dental staff. Consequently, dentists dealing with them should possess thorough knowledge of the unusual medical and orofacial abnormalities and their implications and should liaise with different medical specialists in order to formulate safe and effective dental preventive and treatment plans. In CP individual, prevention of dental diseases is of paramount importance especially for those who are severely or profoundly medically compromised.

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