Determinant factors of malocclusion in children and adolescents with cerebral palsy

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Introduction: Cerebral palsy (CP) is an encephalic static lesion characterized as a nonprogressive disorder of movements and posture with functional deficits that may favor the occurrence of various malocclusions. We looked for a possible association between overall functional impairment and malocclusion in this population. **Methods:** Seventy patients from the Center of Attendance for Special Needs Patients, ages 6 to 18 years and with a CP diagnosis, were involved in the research. The overall degree of functional impairment was assessed with the Gross Motor Function Classification System, and malocclusion was evaluated with the criteria established by the World Health Organization and selected occlusion characteristics. To test the associations, univariate and multiple logistic Poisson regression analyses were used, and prevalence ratio values were calculated. **Results:** Patients with limited or severely limited mobility (Gross Motor Function Classification of 4 or 5) ($P = 0.003$), parafunctional habits ($P = 0.001$), and a caregiver who was not the mother had 3 to 4 times more risk for open bite. Patients with dyskinetic CP are 4 times more likely to develop deepbite ($P = 0.005$). **Conclusions:** The results showed that the type of CP, the degree of motor involvement, and the presence of parafunctions are important factors to be considered to establish a correct diagnosis of malocclusion in persons with CP. (Am J Orthod Dentofacial Orthop 2018;154:405-11)

An international definition described cerebral palsy (CP) as a group of permanent disorders of the development of movement and posture.[1] It can cause limitation of activities that is attributed to nonprogressive disturbances in the developing fetal or infant brain. It has been considered the most common form of neuromuscular disability affecting children.[2] In Brazil, there is a lack of studies evaluating the prevalence of CP, but it is estimated that its prevalence in developing countries, such as Brazil, is about 7 per 1000 live births.[3]

Dystonia, contractures, abnormal bone growth, poor balance, loss of motor control, and weakness are symptoms related to motor impairment in CP, with spasticity (abnormal increase of muscle tone) a major motor impairment.[4] In patients with CP, damage to different areas of the central nervous system implies different clinical characteristics as shown in Table I.[3,5]

One of the most frequent symptoms observed in CP patients is oral motor difficulties, such as feeding problems, including abnormal control of chewing and swallowing, and speech anomalies. The increased muscular tension, ascribed to the hypertonic muscles, is the main element of the spasms that characterize the disease.[2,6] Motor disorders of CP are often accompanied by disturbances of sensation, perception, cognition, communication, and behavior, and also by seizures.[2] Due to the diversity of clinical characteristics, other classifications have been proposed. One is the Gross Motor Function Classification System (GMFCS), which aims to identify the level of associated motor impairment.[7]

Persons with CP have a high prevalence of malocclusion compared with those with other disabilities (59%-92%), and most have an Angle Class II malocclusion.[8] The risk factors for malocclusion can originate from physical, behavioral, or disease mechanisms. Subjects having premature tooth loss, missing teeth, or a discrepant jaw and tooth size have a greater risk of malocclusion. Some studies have attributed the high prevalence of malocclusion in CP populations to finger-sucking habits, excessive mouth breathing, lip

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Table I. CP classifications according to its characteristics[5]

Type of CP	*Etiology*	*Characteristics*
Spastic	Lesion in the pyramidal system, corticocapinal interval, or motor cortex	Increased muscle tone.
Dyskinetic	Lesion in the extrapyramidal system, mainly in the nuclei of the base (striatum, black substance, and thalamic nucleus)	Atypical or involuntary movements/posture, including dystonia. The muscle tonus may be hypotonic or hypertonic.
Ataxic	Dysfunction in the cerebellum or lower part of the brain	Disturbance of the coordination of movements as a result of dyssynergy. There may be tremors.

incompetence, long face, and oral dyskinesia which may suggest an association with muscle impairment.[9-11]

The aim of this study was to investigate the association between overall functional impairment and malocclusion in children and adolescents with CP. Our hypothesis was that biologic and functional components of CP are associated with an increased prevalence of malocclusion.

MATERIAL AND METHODS

For this observational cross-sectional study, a convenience sample was selected. It comprised children with CP who attended the Center of Attendance for Special Needs Patients in São Paulo, Brazil. The study was undertaken after obtaining ethical clearance from the ethical board of the dental school, University of São Paulo.

For sample size calculation, data on the prevalence of malocclusion in adolescents with CP was extracted from the literature as 69%.[9] With a significance level of 5% and a power of 80%, the minimum number of subjects to be evaluated was 71. A total of 85 parents of children with CP, ages of 6 to 18 years, and registered in the database of the center were contacted and invited to participate. Parents who were not fluent in Brazilian Portuguese, changed address, or refused to participate, and children who had previously received or were receiving orthodontic treatment, were excluded (n = 15). The final sample comprised 70 pairs of parent and child. All parents were informed about the nature of the research and signed the informed consent form. The children received all necessary care after the evaluation.

Data were collected in a questionnaire that was administered to a parent. It contained items addressing personal and sociodemographic characteristics (sex, age, premature birth, birth weight, mental deficiency, caregiver, feeding, presence of parafunction, such as nonnutritive sucking habit, mouth breathing, altered swallowing, and bruxism). Age was categorized according to the averages among patients. Premature birth and birth weight were categorized according to the criteria of the World Health Organization.[1] Way of feeding was categorized as independent feeding, assistive feeding, or through a probe tube. Caregiver was the one who took care of the patient for most of the day.

The data were collected in face-to-face interviews by a blinded interviewer (L.A.C.A.) before the oral examinations. The interviews were completed before dental clinical examinations, and all parents agreed to answer the questions.

The same interviewer evaluated the type of CP (previously classified by medical evaluation) and the GMFCS. The nature of motor disorder was classified as spastic, dyskinetic, ataxic, or a combination.[12] The GMFCS is a standardized observational instrument for children with CP, developed to measure changes in gross motor function over time. Its main focus is on self-initiated movements, in particular sitting and walking (Table II).[7,13] It is an age-related 5-level system in which level 1 represents the least limitation, and level V the most limitations. For statistical reasons, levels 1 to 3 and 4 and 5 were grouped in the results.

Dental clinical examinations were carried out by another trained examiner (H.Y.). The children were examined with a dental mouth mirror, a sterile wood spatula, and a ruler.

Occlusion was assessed with the teeth in centric occlusion. The diagnosis of malocclusion was based on the criteria established by the World Health Organization,[14] using some components of the dental aesthetic index: excessive overjet (>3 mm), anterior mandibular overjet (<0 mm), vertical anterior open bite (>0 mm), and anteroposterior molar relationship (1/2 unit cusp mesial or distal). Posterior crossbite (unilateral or bilateral) and deepbite (overbite >4 mm) were also evaluated.

Statistical analysis

All data were statistically processed using Stata software (version 9.0; StataCorp, College Station, Tex). The Cohen kappa was used to calculate the intraobserver error. A value close to 1 was the ideal condition. The univariate Poisson regression analysis with robust variance was used to correlate different aspects of malocclusion