Occlusal Characteristics in Cerebral Palsy Patients

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ABSTRACT

Purpose: The purpose of this study was to evaluate the occlusal characteristics of 104 randomly selected, noninstitutionalized patients with a medical diagnosis of cerebral palsy (CP).
Methods: Patients were grouped according to the CP motor disorder and clinical patterns. Occlusal characteristics were collected by one examiner. Nonparametric statistical tests, including Fisher's exact test (*P*) and chi-square test were used.
Results: The results showed that Class II molars were statistically higher ($P<.05$) for spastic patients. Anterior open bite and an increased overjet were significant ($P<.01$) in spastic patients with clinical patterns of quadriplegia, double-hemiplegia, and diplegia. Double hemiplegia patients presented a higher incidence of open bite (64%) with an edge-to-edge overjet (45%). A deep overbite was presented in athetoid (50%) and ataxic (67%) patients. A high incidence of tooth wear was observed in the athetoid group (54%).
Conclusion: Spastic patients presented a high incidence of open bite and Class II malocclusion. A low level of malocclusion was observed in the ataxic group compared to the other groups studied. Further studies would be useful to determine if neurological injuries can be the cause of changes of the craniofacial growth and development patterns resulting in malocclusion in cerebral palsy patients. (J Dent Child 2007;74:41-5)

KEYWORDS: CEREBRAL PALSY, MALOCCLUSION, SPASTICITY, ATHETOSIS, SWALLOWING

Cerebral palsy (CP) is a nonprogressive syndrome of posture and motor impairment that results from an insult to the developing central nervous system. It is also the most common cause of severe physical disability in childhood.[1] The worldwide prevalence and incidence of the disorder is not clearly known.[1] CP patients have some similar characteristics, including:

1. the inability to perform smooth motions due to involuntary motions and excessive muscle tonus;
2. oral motor skill disorders;
3. difficulties in eating, swallowing, and chewing, due particularly to incoordination of motions of masticatory muscles.[2,3]

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The dental status of CP children is similar in many ways to that of unaffected children. They suffer from: (1) cavities; (2) periodontal disease; (3) malocclusion; (4) enamel hypoplasia; (5) bruxism; and (6) trauma.[4-6]

There are contrasting reports in literature regarding the prevalence of malocclusion in CP children,[7] but others have found the prevalence of malocclusion to be within normal limits.[11,12] Thurrow[13] states that the primary occlusion is in a continuous and rapid change to adapt to functional patterns of growth and development. The basic functional patterns of occlusion are established before permanent dentition eruption.

The muscles of the face and oral cavity play a role in facial growth and occlusal development.[14] As the tone and function of the oral facial muscles in CP children can be abnormal, the facial growth and occlusion in these children may be outside of normal limits.[5,15]

The aim of this study was to evaluate the occlusal characteristics of 104 cerebral palsy patients, from 4 to 21 years old, treated at the dental clinic of Cruzeiro do Sul University (UNICSUL), São Paulo, Brazil.

Table 1. Movement Disorder and Clinical Patterns of Involvement Data for 104 Patients			
		n (%)	Mean age±(SD)
Movement disorder	Spastic	88 (85%)	8.6±3.8
	Athetoid	13 (12%)	10.1±4.5
	Ataxic	3 (3%)	13.6±4.0
	Total	104 (100%)	8.9±3.8
Clinical patterns	Quadriplegia	36 (41%)	8.6±4.0
	Hemiplegia	8 (9%)	9.0±3.4
	Diplegia	33 (38%)	8.6±3.9
	Double hemiplegia	11 (12%)	8.0±1.8
	Total	88 (100%)	8.6±3.8

METHODS

A convenience sample was used, formed by 104 noninstitutionalized patients with a medical diagnosis of CP (age range=4-21 years, mean±SD=8.9 ±3.8). They are patients treated at the Division of Persons with Disabilities, UNICSUL.

Prior to data collection, written consent was obtained from the parents of all patients, according to the rules of the Ethics Committee of UNICSUL. The personal data and medical information of the CP children were obtained from their records, including: (1) gestation period; (2) birth weight; (3) CP type; and (4) previous childhood medical and surgical events.

Children were examined at a dental office by a calibrated examiner. The intraexaminer's reliability was established by re-examination of 20 children in 2 different visits (K=0.93).

The occlusal characteristics observed were: (1) sagittal occlusion; (2) overbite going forward; (3) overjet; (4) transverse occlusion; and (5) tooth wear. All evaluations were made according to: (1) Foster and Hamilton[16] for primary dentition; and (2) Angle's classification[17] for permanent dentition.

SAGITTAL OCCLUSION

Molar occlusion of primary dentition: Class 1; Class 2; Class 3.

In the mixed dentition, the sagittal occlusion was determined initially with the first permanent molar[17] and then in the second primary molar.[16]

Molar occlusion in permanent dentition: Class I; Class II; Class III.

OVERBITE

According to the normal values determined for all types of dentition, the overbite was classified as: (1) normal; (2) open bite; (3) deep overbite; or (4) edge-to-edge.

For primary dentition, the normal value of overbite was considered when the incisal tips of the primary lower central incisors contacted the palatal surfaces of the upper primary incisors in centric occlusion.

For permanent dentition, the normal value of overjet considered was a positive incisor overjet not exceeding one third and covering the lower incisor in centric occlusion.

When the permanent incisors were not present or if their crowns were not fully erupted, the overbite was not evaluated.

OVERJET

The overjet was determined to be normal, increased, reversed, or edge-to-edge, according to the normal values determined for all types of dentition.

For primary dentition, the normal value of overjet considered was a positive incisor overjet not exceeding 2 mm measured on the primary upper central incisors in centric occlusion.

For permanent dentition, the normal value of overjet considered was a positive incisor overjet not exceeding 2 mm measured using the upper central incisors in centric occlusion.

TRANSVERSE OCCLUSION

In these analyses, only the presence/absence of posterior crossbite was observed.

TOOTH WEAR

A simplified form of the tooth wear index of Smith and Knight[18] was used, examining incisal/occlusal wear only, with-

Table 2a. Patient Distribution According to Dentition wType		
Dentition	n (%)	Mean age±(SD)
Primary	26 (25%)	4.7±2.0
Mixed	57 (55%)	8.9±1.7
Permanent	21 (20%)	14.0±3.5
Total	104 (100%)	8.9±3.8

Table 2b. Patient Distribution According to Dentition Type and Molar Relationship				
Dentition	Class I or 1	Class II or 2	Class III or 3	Total
Primary	9 (35%)	14 (54%)	3 (12%)	26 (100%)
Mixed	16 (28%)	38 (67%)	3 (5%)	57 (100%)
Permanent	10 (48%)	7 (33%)	4 (19%)	21 (100%)
Total	35 (34%)	59 (57%)	10 (10%)	104 (100%)

out attempting to define the etiology.

Nonparametric statistical tests including Fisher´s exact test (*P*) and chi-square test, were used according to the nature of the variables studied, with the level of significance set at $P<.05$.

RESULTS

The study group consisted of 104 CP children (age range=4-21 years; average=8.9±3.87) with primary, mixed, and permanent dentition. The patients were grouped according to the CP motor disorder. Of these, 88 (85%) had spastic movement disorder (mean age=8.6±3.8); 13 (13%) were athetoid, (mean age=10.1±4.5); and 3 (3%) were classified as ataxic (mean age=13.6±4). Regarding the clinical patterns of involvement of spastic patients, 36 (41%) presented with quadriplegia, 8 (9%) with hemiplegia, 33 (38%) with diplegia, and 11 (13%) with double hemiplegia. The movement disorders and clinical patterns of the 104 CP patients evaluated in this study are shown in Table 1.

They were also grouped according to their dental age. Most of these patients had mixed dentition (55%), followed by primary dentition (25%) and permanent dentition (20%; Table 2a).

Table 2b shows the patient's distribution according to the type of dentition and the molar relationship present. In the primary dentition, Class 2 represented 54% of the malocclusion. The same occurred in mixed dentition, where 67% of the sample presented Class II malocclusion. In permanent dentition, 33.3% of the sample showed Class II malocclusion.

In Tables 3b and 3c, 3 spastic patients and 1 athetoid patient are missing because central incisors were not present.

Regarding sagittal occlusion of the 104 patients with CP, 35 (34%) presented Class I or 1; 59 (57%) Class II or 2; and 10 (10%) Class III or 3. In relation to spastic clinical patterns of involvement, a high incidence of molar Class II was present in this group (59%) with statistical difference ($P<.05$) mainly in quad riplegia (61%) and diplegia (64%) clinical patterns. These data are shown in Table 3a.

Table 3a. Sample Distribution According to Movement Disorder, Clinical Patterns, and Molar Relationship

		Class I or 1	Class II or 2	Class III or 3	Total
Movement disorder	Spastic	28 (32%)	52 (59%)	8 (9%)	88 (100%)
	Athetoid	6 (46%)	5 (39%)	2 (15%)	13 (100%)
	Ataxic	1 (33%)	2 (67%)	0	3 (100%)
	Total	35 (34%)	59 (57%)	10 (10%)	104 (100%)
Clinical patterns spastic	Quadriplegia	12 (33%)	22 (61%)	2 (6%)	36 (100%)
	Hemiplegia	3 (38%)	4 (50%)	1 (13%)	8 (100%)
	Diplegia	9 (27%)	21 (64%)	3 (9%)	33 (100%)
	Double hemiplegia	4 (36%)	5 (46%)	2 (18%)	11 (100%)
	Total	28 (32%)	52 (59%)	8 (9%)	88 (100%)

Table 3b. Sample Distribution According to Movement Disorder, Clinical Patterns, and Overbite

		Normal	Open bite	Deep	Edge-to-edge	Total
Movement disorder	Spastic	7 (8%)	50 (59%)	17 (20%)	11 (13%)	85 (100%)
	Athetoid	3 (25%)	3 (25%)	6 (50%)	0	12 (100%)
	Ataxic	0	1 (33%)	2 (67%)	0	3(100%)
	Total	10 (10%)	54 (54%)	25 (25%)	11 (11%)	100 (100%)
Clinical patterns	Quadriplegia	3 (8%)	22 (61%)	4(11%)	7 (20%)	36 (100%)
	Hemiplegia	1 (13%)	4 (50%)	2 (25%)	1 (13%)	8 (100%)
	Diplegia	2 (7%)	17 (57%)	9 (30%)	2 (7%)	30 (100%)
	Double hemiplegia	1 (9%)	7 (64%)	2 (18%)	1 (9%)	11 (100%)
	Total	7 (8%)	50 (59%)	17 (20%)	11 (13%)	85 (100%)

Table 3c. Sample Distribution According to Movement Disorder, Clinical Patterns, and Overjet

		Normal	Crossed	Increased	Edge-to-edge	Total
Movement disorder	Spastic	8 (9%)	3 (4%)	54 (64%)	20 (24%)	85 (100%)
	Athetoid	3 (25%)	1 (8%)	4 (33%)	4 (33%)	12 (100%)
	Ataxic	0	0	2 (67%)	1 (33%)	3 (100%)
	Total	11 (11%)	4 (4%)	60 (60%)	25 (25%)	100 (100%)
Clinical patterns	Quadriplegia	2 (6%)	1 (3%)	26 (72%)	7 (19%)	36 (100%)
	Hemiplegia	1 (13%)	0	4 (50%)	3 (38%)	8 (100%)
	Diplegia	2 (7%)	2 (7%)	21 (70%)	5 (17%)	30 (100%)
	Double hemiplegia	3 (27%)	0	3 (27%)	5 (45%)	11 (100%)
	Total	8 (9%)	3 (4%)	54 (64%)	20 (24%)	85 (100%)

Almost the same occurred with the results of anterior relationship. According to the overbite, the presence of an anterior open bite was significant ($P<.01$) in spastic patients (59%) mainly in patients with clinical patterns of quadriplegia (61%), diplegia (57%), and double-hemiplegia (64%) shown in Table 3b. High incidence of deep overbite was present in athetoid (50%) and ataxic patients (67%).

In relation to overjet, an increased overjet was significant ($P<.01$) in spastic patients (64%) and more prevalent in

Table 3d. Sample Distribution According to Movement Disorder, Clinical Patterns, and Tooth Wear

		With	Without	Total
Movement disorder	Spastic	21 (24%)	67 (76%)	88 (100%)
	Athetoid	7 (54%)	6 (46%)	13 (100%)
	Ataxic	1 (33%)	2 (67%)	3 (100%)
	Total	29 (28%)	75 (72%)	104 (100%)
Clinical patterns	Quadriplegia	12 (33%)	24 (67%)	36 (100%)
	Hemiplegia	2 (25%)	6 (75%)	8 (100%)
	Diplegia	5 (15%)	28 (85%)	33 (100%)
	Double hemiplegia	2 (18%)	9 (82%)	11 (100%)
	Total	21 (24%)	67 (76%)	88 (100%)

ataxic patients (67%). Regarding 85 spastic patients, an increased overjet was present in 26 (72%) patients with clinical patterns of quadriplegia; 4 (50%) with hemiplegia and 21 (70%) with diplegia. Patients with double-hemiplegia clinical patterns presented a high incidence (45%) of edge-to-edge overjet. These data are shown in Table 3c.

The absence of tooth wear was significant ($P<.001$). Tooth wear was most observed in athetoid group (54%) as shown in Table 3d.

DISCUSSION

Because of the difficulty in obtaining an adequate sample and limited opportunities for the dentist to obtain clinical information, few studies have been reported in the dental literature concerning the occlusal characteristics of CP children. On the other hand, the CP rate has been increasing despite the fall of perinatal and neonatal mortality rates.[1,6,10] Thus, these children need special or intensive care, requiring the interest of investigators not only in the prevention of the disease, but also in the prevention of the problems related to it, such as malocclusion.[6,10] There are few studies that observed the occlusion in CP patients but most of them do not classify patients by movement disorder and clinical patterns.[2,6,8-9]

The present study adds to the evidence that there is an increased prevalence of malocclusion in CP children, mainly in spastic patients.

Class II molar relationship was more prevalent (57%) agreeing with Franklin et al,[5] Strodel,[7] Vittek et al,[9] although some reports have not found the same results.[11]

Nevertheless, all studies found an increased overjet in these patients. In this study, increased overjet was statistically significant ($P<.01$) in spastic patients with clinical patterns of quadriplegia, diplegia, and hemiplegia.

The open bite was statistically significant for spastic patients but athetoid and ataxic patients presented a higher incidence of deep overbite. This result may explain the conflicting reports in literature. Rosenbaum[10] found the incidence of open bite decreasing as the age of children increased; Franklin et al[5] and Strodel[7] found an increased overbite.

All results show that there is a difference of the occlusal characteristics of spastic and the other movement disorder in patients. Spasticity induces neuromuscular involvement and, consequently, bone involvement[7] changing facial growth and occlusal development patterns.[15] It was also observed that the quadriplegia group presented more alterations from the normality pattern.

Open bite in spastic patients was significantly higher ($P<.021$) than in athetoid patients. Athetoid patients didn't present a high incidence of open bite and molar relationship of Class II. That may occur because the injury to the developing central nervous system affected in those patients was only in the extrapyramidal system, therefore they don't have a high involvement of motor skill.[1]

It was also observed that Class II malocclusion was prevalent in CP patients in all types of dentitions and its incidence was higher than Class I or Class III. The high incidence of Class II in permanent dentition can be explained by the abnormal craniofacial growth and development in CP patients.[15]

The presence of erosion was marginally significant ($P=.077$) in the athetoid group. This result can be explained by the presence of involuntary movements resulting in bruxism in these patients.[10]

CONCLUSIONS

Based on this study's results, the following conclusions can be made:

1. In cerebral palsy patients, the group with spastic movement disorders presented a high incidence of open bite and Class II malocclusion.
2. The incidence of Class II and Class 2 malocclusion (permanent or primary dentition, respectively) increased from primary to mixed, but from mixed to permanent dentition, the incidence was reduced.
3. A low level of malocclusion was observed in the ataxic group compared to the other groups studied.
4. The athetoid group showed a higher incidence of tooth wear.
5. Further studies would be useful to determine if neurological injuries can be the cause of changes in the craniofacial growth and development patterns resulting in malocclusion in cerebral palsy patients.

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