Oral Cavity Alterations Diagnosis in Cerebral Palsy Subjects

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Abstract

Objective: To diagnose the demographic profile, teeth structural alterations, pathological findings and dental caries risk in both genders subjects with cerebral palsy (CP), aged 10 and 44 years, receiving dental treatment at Center for Study and Care of Special Patients (CEAPE) of Paulista University. Materials and Methods: Decayed, missing, and filled teeth index (DMFT) and Bacterial plaque (BP) index were performed through the Ainamo and Bay Test. The clinical exam was complemented with the radiographic exam. A salivary test – Dentobuff® was used for the saliva flow rate (SF) and salivary buffering capacity (BC). Results: The BP index was (77.3%); DMFT was (9.5%); patients presented low SF (0.6) and BC (4.3) indexes (p<0.05). Conclusions: We have concluded that, considering this reality, there is a need to implement and/or review the education, prevention and treatment programs for patients with (CP), aiming at providing these patients improvements in their oral health.

ABBREVIATIONS

CP: Cerebral Palsy; BP: Bacterial Plaque; CEAPE: Center for Study and Care of Special Patients; SF: Saliva Flow Rate; DFMT: Decayed, Missing, and Filled Teeth index; BC: Buffering Capacity

INTRODUCTION

Cerebral palsy (CP) was firstly described in 1861 by the English orthopedist Dr. William John Little, not as a pathological entity, but rather as a denomination to designate a series of clinical alterations involving several types of CP, in coordination, trembling and disability in consequence of brain lesions [1].

CP is a non-progressive disorder characterized by a set of motor and sensorial perturbations, caused by a developing brain lesion which can happen before, during or after birth, which can achieve one or more brain areas. The lesion in the immature brain can be caused by several factors, including abnormal brain development, cerebral hemorrhage, infections, cerebral anoxia or trauma [2-4].

There are several types of CP, classified according to the body parts involved (diplegia, hemiplegia, quadriplegia and double hemiplegia) and according to the neuromuscular impairment, which can be spastic, athetoid or ataxic. CP is characterized by spasticity, rigidity, involuntary movements, dystonia and hypotonia, and the symptom can occur isolated or in conjunction [3].

The current oral health of special patients has been little studied and trustworthy data are scarce in Brazil. This reality reaches some 10% of the Brazilian population, nowadays represented by about 15 million disabled people, in its majority sporadically assisted, in a well-deserved way [5]. The oral health conditions in patients with cerebral palsy are not satisfactory since the motor disability would reduce the oral hygiene adequate maintenance possibility by the patient [6-9]. Thus the ones responsible must be answerable for these patients oral hygiene maintenance and it is the dental surgeon duty to stimulate, make aware and train the parents or the responsible ones for the oral hygiene care.

The most frequent oral manifestations in cerebral palsy patients are malocclusion or class II malocclusion [10], tongue interposition, bruxism, digital sucking, dummy sucking and the habit of biting other objects [11].

The tendency to the cariogenic diet (rich in carbohydrates), inadequate oral hygiene, plus the frequent use of sugary drugs by patients with cerebral palsy are important factors for the dental caries development [12,13]. Studies reveal a Decayed, missing, and filled teeth index (DMFT) incidence ranging from 1.2% to 6.67% in cerebral palsy patients [6,9].
This study purpose was to analyze dental caries incidence and periodontal disease in 65 patients with CP, aged 12 years or older; 74% presented spastic cerebral palsy, 49% of the participants with mild mental disability and 31% with moderate mental disability to compare with the revised literature. The Chinese teenagers with CP sample of medium DMFT index was 1.2 and 57% presented calculus. The authors concluded that the periodontal status of the research participants was bad, needing intensification in the oral hygiene instruction [14].

A study was to describe the incidence of caries among children and adolescents who have cerebral palsy. The authors conducted baseline and follow-up dental examinations of 118 children and adolescents with cerebral palsy in a specialized healthcare unit in São Paulo, Brazil. Family care-givers completed a questionnaire that provided socioeconomic and behavioral information. More than half (52.5%) of the subjects had at least one permanent or deciduous tooth affected by new caries during the longitudinal assessment (2004–2008). The incidence of caries was associated with the baseline prevalence of caries (incidence ratio = 1.92), a higher frequency of sugar intake (IR = 1.56), and having at least one sibling (IR = 1.64). Participants whose family care-givers had more knowledge about oral health had a significantly lower incidence (IR = 0.68). This evidence can potentially be used to develop an effective oral health promotion program for these patients [15].

The risk of dental caries is increased by enamel hypoplasia, poor nutritional status, and medicines that reduce saliva or contain sugar [16].

When evaluating the pH, flow and buffering saliva capacity in 24 teenagers with CP, and in a control group composed by 18 normal subjects, the result evidenced that the saliva flow, pH and buffering capacity in the 6.9-6.0 pH were significantly lower in subjects with CP. The authors concluded that the teenagers with cerebral palsy presented lower pH, saliva flow and buffering capacity when compared to the control group, which raises oral diseases risk in this population [17].

Another study was conducted to evaluate the buffering capacity, flow, saliva pH and dental caries incidence in children with age between 5 and 12 with CP. The study results showed that the children with cerebral palsy presented medium DMFT index of 2.51 and 0.73 respectively, saliva pH was 6.83, buffering capacity 10.84 min., and saliva flow rate 1.08 mL/ min. The authors observed a significant correlation between saliva pH and dental caries in the dentition of children with cerebral palsy [18].

The objective of this study was to diagnose structural alterations in the shape and number of teeth, possible pathologic findings, DMFT index, buffering capacity, saliva flow, dental caries risk, bacterial plaque and demographic profile of subjects with cerebral palsy.

MATERIALS AND METHODS

This research was developed in the Integrated Clinical Discipline of the Dental College of Paulista University of São Paulo – Indianópolis Campus, together with Center for Study and Care of Special Patients (CEAPE), after approval by the Institutional Ethics Committee of Paulista University – UNIP – Protocol number: 018/07 CEP/IC/UNIP.

Sample and clinical data

Forty (40) subjects of both genders, with ages between 10 and 44 years old, medically diagnosed with CP, on dental treatment, were randomly chosen. The patients did not use any medications the information related to age, gender, race, and skin color was obtained at the moment of anamnesis and of the clinical exam of the patients. Among the oral alterations/ manifestations, the ones present at the moment of the clinical exam and those that had manifested during the dental treatment were analyzed, disregarding previous reports of the patients. The oral exams were carried out by the researcher himself, using individual protection equipment (IPE), according to the approved universal biosafety standards.

The clinical exam was complemented by radiographic exam, with the objective of observing and evaluating structural alterations in the shape and number of teeth, as well as pathological findings. DMFT index, bacterial plaque index and sialometry (a measurement of saliva flow and buffering capacity) were analyzed.

Oral hygiene was performed by parents or caregivers on average twice a day. The diet offered to 60% of the patients of the sample showed to be cariogenic. The BMI index of these patients was not measured.

Regarding the bacterial plaque, the approved index by Ainamo and Bay was used [19], evaluating the presence or absence of plaque in a binomial standard (dichotomic count). The visible plaque received the marking “1”, while no visible plaque received the marking “0”; up to 30% was considered low, 30-65% was considered intermediate and above 65% high plaque index. The bacterial plaque index was performed with a plaque identifier (erythrosine tablet) placed in the oral cavity, promoting the bacterial plaque coloration on the dental element. A cotton swab with the identifier was placed on the teeth of the patients with cerebral palsy who had difficulty chewing.

Saliva collection and analysis

For saliva flow (SF) and buffering capacity (BC) measurement, the Salivary Test – DentoBuff® (Indon, Porto Alegre, RS, Brazil) – kit no. DB 005328, DB 005329 – was performed. In the patients with mild mental deficiency, the SF and BC tests were performed as follows: For salivary sample collection, the subject had been fasting for a period of 2 hours before its collect; for the patients who use anticonvulsive medication, its administration was carried out 2 hours before the saliva collection. In a sitting position, the patient chewed a tablet of the base gum and all the saliva accumulated in the first 30 seconds was ignored. From that on, the time was chronometered again and the saliva secreted was being collected in the graded cup at frequent intervals from 1 to 5 minutes. The total saliva volume was written down and the SF was calculated dividing the saliva volume by the collection time.

The same saliva sample was used for the BC evaluation; 1.5 mL of saliva was collected. The saliva was added to the acid solution kit together with 4 drops of the reagent. In the patients with moderate and severe mental deficiency, only the buffering capacity test was performed, as follows: The subject was fasting.

for a period of 2 hours before its conduction; for the patients on
anticonvulsive medication, its administration was carried out 2 hours before the saliva collection. A swab was introduced in the oral cavity for 3 minutes for the saliva collection after that it was centrifuged placing the saliva in the collector, and then the salivary test DentoBuff® method was used.

**Statistical analysis**

The statistical analysis performed was descriptive and analyzed the Buffering Capacity variables, Plaque and Saliva Flow Index in two different ways: considering them in their quantitative and qualitative versions. The correlation between variables of interest was evaluated through the Pearson’s linear coefficient correlation; for the Pearson’s coefficient calculation the MINITAB program – Version 15 was used. Dispersion charts were created and the correlation coefficient nullity hypothesis was tested. The tests descriptive levels were compared to the significance level of 5%.

**RESULTS**

The diagnosis of CP and its type were classified according to the medical report in relation to the type of CP, showing that 75% of the patients had the spastic type.

The results found in this article regarding the gender revealed that most of the patients were of the male gender, 65% when the frequency distribution of the variable skin color in patients with CP was analyzed, the prevalence was of 77.5% leukoderma.

Table (1) shows the mean values of some descriptive measures for the variables, age (21.6), number of tooth decay (4.3), number of missing teeth (2.6), and number of filled teeth (2.7), DMFT (9.5), Saliva Flow (0.6), Plaque Index (77.3) and Buffering Capacity (4.3).

We evaluated the existence of linear association between the following variable pairs: buffering capacity and plaque index, buffering capacity and DMFT, plaque index and DMFT, SF and BC, saliva flow and plaque index, saliva flow and DMFT.

Table (2) shows the Pearson linear coefficient correlation values calculated for the six variables pairs. In this table we can also observe the hypothesis tests descriptive levels.

\[ H_0: \text{there is no linear association between the variables of the pair against the alternative hypothesis} \]

\[ H_1: \text{there is linear association between the variables of the pair.} \]

A \( P \)-value of less than 5% (in bold) shows that there is evidence of linear association between the variables of the pair at the 5% significance level.

The results in Table (2) show that there is evidence of linear association only between buffering capacity and plaque index (moderate negative linear association), plaque index and DMFT (moderate positive linear association), and saliva flow and buffering capacity (moderate positive linear association).

In Table (3), it is possible to observe that, of the 40 patients evaluated, 34, i.e., 85% did not present structural alterations in the shape and number of teeth, with only 2 patients presenting agenesis and 4 presenting tooth rotation.

This study has demonstrated an increased number of decayed teeth 172 (45.1%), missing teeth 103 (27%), and filled teeth 106.

**Table 1: Descriptive measures.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of patients</th>
<th>Average</th>
<th>Standard deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>40</td>
<td>21.6</td>
<td>9.5</td>
<td>10</td>
<td>44</td>
</tr>
<tr>
<td>No. decayed teeth</td>
<td>40</td>
<td>4.3</td>
<td>4.2</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>No. missing teeth</td>
<td>40</td>
<td>2.6</td>
<td>5.1</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>No. filled teeth</td>
<td>40</td>
<td>2.7</td>
<td>3.6</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>DMFT index*</td>
<td>40</td>
<td>9.5</td>
<td>8.0</td>
<td>0</td>
<td>32</td>
</tr>
<tr>
<td>Salivary flow</td>
<td>40</td>
<td>0.6</td>
<td>0.3</td>
<td>0.2</td>
<td>1.6</td>
</tr>
<tr>
<td>Plaque index</td>
<td>40</td>
<td>77.3</td>
<td>23.1</td>
<td>19.6</td>
<td>100</td>
</tr>
<tr>
<td>Buffer capacity</td>
<td>40</td>
<td>4.3</td>
<td>1.2</td>
<td>3</td>
<td>7</td>
</tr>
</tbody>
</table>

*DMFT index: Decayed, missing, and filled teeth index

**Table 2: Pearson correlation coefficient values and corresponding \( P \) descriptive levels.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pearson correlation coefficient</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffer capacity Versus Plaque index</td>
<td>-0.408</td>
<td>0.009</td>
</tr>
<tr>
<td>Buffer capacity Versus DMFT index*</td>
<td>-0.117</td>
<td>0.473</td>
</tr>
<tr>
<td>Plaque index Versus DMFT index*</td>
<td>0.327</td>
<td>0.039</td>
</tr>
<tr>
<td>Salivary flow Versus Buffer capacity</td>
<td>0.642</td>
<td>0.002</td>
</tr>
<tr>
<td>Salivary flow Versus Plaque index</td>
<td>-0.163</td>
<td>0.493</td>
</tr>
<tr>
<td>Salivary flow Versus DMFT index*</td>
<td>-0.243</td>
<td>0.302</td>
</tr>
</tbody>
</table>

*DMFT index: Decayed, missing, and filled teeth index; \( p < 0.05 \)
(27.8%). The caries component ‘D’ regarding untreated caries was major in the composition of the DMFT index (Table 4).

In relation to bacterial plaque, it was verified that, of the 40 patients with cerebral palsy examined, the bacterial plaque index mean was of 77.3%. In Table (5) it is possible to observe that, of the 40 patients evaluated, 75% presented high bacterial plaque index, 20% presented intermediate and 5% presented low bacterial plaque index.

Among the factors related to saliva, one can see in Figure (1), the frequency of the saliva variable buffering capacity. The patients with CP presented 70% low buffering capacity and 15% intermediate and normal buffering capacity. In Figure (2), the results regarding the number of patients with CP presenting normal, intermediate and low levels of salivary flow were analyzed. We found a high percentage of patients (85%) with low salivary flow, 10% with intermediate salivary flow, and only 5% presented normal salivary flow.

**DISCUSSION**

After literature review, associated with clinical observations, it was possible to verify that there was an increased prevalence of caries in the permanent dentition of the patients examined (45.1%), that among the patients of the sample the bacterial plaque index was of 77.3%, and that the variables salivary flow and buffering capacity of saliva in the patients with CP were low.

The most frequent oral manifestations in patients with CP would be class II malocclusion, presence of bruxism, dental hypoplasia, dental trauma and delayed eruption of the first permanent molar [10,11,20,21]. The patients of this study 85% did not present structural alterations in the shape and number of teeth, with only 2 patients presenting agenesis and 4 presenting tooth rotation.

The incidence of the caries disease in children with CP can be higher due to the following factors: inappropriate diet, prolonged retention of food residues in the oral cavity, diet consistency, inappropriate oral hygiene, and high incidence of dental hypoplasia, which would function as a predisposing factor to dental caries [22]. This study has demonstrated an increased number of decayed teeth in 172 (45.1%), missing teeth in 103 (27%), and filled teeth in 106 (27.8%), and the DMFT index mean was of 9.5%.

Caries prevalence comparative studies among subjects with CP (study group) and subjects without cerebral palsy (control group) demonstrate a higher DMFT index in the study group [23-25].

The prevalence of caries in the deciduous, mixed and

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Table 3: Frequencies distribution of the variable structural alterations in the shape and number of teeth.

<table>
<thead>
<tr>
<th>Structural alterations in the shape and number of teeth</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>34</td>
<td>85.0</td>
</tr>
<tr>
<td>Agenesis of tooth 11</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Agenesis of tooth 45</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Giroversion of tooth 24</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Giroversion of tooth 34</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Giroversion of tooth 35</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Giroversion of tooth 43</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4: Frequencies distribution of the categorized variable DMFT*.

<table>
<thead>
<tr>
<th>Categorized DMFT*</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decayed teeth</td>
<td>172</td>
<td>45.1</td>
</tr>
<tr>
<td>Lost teeth</td>
<td>103</td>
<td>27.0</td>
</tr>
<tr>
<td>Filled teeth</td>
<td>106</td>
<td>27.8</td>
</tr>
<tr>
<td>Total</td>
<td>381</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*DMFT index: Decayed, missing, and filled teeth index

Table 5: Frequencies distribution of the categorized variable Plaque index.

<table>
<thead>
<tr>
<th>Categorized plaque index</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>30</td>
<td>75.0</td>
</tr>
<tr>
<td>Intermediate</td>
<td>8</td>
<td>20.0</td>
</tr>
<tr>
<td>Low</td>
<td>2</td>
<td>5.0</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 1 The frequency (%) of the saliva variable buffer capacity.

Figure 2 Percentage of patients X Levels of salivary flow.

The prevalence of caries in the deciduous, mixed and...
permanent dentitions in patients with CP and with special needs was evaluated by several authors, who, with their studies, verified that these patients present a difference as for the type of dental treatment received, high numbers of untreated caries lesions in both dentitions, and low number of restored teeth [23,24,26].

The bacterial plaque index was of 77.3%, which reveals that the oral health conditions in the patients with cerebral palsy in this study are not satisfactory. The oral hygiene in subjects with CP and with special needs was evaluated by several authors, and the data obtained in these studies revealed to be had with higher incidence of dental plaque, gingivitis, periodontal disease and calculus [6,7,9,25].

The presence of thick bacterial plaque is a factor that influences saliva pH, causing its reduction and facilitating the development of caries lesions [27]. Cariogenic diet consumption would cause a decrease in saliva pH, and a high DMFT index would be the reflex of an acid saliva pH. The reduced quantity of saliva flow diminishes buffering capacity and the absolute quantity of antibacterial components of saliva [28].

The saliva flow reduction observed in subjects with CP in this study would be related to the chewing stimulus reduction observed in these patients, functioning as a facilitating mechanism of odontopathogens adherence and, thus, resulting in self-cleaning reduction. The salivary flow and saliva buffering capacity variables in the patients of the sample with CP were low, respectively (85% e 70%). Other studies also had, in their sample, a higher number of participants with CP with low salivary flow velocity and buffering capacity.

CP patients should be considered an important component of the oral health team and must become knowledgeable and competent in home oral health practices. Such practices can significantly affect the child's quality of life and control dental costs [29].

During three Italian Special Olympics National Games, 365 athletes were screened. Dental and medical conditions and demographic data were recorded. The athletes were divided into two groups: those with Down syndrome (DS) and those without DS but who had intellectual disabilities (non-DS). Athletes with DS and without DS who participated in the Italian Special Olympics had a similar oral status, which was better than Italian persons who were institutionalized and who had an intellectual disability [30].

Oral hygiene, reports of oral pain, untreated caries, missing and filled teeth was recorded. The majority of the athletes were 20 years of age or older (52%). Of the examined athletes, 9% reported oral pain, 8% needed urgent care, 28% had untreated caries, 60% had filled teeth and 32% had signs of gingival disease. Mouth guards were recommended for 26% of athlete [31].

CONCLUSION

This study revealed that the profile of patients with cerebral palsy treated in a clinic of a private university of São Paulo was in the majority male (65%), leucoderma with mean age 21.6 years (9.5 years) diagnosed with spastic PC (75%), 85% of these patients did not present structural alterations in the shape and number of teeth, however, 75% presented high bacterial plaque index. 70% of the sample presented low buffering capacity and high percentage of patients (85%) with low salivary flow, there being a positive correlation between salivary flow and saliva buffer capacity suggesting that flow rate and buffering capacity of saliva should be analyzed together with other factors for determining the cariogenic potential. The findings of this study indicate the need for intervening in order to promote educational measures of prevention and health promotion.

REFERENCES

15. Ferreira de Camargo MA, Frías AC, Antunes, JLF. The incidence of dental caries in children and adolescents who have cerebral palsy and are participating in a dental program in Brazil. Spec Care Dentist 2011; 31: 210-215.


