# Prevalence and Risk Indicators of Temporomandibular Disorder Signs and Symptoms in a Pediatric Population with Spastic Cerebral Palsy

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***Objective:*** *To determine risk indicators for signs and symptoms of temporomandibular disorders (TMD) in children with cerebral palsy (n=60) and control subjects (n=60).* ***Study design:*** *The subjects were assessed by means of questionnaire and clinical exam: 1) signs and symptoms of TMD; 2) malocclusions [Dental Aesthetic Index (DAI)]; 3) harmful habits; and 4) bio-psychosocial characteristics. Statistical analysis involved the chi-square, Fisher's exact tests (p≤0.05) and multivariate logistic regression (forward stepwise procedure). Variables that achieved a p-value ≤ 0.20 were used as potential predictors of signs and symptoms of TMD and applied as co-variables in the multivariate analysis.* ***Results:*** *The prevalence of at least one sign and/or symptom of TMD in the present sample was 1.7% (n=1) among the individuals in the control group and 13.3% (n=8) among the individuals with cerebral palsy. The presence of cerebral palsy (Odds Ratio: 9.08; p=0.041), male gender (OR: 6.21; p=0.027), severity of the malocclusion (OR: 4.75; p=0.031), mouth breathing (OR: 5.40; p=0.022) and mixed dentition (OR: 4.73; p=0.035) were identified as risk indicators for signs and symptoms of TMD.* ***Conclusions:*** *It was concluded that children with cerebral palsy had a significantly greater chance of developing signs and symptoms of TMD.*

***Keywords:*** *temporomandibular disorder, cerebral palsy, malocclusion*
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## INTRODUCTION

The term temporomandibular disorder (TMD) refers to a set of functional disorders of the masticatory system,[1] marked by the presence of joint noises, mandible deviation upon opening the mouth, limitation to mandible movement, temporomandibular joint (TMJ) pain, facial pain, headaches and pain in the mandible during functioning.[2] It is a quite common disorder,[3] and its signs and symptoms used to be reported only in adult patients. However, studies carried out in recent years directed at the determination of the prevalence of signs and symptoms of TMD in young populations have demonstrated affected children and adolescents as well.[2,4-6] TMD has a multi-factor etiology,[7] including occlusal factors (malocclusion), psychological factors, parafunctional habits and hormonal factors.[5,8,9]

Individuals with cerebral palsy are considered more prone to exhibiting signs and symptoms of TMD.[10] Cerebral palsy encompasses a group of non-progressive motor disorders caused by chronic brain damage originating in the prenatal/perinatal period or the first years of life. The four main subtypes are spastic, athetoic, ataxic and mixed cerebral palsy, among which the spastic form is the most common.[11] The relation between risk indicators of TMD in such individuals is contradictory and the study of risk indicators are rare, which leaves a gap in the specialized literature and justifies the present study. This problem is all the more critical, as there have been different diagnostic criteria employed, small, heterogeneous samples and a lack of standardization regarding the degree of severity in such individuals.

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The aim of the present study was to determine risk indicators for signs and symptoms of temporomandibular disorder (TMD) in children with and without cerebral palsy.

## METHOD

One hundred twenty individuals were analyzed: 60 with the spastic form of cerebral palsy, undergoing medical-hospital care at four healthcare centers and a control group of 60 individuals with no physical or mental impairment, selected from among patients awaiting dental treatment at a teaching institution (Table 1). The following were the eligibility criteria for participation in the study: not having undergone any type of orthodontic intervention; Brazilian nationality; and confirmed diagnosis of the condition based on medical records. The project received approval from the Ethics Committee (Protocol number 0004.0.380.000-09). Parents/guardians of the participants signed terms of informed consent. The data were collected by means of a clinical exam and a questionnaire with items addressing individual and behavioral characteristics.

For the clinical exam, clinical mirrors and millimeter periodontal probes (probe from the Community Periodontal Index) were used. Dentition characteristics (primary or mixed; presence of caries) and morphological characteristics of the occlusion (tooth loss, crowding, spacing, diastema, Angle Class I, II or III, overjet, overbite, anterior open bite), facial type (average, short face or long face) and incisor relation (open bite, deep bite, protrusion) were assessed under natural light with the aid of wooden tongue depressors and a millimeter ruler.

For the determination of malocclusion severity, the criteria of the Dental Aesthetic Index (DAI)[12,13] were adopted. The DAI provides four outcome possibilities: normality or mild malocclusion, the treatment of which is unnecessary (DAI<25); defined malocclusion, the treatment of which is elective (DAI=26 to 30); severe malocclusion, the treatment of which is highly desirable (DAI=31 to 35); and very severe or debilitating malocclusion, the treatment of which is fundamental (DAI≤36). This variable was dichotomized into moderate (DAI≤30) and severe (DAI>30). Malocclusions were clinically classified as Class I, Class II and Class III (Angle classification). Crossbite was also included and identified through the clinical exam.

The criteria for the assessment and definition of signs and symptoms of TMD were based on the study carried out by Pereira et al.[14] Deviation upon opening the mouth, joint noises, limitation to movement and pain in the mandible or during movement were assessed using a millimeter ruler and facial expressions of the children and parents observations. The following social indicators were obtained by means of a specific questionnaire to which the parents/guardians responded: schooling, type of residence, number of residents in the home, use of behavior-controlling medication and scars on the chin. A semi-structured questionnaire was sent to the parents/guardians with questions regarding the child's habits (finger and/or pacifier sucking, mouth breathing, difficulty swallowing) and contained qualitative (yes or no) and quantitative (often, sometimes, never) questions.

**Table 1.** Descriptive analysis of the sample

| | Control | Cerebral Palsy |
|---|---|---|
| Number of Individuals (n) | 60 | 60 |
| Mean Age (years) | 9.63 | 11.18 |
| Primary Dentition (n) | 44 | 37 |
| Mixed Dentition (n) | 16 | 23 |

For the statistical analysis, the chi-square test and/or Fisher's exact test was used to determine the association between each independent variable and the dependent variable ($p \leq 0.05$). Variables with a p-value $\leq 0.20$ were inserted into the multivariate logistic regression model (forward stepwise procedure). The non-existence of an association between the variables was considered the null hypothesis.

## RESULTS

The prevalence of at least one sign and/or symptom of TMD in the present sample was 1.7% (n=1) among the individuals in the control group and 13.3% (n=8) of the individuals with cerebral palsy. In the preliminary analysis using the chi-square test and Fisher's exact text, significant independent associations were found for the following variables: presence of cerebral palsy (p=0.032); male gender (p=0.027); less than five residents in the home (p=0.133); calm behavior (p=0.041); facial type (p=0.056); difficulty swallowing (p=0.099); posterior crossbite (p=0.133); severe malocclusion (DAI) (p=0.011); and mixed dentition (p=0.057) (Tables 2 and 3). After the multivariate logistic regression (forward stepwise procedure), however, only the following variables remained as risk indicators for signs and symptoms of TMD: presence of cerebral palsy (Odds Ratio: 9.08; p=0.041); male gender (OR: 6.21; p=0.027); malocclusion severity (OR: 4.75; p=0.031); mouth breathing (OR: 5.40; p=0.022) and mixed dentition (OR: 4.73; p=0.035) (Table 4).

## DISCUSSION

The present study found that the patients with cerebral palsy were more prone to temporomandibular disorder. The prevalence of signs and symptoms of TMD among this population was approximately 13.3% and the presence of cerebral palsy was a strong risk indicator for this disorder (Odds Ratio: 9.08; p=0.041), with a nine-fold greater chance of such individuals having signs or symptoms of TMD over the control subjects. This corroborates findings described in the literature.[10] In individuals with cerebral palsy, disorders may range from difficulties with refined movements to severe spasticity throughout the entire body,[11] which could cause constant muscle dysfunction, thereby favoring states of mandible deviation, fatigue and/or contraction.

Ortega *et al*[10] used the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD)[15] as an assessment tool for the presence of TMD. The RDC/TMD is considered the best scale for population-based studies, but is not indicated for individuals less than 13 years of age and was therefore not used in the present study. Thus, comparisons

**Table 2.** Univariate analysis for Bio-psychosocial variables and signs and symptoms of TMD

| | Presence of one sign and/or symptom of TMD (%) | | |
|---|---|---|---|
| | No | Yes | p |
| **Groups** | | | |
| Control | 59 (98.3) | 1 (1.7) | 0.032 |
| Cerebral Palsy | 52 (86.7) | 8 (13.3) | |
| **Gender** | | | |
| Female | 71 (97.3) | 2 (2.7) | 0.027 |
| Male | 40 (85.1) | 7 (14.9) | |
| **Age** | | | |
| < 10 years | 53 (94.6) | 3 (5.4) | 0.500 |
| ≥ 10 years | 58 (90.6) | 6 (9.4) | |
| **Birth Weight** | | | |
| < 2500 g | 52 (92.9) | 4 (7.1) | 0.360 |
| ≥ 2500 g | 16 (84.2) | 3 (15.8) | |
| **Guardian's Schooling** | | | |
| > 8 years | 55 (94.8) | 3 (5.2) | 0.493 |
| ≤ 8 years | 56 (90.3) | 6 (9.7) | |
| **Type of Residence** | | | |
| Owned | 70 (90.9) | 7 (9.1) | 0.487 |
| Rented / Loaned | 41 (95.3) | 2 (4.7) | |
| **No. of Residents** | | | |
| ≤ 5 | 96 (94.1) | 6 (5.9) | 0.133 |
| > 5 | 15 (83.3) | 3 (16.7) | |
| **Use of Medication** | | | |
| No | 75 (94.9) | 4 (5.1) | 0.271 |
| Yes | 36 (87.8) | 5 (12.2) | |
| **Behavior** | | | |
| Calm | 95 (95.0) | 5 (5.0) | 0.041 |
| Agitated | 16 (80.0) | 4 (20.0) | |
| **Breathing** | | | |
| Nasal | 81 (96.4) | 3 (3.6) | 0.021 |
| Mouth | 30 (83.3) | 6 (16.7) | |
| **Scars on Chin** | | | |
| No | 109 (92.4) | 9 (7.6) | 1.000 |
| Yes | 2 (100) | 0 (0) | |
| **Caries** | | | |
| Absent | 43 (95.6) | 2 (4.4) | 0.481 |
| Present | 68 (90.7) | 7 (9.3) | |
| **Facial Type** | | | |
| Average | 69 (94.5) | 4 (5.5) | 0.056 |
| Short Face | 1 (50.0) | 1 (5.0) | |
| Long Face | 41 (91.1) | 4 (8.9) | |

**Table 3.** Variables regarding functional aspects and malocclusion (Fisher's exact test) in relation to signs and symptoms of TMD

| | Presence of one sign and/or symptom of TMD | | |
|---|---|---|---|
| | No | Yes | p |
| **Bruxism (tooth grinding/clenching)** | | | |
| No | 83 (91.2) | 8 (8.8) | 0.686 |
| Yes | 28 (96.6) | 1 (3.4) | |
| **Non-Nutritive Sucking Habit** | | | |
| No | 95 (92.2) | 8 (7.8) | 1.000 |
| Yet | 16 (94.1) | 1 (5.9) | |
| **Difficulty Swallowing** | | | |
| No | 98 (94.2) | 6 (5.8) | 0.099 |
| Yes | 13 (81.3) | 3 (18.7) | |
| **Posterior Crossbite** | | | |
| Absent | 96 (94.1) | 6 (5.9) | 0.133 |
| Present | 15 (83.3) | 3 (16.7) | |
| **Tooth Loss** | | | |
| None | 100 (93.5) | 7 (6.5) | 0.252 |
| One or More | 11 (84.6) | 2 (15.4) | |
| **Crowding** | | | |
| None | 67 (93.1) | 5 (6.9) | 1.000 |
| One or Two Segments | 44 (91.7) | 4 (8.3) | |
| **Spacing** | | | |
| None | 59 (93.7) | 4 (6.3) | 0.734 |
| One or Two Segments | 52 (91.2) | 5 (8.8) | |
| **Midline Diastema** | | | |
| < 2 mm | 80 (93.0) | 6 (7.0) | 0.712 |
| ≥ 2 mm | 31 (91.2) | 3 (8.8) | |
| **Upper Irregularity** | | | |
| < 2 mm | 94 (93.1) | 7 (6.9) | 0.633 |
| ≥ 2 mm | 17 (89.5) | 2 (10.5) | |
| **Overjet** | | | |
| < 4 mm | 97 (92.4) | 8 (7.6) | 1.000 |
| ≥ 4 mm | 14 (93.3) | 1 (6.7) | |
| **Mandible Protrusion** | | | |
| < 4 mm | 69 (95.8) | 3 (4.2) | 0.154 |
| ≥ 4 mm | 42 (87.5) | 6 (12.5) | |
| **Anterior Open Bite** | | | |
| No | 109 (93.2) | 8 (6.8) | 0.210 |
| Yes | 2 (66.7) | 1 (33.3) | |
| **Severity of Malocclusion (DAI)** | | | |
| Moderate | 65 (98.5) | 1 (1.5) | 0.011 |
| Severe | 46 (85.2) | 8 (14.8) | |
| **Type of Dentition** | | | |
| Primary | 78 (96.3) | 3 (3.7) | 0.057 |
| Mixed | 33 (84.6) | 6 (15.4) | |

should be made with caution.

The prevalence of musculoskeletal disorders in the individuals who participated in the present study was low. However, the prevalence of TMD in young individuals is predictably lower than that found in adolescents and adults[5,16,17] and severe dysfunction is rarely encountered in young patients.[18] The present study involved only individuals in the phases of primary and mixed dentition, such that the results were compatible with the above-cited studies. Ortega et al.[10] found a threefold greater prevalence of TMD in individuals with cerebral palsy (67%) in comparison to control subjects (25%), which was also found in the present study. It should be stressed that the greater frequency of patients with TMD in the sample of the study cited was mainly due to the assessment instrument employed, which involved a greater number of items and therefore increased the chances of a positive diagnosis. Moreover, the individuals assessed were between three and 23 years of age, such that older individuals, who are more prone to signs and symptoms of TMD, were included in the sample.

In the present study, gender was also considered an important factor in the incidence of TMD, with males affected more than females. This result is in disagreement with the knowledge widely discussed in the literature, which suggests that TMD is 1.5-to-2.0-fold more prevalent among women.[19] This result may be easily explained by the fact that the majority of individuals with signs and symptoms of TMD in the present study had cerebral palsy and, as such, the preponderant factor was not the hormonal influence, but rather the cerebral palsy. Furthermore, gender differences are less evident in early childhood and become more obvious between the ages of 20 and 40 years, at which point they tend to diminish with age.[20]

The risk indicators assessed in the present study were chosen based on the search for possible triggering agents of pain and dysfunction in childhood. The influence of dentition phases and occlusal factors over the development of TMD remains a matter of speculation. In the present study, the severity of the malocclusion (OR: 4.75; p=0.031) and the mixed dentition phases were significantly associated to the

**Table 4.** Multivariate logistic regression for dependent variable (signs and symptoms of TMD)

| | Presence of one sign and/or symptom of TMD | |
|---|---|---|
| | **Non-adjusted OR (95% CI)** | **p** |
| **Groups** | | |
| Control | 1.00 | |
| Cerebral Palsy | 9.08 (1.1-75.0) | 0.041 |
| **Gender** | | |
| Female | 1.00 | |
| Male | 6.21 (1.23-31.3) | 0.027 |
| **Severity of Malocclusion (DAI)** | | |
| Moderate | 1.00 | |
| Severe | 4.75 (1.1-19.6) | 0.031 |
| **Type of Breathing** | | |
| Nasal | 1.00 | |
| Mouth | 5.40 (1.3-22.9) | 0.022 |
| **No. of Residents** | | |
| ≤ 5 | 1.00 | |
| > 5 | 3.77 (0.8-16.9) | 0.083 |
| **Posterior Crossbite** | | |
| Absent | 1.00 | |
| Present | 3.20 (0.7-14.2) | 0.126 |
| **Overjet** | | |
| < 4 mm | 1.00 | |
| ≥ 4 mm | 3.29 (0.8-13.8) | 0.105 |
| **Dentition** | | |
| Primary | 1.00 | |
| Mixed | 4.73 (1.1-20.0) | 0.035 |
| **Facial Type** | | |
| Average | 1.00 | |
| Short Face | 17.25 (0.9-32.4) | 0.058 |
| Long Face | 1.7 (0.4-7.1) | 0.478 |

presence of TMD in the multivariate analysis (OR: 4.73; p=0.035). In a systematic review of population-based studies, Gesch *et al* [8] investigated the association of malocclusion and occlusal interference with symptoms of TMD. The results revealed that such associations were not uniform and no occlusal pattern was found. However, there are accounts in the literature finding malocclusion to be associated to abnormalities in masticatory function among children, with lesser masticatory efficiency,[21] lesser bite strength,[22] asymmetry in the activity of masticatory muscles and morphological musculoskeletal abnormalities.[23] Thus, occlusal factors appear to be involved in some aspect of individual susceptibility to TMD.[24]

Mouth breathing was also a strong risk indicator for signs and symptoms of TMD (OR: 5.40; p=0.022). The use of accessory respiratory muscles and mouth breathing suggest a direct relation with TMD. Children with a mouth-breathing habit have greater sensitivity upon palpation of the posterior region of the TMJ, medial and lateral pterygoid muscle and trapezium when compared to children with a nasal-breathing habit.[25]

The socioeconomic variables assessed, such as income and schooling of the parents/guardian, were not associated to signs and symptoms of TMD; the same was true for birth weight and harmful habits in the multivariate regression model (p>0.05). A number of studies have attempted to find a relation between socioeconomic level or schooling with pain[27,28] and TMD.[29,30] However, this relation actually appears not to exist,[17,30] which is corroborated by the findings in the present study. Sucking habits are very common and normally do not affect the equilibrium of the stomatognathic system.[4,6]

Short face was preliminarily identified as independently associated to signs and symptoms of TMD. Previous studies have found that low activity of the elevator muscles of the mandible are associated to the vertical growth pattern[31] and this characteristic is frequently seen in patients with TMD.[32] However, in the multivariate analysis in the present study, facial pattern was no longer associated to signs and symptoms of TMD. This is likely due to the fact that the individuals were young and therefore exhibited signs and symptoms of low intensity and had not yet gone through the growth spurt of puberty.

Care for children with cerebral palsy is a considerable challenge for healthcare professionals. The results of the present study furnish important evidence that may assist multidisciplinary approaches directed at patients with this profile, leading to a better understanding of the determinant factors of TMD and an early treatment of these patients in specialized institutions.

## CONCLUSION

Children with cerebral palsy had a greater chance of developing signs and symptoms of temporomandibular disorders than individuals without this condition.

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