

## Temporomandibular disorders in cerebral palsy: literature review

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### Abstract

**Introduction:** In cerebral palsy the greater neurologically compromised patients have the highest functional involvement of the masticatory system and the highest structural involvement of the temporomandibular joint (TMJ). These conditions contribute to the likelihood of the onset of articular and muscular disorders. These disorders affect the orofacial region and can cause pain, audible noise upon articulation, irregular mandibular functions with deviations, known as Temporomandibular Joint Dysfunctions (TMD). Traditionally, clinical studies have been limited to articular restrictions in detriment to the various neurological and motor clinical aspects. The objective of this research is to examine studies which investigated the prevalence of TMD signs in cerebral palsy, as well as studies about several aspects of the pathology surrounding TMD, including functional, structural, neurological, and clinical aspects. **Materials and Methods:** We carried out literature review of several studies published between 1976 and 2014. Scielo, MEDLINE, PubMed, EMBASE, CINAHL, DARE, Psych Info, ERIC, AMI, Cochrane, and PEDro databases were used to research literature on TMD using the following keywords without restrictions: cerebral palsy, temporomandibular disorders, and rehabilitation. **Results:** The literature showed that signs of TMD in cerebral palsy may be prevalent in severe clinical forms which can make cervical control more difficult and lead to postural deviations. **Conclusion:** Craniometric changes in head circumference may limit TMJ and occlusion movements, worsened by hypertonia and asymmetry in the pterygoid and masseter muscles. Children with swallowing and oropharyngeal difficulties are more likely to show signs of TMD.

**Keywords:** cerebral palsy, temporomandibular disorders, oral rehabilitation, tonus, head circumference, oropharyngeal, mastication, postural control.

### 1 Introduction

Cerebral palsy (CP) can be defined as a non-progressive, variable, and stable encephalopathy stemming from a pre-natal, peri-natal, post-natal lesion which can compromise the central nervous system's (CNS) neuromaturation period (FLETT, 2003; ROMEO, CIONI, SCOTO et al., 2008; SCHOEN, RICCI, and OLIVEIRA, 2003; SOUZA and FERRARETO, 1998). Epidemiological studies in developed countries demonstrate that there is a prevalence of 1.5 to 2.5 cases for every thousand births (SOUZA and FERRARETO, 1998; BEGNOCHE and PITETTI, 2007).

The patient's clinical conditions describe changes in reflexes, tonus, posture, and in both voluntary and automatic movements (BECKUNG, CARLSSON, CARLSDOTTER et al., 2007; DAMIANO, ABEL, ROMNESS et al., 2006; DIAMENT and CYPEL, 1996; DAMIANO, DODD and TAYLOR, 2002).

According to the severity of motor damage, patients may later show signs of tetraplegia, diplegia, our hemiplegia,

involving, respectively, four members, limited to lower limbs and/or a hemibody (FLETT, 2003; DAMIANO, ABEL, ROMNESS et al., 2006; ROMEO, CIONI, SCOTO et al., 2008; CROMPTON, GALEA and PHILLIPS, 2007). The existent tonic changes may lead, due to encephalopathy, to spasticity, athetosis, dystonic coreoathetosis, or ataxia, with variation according to which areas and regions of the CNS have been harmed (PALISANO, ROSENBAUM, WALTER et al., 1997; DAMIANO, DODD and TAYLOR, 2002, DAMIANO, ABEL, ROMNESS et al., 2006; SCHOEN, RICCI, and OLIVEIRA, 2003).

Lesions in the CNS may cause involuntary movements, excessive contortions, stiffness in muscle groups, as well as limitations in voluntary movements of face and masticatory muscles (NAKAGIMA, OHNISHI, NAGASAWA et al., 1988). According to Maria (2002) and Vaughan, Neilson and O'Dwyer (1988), patients with CP who are more neurologically compromised

have higher functional involvement of the masticatory system and structural involvement of the temporomandibular joint (TMJ). This is undoubtedly due to the increase in muscle spasticity, and limitations in jaw movements.

These conditions increase the onset of joint and muscle disorders affecting the orofacial region, characterized mainly by pain, audible noise upon movements with the TMJ, and irregular mandibular function, thus defining a temporomandibular joint dysfunction (TMD) (ZARB, CARLSSON, SESSLE et al., 2000). According to Miamoto, Pereira, Paiva et al. (2011), continuous signs of TMD in children with CP show that these patients are much more likely to develop the dysfunction compared to healthy individuals.

Recent studies on oral rehabilitation in dentistry for special needs patients have been focusing on the importance of assessing TMDs in the masticatory function, in the stomatognathic and respiratory functions, as well as in the dental treatment prognosis (ORTEGA, GUIMARÃES, CIAMPONI et al., 2008; MARIA, 2002). Recently, research results on the clinical aspects of TMDs involve not only pathological articular signs, but also craniofacial, functional, and neurological structural variations, such as head circumference, means of how TMD appear, diet, motor, tonic, and postural involvement (RIES and BERZIN, 2005; ORTEGA, GUIMARÃES, CIAMPONI et al., 2008; PELEGANO, 1976; MARRARA, DUCA, DANTAS et al., 2008; SCHMIDT, BRIESEMEISTER and RIES, 2014).

However, the study of clinical signs assigned to patients' TMJ is still limited to answers from analyzing joint limitations at the detriment of signs of the severity of neurological problems in clinical cases of CP. This can hide the severity of TMD in guidance and individual treatment by the professionals involved (ORTEGA, GUIMARÃES, CIAMPONI et al., 2008; MARIA, 2002; NAKAGIMA, OHNISHI, NAGASAWA et al., 1988). As such, upon assessing individuals with CP, it is necessary to do so with a multifactorial approach, so that new methods for preventing TMD can be found which would help patients grow up without requiring severe oral correction treatments and rehabilitation (MARIA, 2002).

The objective of this study is to carry out literature review of several studies published between 1976 and 2014 regarding functional, structural, neurological, and clinical characteristics of TMD in patients with CP.

## 2 Materials and Methods

Scielo, MEDLINE, PubMed, EMBASE, CINAHL, DARE, PsychInfo, ERIC, AMI, Cochrane, and PEDro databases were used as resources for research scientific literature using keywords without restrictions. In this systematization, a search was conducted using the following words: cerebral palsy, temporomandibular disorders, and oral rehabilitation.

## 3 Results and Discussion

After examining literature and analyzing the databases, 38 scientific articles were selected. Of these articles, 24 of them were used. These 24 articles were about parameterized clinical essays involving patients with CP and a clinical morphofunctional approach directly or indirectly related to the assessment of signs of TMD in joints. The assessment regarded the following themes: topographic and/or tonic clinical forms, oropharyngeal function, orofacial muscles,

craniometry, and postural control. Fourteen studies were discarded, as they were not clinical essays and/or were not conducted by oral rehabilitation professionals.

In a clinical study about TMD in 36 children with CP, Rocco (1976) showed a high incidence of these disorders in the pathology, especially in regards to difficulties in occlusion with overbite (class II – Angle), due to motor disorders that these children displayed and affecting orofacial muscles. Ortega, Guimarães, Ciamponi et al. (2008) reported that the number of TMD cases are significantly higher in individuals with CP (68%) compared to a control group made up of normal subjects (25%), concluding that the clinical severity of CP seems to worsen the pathological signs of TMD. However, Bertoli, Losso and Moresca (2009) note that although these signs and symptoms are present in normal children, they are less severe compared to adults, showing that these signs increase with age, and that early diagnosis is of great importance.

Clinically, aside from TMDs, there are various important functional disorders which aggravate not only TMDs in CP, but also joint restrictions. These disorders may emerge primarily due to the increases in patient's life expectancy, and may also include malocclusion and bruxism (SOUZA and FERRARETO, 1998). There have also been studies surrounding CP about signs of TMD which considered the patients' tonic condition. Ries and Berzin (2005) compared children with CP and healthy children, using the modified Ashworth scale for measuring the degree of spasticity in places where a higher incidence of changes in jaw movements was observed, such as lateral deviations and protrusions, in children with CP. Other studies show no correlation between the severity of TMD and the degree of spasticity (VAUGHAN, NEILSON and O'DWYER, 1988; MARIA, 2002). Alfaro, Gonzalez, Robles et al. (1999) demonstrated that the masseteric inhibitor reflex obtained in young individuals and adults with CP is not altered by the disease's subgroup (spastic group or athetosis group), but by the patients' type of occlusion.

Oral motor coordination dysfunction, as well as oropharyngeal and masticatory muscle dysfunction, have been responsible for the aggravation of TMD signs in CP. In a clinical essay, Ortega, Guimarães, Ciamponi et al. (2008) showed that the severity of TMJ dysfunction in spastic tetraplegia patients is associated to reduced bite strength and to mouth opening limitation. According to Souza and Ferrareto (1998), it is important to consider the possible ways children with CP can be compensated to better coordinate abnormal oral motor skills when swallowing, breathing, and chewing, caused by insufficient selective intrinsic movements dissociated from the tongue and jaw (SOUZA and FERRARETO, 1998). Marrara, Duca, Dantas et al. (2008), during a clinical retrospective study on how children with neurological conditions swallow, observed that, in the oral stage, when swallowing liquid or viscous foods, the inadequate presence of food propulsion was most frequently detected as the consequence of an oropharyngeal muscle dysfunction upon chewing, thus interfering with the TMJ's functions.

The correlation between morphology, function, and TMD has been reported in CP cases using craniometric measurements. In an anthropometric analysis, Watemberg, Silver, Harel et al. (2002) observed, by analyzing and measuring the head circumference of children with CP that 15.4% of the patients showed below average measurements, which is considered one of the main diagnoses associated with microcephaly. Studies about the head

circumference's growth parameters related to all of the clinical forms of CP show that these measurements are significantly lower in cases of tetraplegia and hemiplegia, compared to healthy individuals (ZONTA, AGERT, MUZZOLON et al., 2009). According to Pelegano (1976), these restrictions on growth stimuli of the craniomandibular structure around the TMJ region may condition and worsen muscle groups' reduced activity, including lateral pterygoid muscles affected by hypertonia brought upon by CP.

Joint signs and noise indicating the presence of the dysfunction, as well as mouth opening limitation and reduced occlusion strength (biting), are correlated with CP patients and patients with smaller head circumference (ORTEGA, GUIMARÃES, CIAMPONI et al., 2008; PELEGANO, 1976). These clinical signs show that morphological changes and changes in the craniometric structure, caused by TMD in the joint components of patients with CP are important functional restriction factors, similarly seen in other pathologies and joint degenerative diseases (FLETT, 2003; CROMPTON, GALEA and PHILLIPS, 2007).

Clinical studies drawing correlations between TMD and CP have been performed applying validated clinical protocols, such as the *Diagnostic Criteria for Temporomandibular Disorders* (DC/TMD) (ORBACH, GONZALEZ, LIST et al., 2013). Although the protocols contain evidence of joint signs that could facilitate the emergence of TMD, it is still necessary to investigate variables related to neurological and motor conditions afflicting patients (ORTEGA, GUIMARÃES, CIAMPONI et al., 2008; MARIA, 2002; NAKAGIMA, OHNISHI, NAGASAWA et al., 1988).

Posture deviations are common in patients with CP, due to limitations in the movement of the cervical column and, consequently, tensing of muscle groups around the neck and pectoral girdle, making CP patients more likely to be affected by temporomandibular and masticatory system dysfunctions (KIRVESKARI, ALANEN, KARSKELA et al., 1988; MARIA, 2002; ROBINSON, 1966). For example, forward head posture with mandibular retrognathism may lead to posterior rotation and condyle fixation, further accentuating the TMJ's deterioration (ORTEGA, GUIMARÃES, CIAMPONI et al., 2008). Saito, Akashi and Sacco (2009) consider that postural changes may interfere not only with displacement of the articular disk, but also with painful symptomatology. However, these analyses are based on evidence and assessments of healthy individuals (KIRVESKARI, ALANEN, KARSKELA et al., 1988; MARIA, 2002; ROBINSON, 1966).

Schmidt, Briesemeister and Ries (2014), in a study conducted on 16 children with CP, observed that during chewing cycle maintenance, there is greater asymmetry present in the pterygoid muscles' electric activity in relation to masseter muscles, associated with further extension and forwarding of the head. However, patients have showed few signs of TMD. According to the author, stimulating masticatory muscles decreases the likelihood of craniofacial disorders found in patients with CP (SCHMIDT, BRIESEMEISTER and RIES, 2014).

#### 4 Conclusion

Temporomandibular dysfunctions may be prevalent in severe clinical forms with higher difficulty in cervical control and posture deviations in CP. Craniometric changes in the head circumference may limit TMJ and occlusion movements,

further affected by hypertonia and asymmetry in pterygoid and masseter muscle activities. Children showing difficulties when swallowing and using oropharyngeal muscles possess functional involvement of the masticatory and temporomandibular systems, increasing the likelihood of TMD signs to emerge.

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