

# MANDIBULAR MOVEMENTS IN CHILDREN WITH AND WITHOUT SIGNS AND SYMPTOMS OF TEMPOROMANDIBULAR DISORDERS

## MOVIMENTOS MANDIBULARES EM CRIANÇAS PORTADORAS OU NÃO DE SINAIS E SINTOMAS DE DISFUNÇÃO TEMPOROMANDIBULAR

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This research aimed to evaluate mandibular movements in children with and without signs and symptoms of temporomandibular dysfunction. The sample taken consisted of 99 children aged 3 to 5 years distributed in two groups: I – Absence of signs and/or symptoms of TMD (25 girls/40 boys); II – Presence of signs and symptoms of TMD (16 girls/18 boys). The symptoms were evaluated through an anamnesis questionnaire answered by the child's parents/caretakers. The clinical signs were evaluated through intra- and extraoral examination. Maximum mouth opening and left/right lateral movements were measured using a digital caliper. The maximum protrusive movement was measured using a millimeter ruler. The means and standard deviations for maximum mouth opening in Group I and Group II were  $40.82\text{mm} \pm 4.18$  and  $40.46\text{mm} \pm 6.66$ , respectively. The values found for the left lateral movement were  $6.96\text{mm} \pm 1.66$  for Group I and  $6.74\text{mm} \pm 1.55$  for Group II, while for the right lateral movement they were  $6.46\text{mm} \pm 1.53$  and  $6.74\text{mm} \pm 1.77$ . The maximum protrusion movements were  $5.67\text{mm} \pm 1.76$  and  $6.12\text{mm} \pm 1.92$ , in Groups I and II, respectively. The mandibular movement ranges neither differed statistically between groups nor between genders. FAPESP Process 96/0714-6.

**UNITERMS:** Temporomandibular dysfunction; Mandibular movements; Child; Dentition, primary.

## INTRODUCTION

Temporomandibular disorder (TMD) is a collective term that embraces a number of clinical conditions that involve the temporomandibular joint (TMJ) and/or masticatory muscles and associated structures<sup>19</sup>. Articular sounds, jaw deviation and mouth opening limitation, condyle asymmetry, temporomandibular joint and facial pain, headache and earache are the most common signs and symptoms of TMD<sup>4,16,17</sup> occurring singly or in combination<sup>21</sup>. Temporomandibular disorder is considered to have a multifactorial etiology. Therefore it is difficult to establish a precise diagnosis, and consequently the treatment tends

only to alleviate the current problems of those disorders<sup>5</sup>.

Some studies have shown that signs and symptoms of TMD can be found in all age groups<sup>8,9,16,17</sup> and there have been an increasing number of experiments with regard to the prevalence of signs and symptoms of TMD in children and adolescents<sup>2,5,6,27</sup>.

Literature suggests that TMD is 1.5-2 times more prevalent in women than in men, and that 80% of patients treated for this disorder are women<sup>18,19</sup>. However, certain contradictory studies exist with evidence that there are no statistically significant differences between genders<sup>14</sup>.

Mandibular movement ranges have been studied in normal adult individuals<sup>8,16</sup> and in individuals with TMD<sup>22,29</sup>.

It was observed that diseased TMJ leads to altered, mainly decreased mandibular movement ranges<sup>5,29</sup>. Therefore, the determination of mandibular movements is a valuable, simple and objective method of TMJ functional evaluation<sup>24</sup>. Although it is unclear how the individual components of the examination contribute to the final diagnosis<sup>20</sup>, most clinicians would agree that substantially reduced mandibular motion is a strong indicator of the presence of TMD and helps to distinguish TMD patients from non-TMD controls<sup>13,26</sup>.

Currently, clinical examination is the gold standard for diagnosing temporomandibular disorders (TMD) and involves assessment of jaw motion, tenderness of jaw muscles and temporomandibular joints, and joint noises<sup>20</sup>. Thus, the purpose of this study was to compare the mandibular range of motion in children with or without clinical signs and/or symptoms of TMD and between genders.

## MATERIAL AND METHODS

Ninety-nine children, ranging from 3 to 5 years of age, were randomly chosen in the city of Piracicaba, Brazil. Written and verbal consent were obtained from each child's parents/caretakers after they had been informed about the procedures, possible discomforts or risks, as well as the possible benefits. The Ethics Committee of the Piracicaba Dental School, State University of Campinas, approved the research. Two examiners from the Department of Pediatric Dentistry carried out the examinations. In order to promote standardized data collection before initiation of the study, including morphological and functional diagnoses, both examiners were trained to locate the specific muscle and joint palpation sites with a pressure of about 500g<sup>11</sup> and measure the mandibular movements. When they were well trained and before starting this study, an inter- and intraobserver calibration test was performed during routine examinations in children of different ages attending the Pediatric Clinic of Piracicaba Dental School. There was good reproducibility during training.

All parents/caretakers were interviewed with an anamnesis questionnaire because the children's age did not allow reliable answers. The questionnaire evaluated the following qualitative (yes or no) and quantitative (frequently, occasional, or never) aspects of:

- Headache
- Neck pain
- Earache
- Jaw pain
- Pain during mastication or mouth opening
- Difficulty during mouth opening, speaking, yawning or eating
- Joint click
- Jaw tiredness

Only headaches and earaches of unknown etiology were recorded to be considered as symptoms, and they should be manifested frequently (more than once a week), as well

as the other symptomatic manifestations.

Clinical examinations based on intra- and extraoral aspects were performed. The intraoral examination consisted of evaluation of occlusal characteristics such as molar and canine relationship, crossbite, premature tooth loss, midline deviation in habitual clenching, overbite and overjet, the details of which are the basis for another report, as well as the parafunctional habits.

Mandibular deviation was determined during the mouth opening movement to the left or right, in accordance to Egermark-Eriksson<sup>10</sup> (1982) by measuring the mandibular midline distance between the mandibular and maxillary central incisors in relation to the maxillary midline. The appropriate position was marked using a pencil marker when the midline deviation was presented in centric occlusion, and a deviation of 2mm or more was recorded as a sign of temporomandibular dysfunction.

The extraoral examination was performed with the index and middle fingers on the temporomandibular joints in order to verify the condyle motion in opening and closing movements (symmetric/asymmetric, synchronized/not synchronized). Moreover, the temporomandibular joints were examined for tenderness, and the child was asked about the difference of sensitivity between the right and left sides. The palpebral reflex caused by pain was also observed (eyelid reaction). Palpation was performed with a standard pressure of about 500g<sup>11</sup>, maintained for 2 seconds with the index finger. No difference in level was considered. Examination of TMJ sounds was carried out as evidently audible for right and left sides without using a stethoscope and using the index finger<sup>16</sup>.

Muscle tenderness was also determined by palpation<sup>23</sup> in the same way as TMJ tenderness. The following muscles were verified:

- anterior and posterior portions of the temporal muscle
- superficial portions of the masseter muscle
- medial pterygoid muscles

Palpation was carried out simultaneously on both right and left sides; however, the medial pterygoid muscles were individually verified.

After evaluation by the above mentioned criteria, the 99 children were separated into 2 groups:

Group I (control) – Absence of signs and symptoms of TMD (25 girls/40 boys)

Group II – Presence of signs and symptoms of TMD (16 girls/18 boys)

The variables analyzed were: maximum mouth opening, protrusion, right and left lateral movements, considering gender differences. Maximum mouth opening and the right and left lateral movements were measured with a digital caliper. For measurement of the maximum mouth opening movement, the children were requested to open their mouths as much as possible, while the examiner accomplished slight bidigital pressure on the surface of the maxillary and mandibular incisors. Then the distance between the incisal borders was measured, adding the overbite value. The children made the right and left lateral movements as instructed by the examiner. The distance measurement was

taken between the coincident mandibular and maxillary midlines. If there was no coincidence, a pencil mark was made on the surface of the maxillary incisor, corresponding to the mandibular midline, and later the measurement was made. The protrusion distance was measured with a ruler between the maxillary and mandibular incisal borders, adding the overjet value. The values considered as restricted movements were:

- Mouth opening < 34 mm
- Lateral movement < 5 mm
- Protrusive movement < 5 mm
- Mandibular mobility. The maximal opening was recorded as moderately reduced range of motion (25–34 mm) or severely reduced range of motion (< 25mm)<sup>28</sup>.

**Statistical Analysis**

The data were computerized and the Sigma Stat package was used to analyze them. The Student t test was used to compare the differences between both data groups. Comparison between genders was made using One-Way Analysis of Variance (Anova) test, at 95% level of confidence. The z-test was used to determine if proportions of restricted mandibular movements within two groups were significantly different.

**RESULTS**

Table 1 shows the mean values and standard deviation of mandibular movements between groups, while Table 2 reveals the mean values of the mandibular movements between boys and girls. Table 3 shows the number of subjects with restricted movements in both groups. There were no statistical differences in any of the mandibular movements between those with and without signs and symptoms and between boys and girls.

**DISCUSSION**

Cross-sectional and longitudinal studies have revealed that the prevalence of signs and symptoms of mandibular dysfunction occurs in children as often as it does in adults<sup>27</sup>. In this study, 34.34% of the sample presented at least one sign and/or symptom of TMD. Comparing to an older population studied, our results are much lower than those found in the Egermark-Eriksson<sup>10</sup> (1982) study, with a prevalence of 46.7% in children aged 7 to 15 years old, and lower than observed by Akeel, Al-Jasser<sup>1</sup> (1999), with a prevalence of 41% in children aged 8, 14, and 18 years old. The smaller prevalence in young children could be justified by the fact that most signs and symptoms are characterized

**TABLE 1-** Mean values (standard deviations) of mandibular movements (mm) between groups

	<b>Mouth Opening</b>	<b>Right lateral movement</b>	<b>Left lateral movement</b>	<b>Protrusion</b>
Group I	40.82 (4.18)	6.46 (1.53)	6.96 (1.66)	5.67 (1.76)
Group II	40.46 (6.66)	6.74 (1.77)	6.74 (1.55)	6.12 (1.92)

Student t test p>0.05

**TABLE 2-** Mean values (standard deviations) of mandibular movements (mm) in relation to gender

	<b>Maximal Mouth Opening</b>		<b>Right Lateral Movement</b>		<b>Left Lateral Movement</b>		<b>Protrusion</b>	
	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy
Group I	39.89 (3.38)	41.39 (4.55)	6.23 (1.62)	6.60 (1.47)	7.07 (1.78)	6.88 (1.60)	5.59 (1.61)	5.73 (1.86)
Group II	39 (7.23)	41.75 (6.02)	6.37 (1.50)	7.06 (1.97)	6.25 (1.39)	7.18 (1.59)	5.97 (1.98)	6.26 (1.91)

ANOVA p>0.05

as mild, and severe dysfunction is rare<sup>9</sup>.

Various signs and symptoms have been used to define temporomandibular conditions in children; however, it is not clear whether these signs and symptoms are normal variation, preclinical features, or manifestations of a disease state<sup>3</sup>. As the reduction of mandibular movements may be a sign of muscle and/or TMJ dysfunction<sup>4,29</sup> the intention was to evaluate mandibular movements in children with and without signs and symptoms of TMD and to compare them to others presented in the literature. Table 1 showed that there were no differences between the two groups. Despite the difference in the sample's age, these findings are in accordance with Vanderas<sup>29</sup> (1992), who did not observe differences in mandibular movements in children aged 6 to 10 years, with and without clinical signs of dysfunction. Sönmes et al.<sup>27</sup> (2001) also observed no statistical difference between children with and without signs and symptoms of TMD. Celic, et al.<sup>7</sup> (2003) found that there were statistically significant differences in the range of mandibular movements that separate asymptomatic subjects from patients with muscle disorders and disc displacements with reduction in a young male population. However, they were not able to conclude that measurements of active mandibular movements could discriminate one group (TMD patients) from the other (asymptomatic subjects), because the mean ranges of these active movements between the groups were measured in clinically normal values.

Considering the maximum mouth opening in the primary dentition, Bernal, Tsamtsouris<sup>4</sup> (1986) verified a mean value of 42±4.6mm, and Gavião, et al.<sup>12</sup> (1997) 45.72mm. The findings of this study (Table 1) were smaller than the above mentioned outcomes and could be attributed to the differences in the methodology and dentition status<sup>4,9</sup>, as well as in the definition of the diagnostic criteria<sup>2</sup>. Nevertheless, Rothenberg<sup>25</sup> (1991) recorded a mean of 40.47mm for children aged 4 to 6, and Alamoudi, et al.<sup>2</sup> (1998) found 41.2±5.6mm for children aged 3 to 7 years old, measurements which are closest to this study.

A great variability was observed in the range of maximum mouth opening in the total sample in the present study (22.75

to 57mm), and values smaller than 34mm were considered moderately restricted mouth opening. These values have indicated a prevalence of 4.04% in the total sample, without statistical difference between groups (Table 3), while only one child presented severely restricted mouth opening. De Vis, et al.<sup>8</sup> (1984) analyzed children aged 3 to 6 years old and obtained values varying from 25 to 55mm, and 2.2% presented restricted opening movement (less than 30mm). Respective values found by Bernal, Tsamtsouris<sup>4</sup> (1986) ranged from 31 to 57mm, with 5% of total sample presenting restricted opening movement (less than 34mm). Also considering opening movement less than 34, Alamoudi, et al.<sup>2</sup> (1998) observed that 1.7% of the sample presented restricted ranges of motion. These differences could be attributed to the variable age of the study samples, as well the body height<sup>29</sup>, developmental or structural differences in the TMJ apparatus<sup>2</sup>. Moreover, there was no difference between the proportions into the two groups (z-test p>0.05, Table 3), suggesting that the clinically detected signs of TMD did not influence the vertical mandibular movement in the studied sample, probably due to the mild severity, corroborating Vanderas<sup>29</sup> (1992) and Sönmez, et al.<sup>27</sup> (2001). Vanderas<sup>29</sup> (1992) considered that, on an individual basis, there may be a decrease in the size of mandibular movement in children with TMJ dysfunction, so it is advisable, when recording a dysfunctional movement, to measure the comfortable movement that is not associated with pain and the maximal movement that may be associated with pain. Furthermore, the author considered that if signs and symptoms of dysfunction do not restrict the movements, the comfortable and maximal movements are the same and any difference between them should be considered dysfunctional. On the other hand, this statement needs more evidence.

In relation to the horizontal mandibular movements in the primary dentition, few data are presented in literature. Bernal, Tsamtsouris<sup>4</sup> (1986) did not record protrusive and lateral movements, since it was difficult to get small children to perform these movements. However, the children in this study sample were trained before collecting the data, thus

**TABLE 3-** Number and percentage of subjects with restricted movements in both groups

	Mouth Opening 25-34mm		Mouth Opening <25mm		Protrusion <5mm		Right lateral Movement <5mm		Left Lateral Movement <5mm	
	n	%	n	%	n	%	n	%	n	%
Group I	2	3.08	-	-	20	30.77	11	16.92	6	9.23
Group II	2	5.88	1	2.94	6	17.65	5	14.71	3	8.82
Total	4	4.04	1	1.01	26	26,26	16	16.16	9	9.09

Z-test p>0.05

they performed truthful movements in the horizontal plane.

Lateral movements normally vary from 8 to 12mm and the decrease in the movement amplitude to one side frequently reflects a contralateral joint disharmony<sup>24</sup>. Vanderas<sup>29</sup> (1992) also studied lateral movements in children aged 6 to 10 years old with and without clinical signs of TMD and observed that there was no difference in the movement average in both groups. No statistical difference was found in this research either, although the absolute values were smaller, due to the different ages of the children.

Könönen, et al.<sup>17</sup> (1987) found higher values (10.7mm) than those found in the present study, however they studied children aged 10 to 16 years old. Vanderas<sup>29</sup> (1992) demonstrated a mean of 9.28mm and 9.08mm in children with and without clinical signs of temporomandibular dysfunction, respectively, differing from the results of this study, although it was in agreement with the finding of no statistical difference between both groups.

There was no statistical difference in any of the mandibular movements between boys and girls. Even though the difference between gender does not seem to influence the presence of signs and symptoms in children and in young and middle-aged adults, it is twice as prevalent in women as in men<sup>17,30</sup>. According to Warren and Fried<sup>30</sup> (2001) the gender and age distribution of TMD suggests a possible link between its pathogenesis and the female hormonal axis, because the pain onset tends to occur after puberty and peaks in the reproductive years, with the highest prevalence occurring in women aged 20-40 and the lowest among children, adolescents, and the elderly.

Since TMD signs and symptoms are present in very young children, a routine dental examination of the TMJ and masticatory system should be undertaken to identify subjects at high risk of having TMD. Other factors must also be investigated in childhood, such as psychological and occlusal characteristics<sup>15,27,28</sup>, in order to associate them with dysfunction. Despite the controversy about occlusal characteristics and TMD, children with malocclusion should be orthodontically treated at an early age to eliminate the traits of the anomaly and to take advantage of the craniofacial growth and thereby achieve the greatest functional adaptation possible<sup>28</sup>. The question of whether such measures will also prevent the development of TMD or not, or even reduce TMD signs and symptoms in these patients, is still open to discussion, since the cause of mandibular dysfunction is obviously multifactorial.

It was possible to conclude that the range of mandibular movements in children with signs and/or symptoms of TMD did not differ from asymptomatic children or between boys and girls. Therefore, the absence of significant difference in the range of mandibular motion between groups could suggest that children present a great capacity for adaptation of the stomatognathic system<sup>23</sup> and it may not affect the mandibular movements.

## RESUMO

O objetivo desta pesquisa foi avaliar a amplitude dos movimentos mandibulares em crianças portadoras ou não de sinais e sintomas de disfunção temporomandibular. A amostra consistiu de 99 crianças entre 3 e 5 anos distribuídas em 2 grupos: I – Ausência de sinais e sintomas de DTM (25 meninas/40 meninos) II – Presença de sinais e sintomas de DTM (16 meninas/18 meninos). Os sintomas foram avaliados através de um questionário respondido pelos pais ou responsáveis das crianças. Os sinais clínicos foram avaliados através de exame intra e extra-oral por dois examinadores calibrados. Os movimentos de abertura máxima e lateralidade direita e esquerda foram mensurados com o auxílio de um paquímetro digital. Para o movimento de protrusão foi utilizada régua milimetrada. A média e o desvio padrão para abertura bucal máxima para o grupo I foi de 40,82mm±4,18 e para o grupo II 40,46mm±6,66. Os valores encontrados para a lateralidade esquerda foram 6,96mm±1,66 para o grupo I e 6,74mm±1,55 para o grupo II e, para a direita, foram 6,46mm±1,53 e de 6,74mm±1,77, respectivamente. Durante a protrusão foram encontrados valores de 5,67mm±1,76 para o grupo I e 6,12mm±1,92 para grupo II. Pode-se concluir que na amostra avaliada a amplitude dos movimentos mandibulares não diferiu estatisticamente entre os grupos, bem como entre os gêneros. FAPESP Processo 96/0714-6.

**UNITERMOS:** Disfunção temporomandibular; Movimentos mandibulares; Crianças; Dentição decídua.

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**Recebido para publicação em: 08/07/2003**  
**Enviado para reformulações em: 16/09/2003**  
**Pronto para publicação em: 30/10/2003**

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