

FACTORS AFFECTING THE MANDIBULAR RANGE OF MOTION IN CHILDREN

Fatores que interferem na amplitude dos movimentos mandibulares em crianças

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ABSTRACT

Purpose: identify factors that may influence the mandibular movement range (MMR). **Methods:** 181 schoolchildren participated, both gender, 8 to 12 years old, asymptomatic for temporomandibular disorders, according to RDC/TMD. Was performed the measurement of the maximum mouth opening (MMO) range, excursive movements of right and left laterality (RL and LL, respectively), and protrusion (PROT), being measured with the digital caliper Starret Série 799 millimeter measurements. Nutritionists registered anthropometric evaluations of height and weight. **Results:** average data of height and weight was: $32,23 \pm 8,74$ kg and $137,42 \pm 9,52$ cm, respectively. To the male gender we found: $49,59 \pm 5,03$ mm, on the MMO; $8,40 \pm 1,74$ mm, on the RL; $8,45 \pm 1,41$ mm, on the LL; $7,60 \pm 1,40$ mm, on the PROT; and to the female gender: $49,06 \pm 4,43$ mm, on the MMO; $7,77 \pm 1,87$ mm, on the RL; $8,02 \pm 1,91$ mm, on the LL; $6,89 \pm 1,74$ mm, on the PROT. The correlation between MMO and weight wasn't significant ($P > 0,05$). The variables frequently to the MMO were gender, age and height. However the gender wasn't correlated with the MMO and LL, and without interference, after applied the regression, to the MMO, except to the PROT ($P = 0,001$). **Conclusion:** the interfering factors on the movement range of MMO, RL, LL and PROT was: age, gender and height to the study sample, being the gender the less expressive variable. It's suggested that to register the MMO, must be consider the age, height and gender, in children in between 8 to 12 years old.

KEYWORDS: Temporomandibular Joint; Range of Motion, Articular; Child; Temporomandibular Joint Disorders

■ INTRODUCTION

Humans go through a phase of growth and development of the craniofacial complex transition from deciduous to permanent dentition, in which several adaptive functional changes occur in the

temporomandibular joint (TMJ)¹. The morphology of TMJ in newborn presents with flattening of the articular cavity, without the presence of articular eminence for the function of suction is feasible. Subsequently, they begin to perform more elaborated and coordinated mandibular movements, generating the development of the articular eminence that allows the realization of biomechanics, promoting mandibular movements of mouth opening, lateral and protrusion². In this, the condylar movements are not only determined by the articular eminence, disc and the ligaments of the TMJ, as well as for occlusal and neuromuscular³ factors. The static and dynamic relations between anatomical structures of the TMJ, occlusal areas and their functional relation participate in the normal and pathological process of temporomandibular system functions⁴.

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Deviations in TMJ and or its functioning, characterized by the presence of signs and symptoms of TMD (Temporomandibular Dysfunction)⁵, although they are more prevalent in adults, they can also be observed in children populations⁶, ie, in the stage of growth and development of the craniofacial complex, including the transition from deciduous to permanent dentition. These signs and symptoms are represented by muscle and joint pain, limitation and deviation in the mandibular trajectory⁷, joint noises during oral opening and closing, headaches, pains in the neck and ear manifestations, such as ear pain, ear fullness, tinnitus, and others^{8,9}.

During the clinical examination, the limitations of mandibular movements represent an important signal for understanding the diagnosis of TMD¹⁰. Thus, knowledge about the mandibular range of motion (MRM) has been the subject of interest of many researchers^{3,10,11}, because this is a relevant tool for the assessment of masticatory functional status^{10,12}. In addition, this information enables a valuable follow-up parameter in the treatment of patients affected by TMD¹¹. Among the studies on mandibular movements in children^{3,4,10,13}, few are correlated to possible factors that may interfere in the determination of the range of these movements^{3,12,14}. The high variability of the movements makes this assessment difficult³. Thus, seeking better understanding of mandibular dynamics, this study aimed to identify factors that may influence mandibular range of motion in children.

METHODS

This study was registered at SISNEP / CONEP, under No. 307495 and approved by the Research Ethics Committee FOUFBA, in accordance with Opinion No.17/10.

This is a descriptive, cross-sectional, observational study. The research was conducted with 181 students, of both genders, aged 8-12 years, living in São Francisco do Conde, Bahia, and the guardians signed, agreeing to the "Terms of Free and Clear Consentment".

The study excluded voluntary children who had absence of the central incisors, loss of 5 or more subsequent dental elements, stunted stories of facial trauma, head and neck surgery, a clinical diagnosis of neurological disorders, craniofacial malformations and non-collaborators. Nor those who had signs and symptoms related to functional disorders of TMJ, according to the contents of the RDC/TMD^{7,15}.

Individual assessments were performed and measurement of the maximum mouth opening (MMO) range were obtained, as well as right lateral (RL),

left lateral (LL) and protrusion (Prot) excursive movements.

a) MMO: They were asked to perform voluntary mouth opening in the painless limit and considered the maximum interincisive distance, having the incisal edge of the right upper and lower incisors as reference, plus the extent of the vertical trespass¹³;

b) Prot: From the condition of the teeth in occlusion, the distance from the buccal surface of the lower incisor teeth to the incisal face of the upper ones was measured. Then it was asked the volunteer to protrude the jaw, sliding it against the maxilla, followed by measuring the horizontal distance from the buccal surface of the upper incisal to the incisal edge of the lower ones. The sum resulted in the jaw protrusion measurement¹⁰;

c) RL/LL: It was requested that the child promote maximum displacement of the jaw to the right and measured the horizontal distance between the dental midline of the upper central incisors and lower central ones or between the labial frenulum. The same procedure was used to measure the left lateral excursion¹⁰.

All children were instructed to remain seated with their feet flat on the floor with their head in a resting position. The instrument used for the measurements was the Universal Type Digital caliper Starrett Series 799. Two measurements for each variable studied were performed and their averages obtained.

The anthropometric measurements of height and weight were measured and recorded by a team of nutritionist researchers.

In statistical analysis, the results were expressed as percentage, average and standard deviation and inferential statistical techniques were used: t-student test with equal or unequal variances or Mann-Whitney test F (ANOVA) with Tukey comparisons, Pearson or Spearman correlations, simple and multiple linear regression with variable selection method. The verification of the hypothesis of equality of variances was performed using the F test (Levene). The margin of error used in the decision of the statistical tests was 5.0%. Statistical "software" used to obtain the statistical calculations was the SPSS (Statistical Package for Social Sciences) version 17 and STAT version 11.

RESULTS

The sample consisted of 181 students, 91 (50.3%) male and 90 (49.7%) females. The age of respondents ranged from 8 to 12 years, with average of 9.70 ± 1.39 years.

Average values of weight and height were 32.23 ± 8.74 kg and 137.42 ± 9.52 cm, respectively. For males the following values were found: 49.59 ± 5.03

mm in MMO, 8.40 ± 1.74 mm in RL, 8.45 ± 1.91 in LL, and 7.60 ± 1.90 mm in Prot and females was observed : 49.06 ± 4.43 mm in MMO, 7.77 ± 1.87 mm in RL, 8.02 ± 1.91 mm in LL, and 6.89 ± 1.74 in Prot . The correlation between MRM and gender, age, weight and height can be seen in Tables 1 and 3.

After the correlations were verified, a multivariate regression was applied for all variables mentioned in order to obtain predictors for mandibular range of motion (Table 4). Among all the analysis, the results indicate that the most often found variable to MRM studied were age, height and gender, but the latter was not correlated to the MMO and LL (Tables 1 and 4).

Table 1 – Average and standard deviation of the variables of the mandibular range of motion based on independent variables

Variables	MMO	RL	LL	Protrusion
	Avg \pm S.D	Avg \pm S.D	Avg \pm S.D	Avg \pm S.D
• Gender				
Male	$49,59 \pm 5,03$	$8,40 \pm 1,74$	$8,45 \pm 1,95$	$7,60 \pm 1,90$
Female	$49,06 \pm 4,43$	$7,77 \pm 1,87$	$8,02 \pm 1,91$	$6,89 \pm 1,74$
Value of p	$p^{(1)} = 0,454$	$p^{(1)} = 0,019^*$	$p^{(1)} = 0,134$	$p^{(1)} = 0,009^*$
• Age (in years)				
8	$47,29 \pm 4,99^{(A)}$	$7,68 \pm 1,91$	$7,62 \pm 1,88^{(A)}$	$6,48 \pm 2,06^{(A)}$
9	$49,74 \pm 4,73^{(AB)}$	$7,85 \pm 1,83$	$7,99 \pm 2,04^{(AB)}$	$7,35 \pm 1,63^{(AB)}$
10	$50,80 \pm 3,60^{(B)}$	$8,10 \pm 1,85$	$8,62 \pm 1,96^{(AB)}$	$7,30 \pm 1,56^{(AB)}$
11	$49,88 \pm 4,69^{(AB)}$	$8,75 \pm 1,40$	$8,91 \pm 1,66^{(B)}$	$7,61 \pm 1,72^{(AB)}$
12	$49,51 \pm 5,01^{(AB)}$	$8,48 \pm 1,89$	$8,42 \pm 1,88^{(AB)}$	$8,04 \pm 1,94^{(B)}$
Value of p	$p^{(2)} = 0,008^*$	$p^{(2)} = 0,103$	$p^{(2)} = 0,031^*$	$p^{(2)} = 0,005^*$

MMO: Maximum Mouth Opening

RL: Right Laterality

LL: Left Laterality

(*): Significant difference at the level of 5.0%

(1): Through t-Student equal test.

(2): Through F(ANOVA) test.

P.S.: If all the letters in brackets are different, there are significant differences between corresponding age groups by Tukey's pairwise comparisons.

Table 2 – Average and standard deviation of weight and height according to gender

Variable	WEIGHT	HEIGHT
	Avg \pm S.D	Avg \pm S.D
Total group	$32,23 \pm 8,74$	$137,42 \pm 9,52$
• Gender		
Male	$32,79 \pm 8,56$	$138,16 \pm 9,25$
Female	$31,65 \pm 8,93$	$136,67 \pm 9,78$
Value of p	$p^{(1)} = 0,254$	$p^{(1)} = 0,238$

(1): Through Mann-Whitney test.

(*): Significant difference at the level of 5.0%

Table 3 – Spearman correlation between age and each variable of the mandibular range of motion

Variable	MMO	RL	LL	Protrusion
	r_s (p)	r_s (p)	r_s (p)	r_s (p)
Age ⁽¹⁾	0,176 (0,018*)	0,197 (0,008*)	0,224 (0,002*)	0,268 (< 0,001*)
Height ⁽²⁾	0,277 (< 0,001*)	0,170 (0,022*)	0,134 (0,072)	0,214 (0,004*)
Weight ⁽²⁾	0,224 (0,002*)	0,095 (0,201)	0,063 (0,399)	0,142 (0,056)

MMO: Maximum Mouth Opening

RL: Right Laterality

LL: Left Laterality

(1): Spearman Correlation.

(2): Pearson Correlation.

(*): Statistically different from zero at the level of 5,0%

Table 4 – Results of mandibular range of motion regression with independent variables

MRM	Variable	Coefficient	Value of p
• MMO	• Height	0,14	p < 0,001*
• RL	• Height	0,03	p = 0,033*
• LL	• Age	0,29	p = 0,005*
• Prot	• Age	0,31	p = 0,001*
	• Gender	0,61	p = 0,026*

MRM: Mandibular Range of Motion

MMO: Maximum Mouth Opening

RL: Right Laterality

LL: Left Laterality

Prot: Protrusion

(*): Significant difference at the level of 5,0%

■ DISCUSSION

The present study determined some variables that might be interfering in mandibular movements. Compared between genders, the MRM does not present statistically significant differences, except for the movements of RL 8.40 ± 1.74 mm in males and 7.77 ± 1.87 mm for females and Prot $7.60 \pm 1,90$ mm, for male and 6.89 ± 1.74 mm for females ($p < 0.05$).

In this research, it was observed that although not significant, the average values of MRM were higher in boys than in girls, unlike what was found in the study that investigated the mandibular movement of children between 6 and 10 years old, divided into TMD symptomatic groups and asymptomatic¹⁶. As a result, the authors concluded that for the opening of the mouth, when compared between genders, there was a higher average in girls, though the representation was also not significant.

Research conducted with a sample of 212 children aged 3 to 11 years, revealed no significant differences between the mandibular range of motion and gender¹², agreeable conclusion to the findings of this study. About-Atme et al.³ in their study of 102

children aged 4 to 15 years also found no differences between genders.

In an analysis conducted with 303 children aged 6 to 14 which investigated the influence of gender on the MRM, did not show any difference between these variables¹⁶. Unlike what was found in studies in children, researches show statistically significant differences between genders in populations comprised of adolescents¹⁷ and adults⁹, revealing that sexual maturity, in which the differentiation of various physical characteristics of humans occurs, seems to be impactful, also, regarding the mandibular range of motion^{10,16}.

Comparing the ages, it was observed that there was only statistically significant difference for the MMO between 8 years old (47.29 ± 4.99 mm) and 10 years old (50.80 ± 3.60), for LL between 8 years old (7.62 ± 1.88 mm) and 11 years old (8.91 ± 1.66), for Prot at ages 8 years (6.48 ± 2.06 mm) and 12 years (8.04 ± 1.94) (Tab.2). I.e., there was difference in average values of 8 years old for other ranges and few changes were observed in the later age groups.

The findings of this study are in agreement with Souza et al.¹⁴ who also found similar differences when investigated the mandibular range of motion

in children 6-14 years old. The research by Axe, Medeiros and Felicio¹⁰ revealed differences among children 6-12 years old. These researchers worked with three different age groups, where GROUP I consisted of children aged 6 and 8 years, the GROUP II from 8.1 to 10 years, and GROUP III consisted of children 10-12 years. Regarding MMO, RL, LL and Prot variables, the authors concluded that the values assigned to Group I were lower than those granted to other groups.

Low values of MMO are found in children with deciduous dentition and slightly lower in children with mixed dentition, hence it is concluded that the difference of these measurement may be subject to various stages of tooth eruption which are unique at different ages¹². Finally, regarding the age, Track-Atme et al.³ argue that there is a wide variety of measurement of MRM found in research involving children.

Regarding the weight, only MMO was significantly correlated, consistent with the research findings of Abou-Atme et al.³ performed in 102 children with an average age of 9.1 years old. The authors found a strong correlation between MMO and variable weight ($p < 0.001$). In the other analyzed mandibular movements (RL, LL and Prot.), there was no correlation between these and the weight (Table 3). Differing from the present research, Souza et al.¹⁴ analyzed the MRM in 303 children aged between 6 and 14 years and also found a positive correlation to the movements of RL, LL and Prot., besides MMO in children who were entered in the weight range 17.30kg to 46,50kg.

In the comparison between the height and range of the other mandibular movements, significant

differences for the MMO, RL and protrusion were found. The results are in agreement with the records of the scientific literature, since correlations between this variable and mandibular movements in children were observed^{3,12,14}. The same behavior seems to repeat in adult populations, as suggested by the study that identified a correlation of height with MMO¹¹. The authors believe that, in some circumstances, height seems to have a greater influence on MMO than age, since although growth is not continuous and constant in years, at certain periods it can happen faster and in others slower³, different, and therefore, the findings among the studied population.

Taking into account the obtained and commented results so far, it should be noted that scientific research to MRM mentions more often MMO with a lack of analyzes involving the lateral excursions of the mandible and protrusion^{10, 14, 18}.

■ CONCLUSION

Based on the findings of this study, the most prevalent factors that interfered with the range of motion of MMO, RL, LL, Prot. were gender, age and height for the studied sample. However, the gender showed little significance, since there was no correlation for MMO and LL as well as non-interfering after regression applied to the MRM, except for the protrusive movement. It is suggested that in clinical evaluations, the MRM is recorded, taking into account the mentioned variables, especially the age and height for children who are aged between 8 and 12 years.

RESUMO

Objetivo: identificar os fatores que possam influenciar na amplitude dos movimentos mandibulares (AMMs) em crianças. **Métodos:** participaram 181 escolares, ambos os gêneros, 8 a 12 anos, assintomáticas para Disfunção Temporomandibular (DTM), segundo o RDC/ TMD. Realizou-se a mensuração da amplitude da abertura oral máxima (AOM), movimentos excursivos de lateralidade direita (LD), esquerda (LE) e protrusão (Prot), sendo aferidas medidas milimétricas com o Paquímetro Digital Starret Série 799. Nutricionistas registraram as avaliações antropométricas de peso e altura. **Resultados:** dados médios do peso e altura foram $32,23 \pm 8,74$ kg e $137,42 \pm 9,52$ cm, respectivamente. Para o gênero masculino encontrou-se os valores: $49,59 \pm 5,03$ mm, na AOM; $8,40 \pm 1,74$ mm, na LD; $8,45 \pm 1,91$, nas LE e $7,60 \pm 1,90$ mm, na Prot e no gênero feminino: $49,06 \pm 4,43$ mm, na AOM; $7,77 \pm 1,87$ mm, na LD; $8,02 \pm 1,91$ mm, na LE e $6,89 \pm 1,74$, na Prot. A correlação entre a amplitude dos movimentos mandibulares e o peso não se mostrou significativa ($P > 0,05$). As variáveis mais influentes para a AMMs foram gênero, idade e altura. No entanto, o gênero não se mostrou correlacionado com a abertura oral máxima e lateralidade esquerda, e sem interferência, após aplicada a regressão, para os movimentos mandibulares estudados, exceto a protrusão ($p = 0,001$). **Conclusão:** os fatores interferentes na amplitude dos movimentos de abertura oral máxima, lateralidade direita, lateralidade esquerda e protrusão foram: idade, gênero e altura para a amostra estudada, sendo o gênero, a variável menos expressiva. Sugere-se nas avaliações clínicas, que a amplitude dos movimentos mandibulares seja registrada, considerando as variáveis mencionadas, especialmente a idade e altura, para crianças de idade entre 8 e 12 anos.

DESCRIPTORIOS: Articulação Temporomandibular; Amplitude de Movimento Articular; Criança; Transtornos da Articulação Temporomandibular

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