Maxillary constriction: Are there differences between anterior and posterior regions?

Regina Helena Lourenço Belluzzo[1], Kurt Faltin Junior[2], Cícero Ermínio Lascala[3], Lucas Bacci Renno Vianna[4]

Objective: To evaluate the transverse constriction of the maxilla in both anterior and posterior regions, using Korkhaus analysis and to check whether there were any statistically significant differences within its values.

Method: The sample comprised 341 study models. The study models were randomly selected from previous cases, without gender, age and malocclusion restrictions. The models were submitted to Korkhaus analysis. Data from these models were subjected to statistical analyzes in order to evaluate differences in anterior and posterior regions.

Results: The transverse discrepancies were statistically significant ($p<0.001$) with a greater constriction in the anterior region (mean -2.84 mm).

Conclusion: The results showed that the differential diagnosis is very important and the treatment plan may be adapted to specific therapy focusing in a greater expansion in the anterior region.

Keywords: Maxilla. Dental casts. Treatment results.

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Atresia maxilar: há diferenças entre as regiões anterior e posterior?

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Objetivo: avaliar a atresia transversa da maxila em duas regiões anatômicas, anterior e posterior, através da análise de Korkhaus, e verificar se há diferença estatisticamente significativa em seus valores.

Métodos: a amostra foi constituída de 341 modelos de estudo iniciais, escolhidos aleatoriamente, sem restrições em relação ao sexo, à idade e à má oclusão. Os modelos foram submetidos à análise transversa de Korkhaus e os valores obtidos analisados estatisticamente, para avaliar se as atresias encontradas eram diferentes nas regiões anterior e posterior.

Resultados: as discrepâncias transversas são, em média, -2,84mm mais atrésicas na região anterior, sendo essa diferença estatisticamente significativa.

Conclusão: os resultados mostraram que o diagnóstico diferencial é muito importante e devemos adequá-lo aos nossos planos de tratamento e, consequentemente, a uma terapia específica de expansão maior na região anterior.

Palavras-chave: Maxila. Modelos dentários. Resultado de tratamento.

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INTRODUCTION

The maxillary deficiency in the transverse plane is called maxillary constriction. The main etiologic factors of this deficiency are mouth breathing, harmful habits, like thumb sucking and/or pacifiers, and atypical phonation and swallowing. The passage of air through the nostrils, purified and warmed by the nasal hair, and the contact of the dorsum of the tongue at rest with the palate are the major stimuli of transverse growth of the maxilla during the craniofacial developmental period. The poor positioning of the tongue, the imbalance of perioral muscles, the lack of lip seal, together with the labial hypotonicity, contribute to maxillary constriction.[1,4,5,6]

The maxilla is a bone fixed in the cranial base through the nasomaxillary and sphenoccipital sutures, and it is mainly formed by two bones, the right and the left, which are articulated through the median palatal suture. At around 3 years of age this suture appears straight and almost flat and still separates the premaxilla in the anterior region. From 6 to 10 years of age the ossification of the intramembranous suture starts to form smooth interdigitations, resulting in a stronger union between the right and the left bones. By 10 years of age, these interdigitations intensify until completion of the "fusion" between both right and left maxillary bones, when the separation of the premaxilla ceases to exist, becoming one bone after puberty.[1,2,3]

The maxillary constriction affects most of the orthodontic patients and is one of the most prevalent malocclusions in the orthodontic practice. This is also because it is generally associated with other types of malocclusion such as Class II and III.[1,2,3,5,8,9]

Maxillary constriction treatment is essential for the success and continuity of treatment of these associated malocclusions. Usually the maxilla must be "prepared" to receive the mandible, unlocking the occlusion and its functions.

Tollaro et al[8] published a study in 60 patients with Class II malocclusion in the mixed dentition. They found -3.5 mm as the mean value of transverse discrepancy due to maxillary constriction.

Bacetti et al[1] reviewed 25 patients presenting with Class II malocclusion in two different times: T_1 during primary dentition, mean age of 5 years and 8 months; and T_2 during mixed dentition, mean age of 8 years and 1 month. The authors found that all patients in primary dentition presented a mean transverse discrepancy of -2.8 mm, due to maxillary constriction, and that this discrepancy worsened during mixed dentition to a mean value of -4.1 mm. Many authors[2-5,7,9] also mention the need for previous expansion in patients with Class III malocclusion at a young age, both to correct transverse discrepancies, but also to lead to the separation of the maxillary sutures and to facilitate the orthopedic movement through maxillary protraction.

OBJECTIVES

The aim of this study was to determine whether maxillary constriction is different in anterior and posterior region in a Brazilian population and to compare these values to establish if there are any clinical statistical differences, as maxillary constriction is one of the most recurrent malocclusions in the orthodontic practice and its previous correction is indispensable to the evolution of associated malocclusion orthodontic treatment.

MATERIAL AND METHODS

The study sample consisted of 341 initial orthodontic study models from a private practice. These were randomly selected from number 1,500 to number 2,100, with no restriction in relation to malocclusion, age and gender.

Korkhaus analysis[6] was performed in each study model to observe the maxilla and the mandible transverse discrepancy values in anterior (first premolars) and posterior (first permanent molars) regions.

The Korkhaus analysis[6] may be used both in primary, mixed or permanent dentition, and its specificity is that a differential diagnosis of maxillary constriction of the anterior and posterior regions can be made separately. For this analysis it was used dry point compass, ruler, and registration sheet to record the results.

According to the analysis of Korkhaus[6] the points for measuring the anterior region are (Figs 1 and 2):

» In the maxilla:

- Deciduous intermolar distance: central fossae to central fossae of the first primary molars, or
- Interpremolar distance: central fossae to central fossae of the first premolars.

» In the mandible:

- Deciduous intermolar distance: top of distobuccal cusp of the first primary molars, or
- Interpremolar distance: most buccal contact point of the first and second premolars.

The points in the posterior region (Figs 1 and 2) are:

» **In the maxilla:**

- Intermolar distance: central fossae to central fossae of the first permanent molars.

» **In the mandible:**

- Intermolar distance: top of buccal median cusp of the first permanent molars.

The Korkhaus analysis[6] is interpreted by subtracting the maxilla's value (anterior and posterior) from the mandible's value, resulting in the transverse discrepancy of each region. Negative values indicate a maxillary constriction, and positive values indicate larger maxilla than mandible or a mandibular constriction. Values equal to zero show a normal maxillomandibular transverse relationship.

These values were measured twice at two different times by the same examiner. When the first measurement was equal to the second one ($M_1 = M_2$), a third measurement was not performed. However when M_1 was different from M_2, a third measurement (M_3) was performed and considered only when equal to M_1 or M_2.

Values for the differences between anterior (interpremolars or first deciduous molars) and posterior (permanent intermolars) regions were then noted in a table, and also if the constriction relationship was anterior or equivalent.

The constriction was considered anterior when values of the difference between anterior and posterior regions were different (negatively) by more than -2.0 mm (Fig 3 and Table 1); and as equivalent when both values (anterior and posterior) were equal or their difference was smaller than -2.0 mm (Fig 4 and Table 2).

After obtaining the values of anterior and posterior discrepancies, and its classification in anterior or equivalent constriction, the results were subjected to statistical analysis.

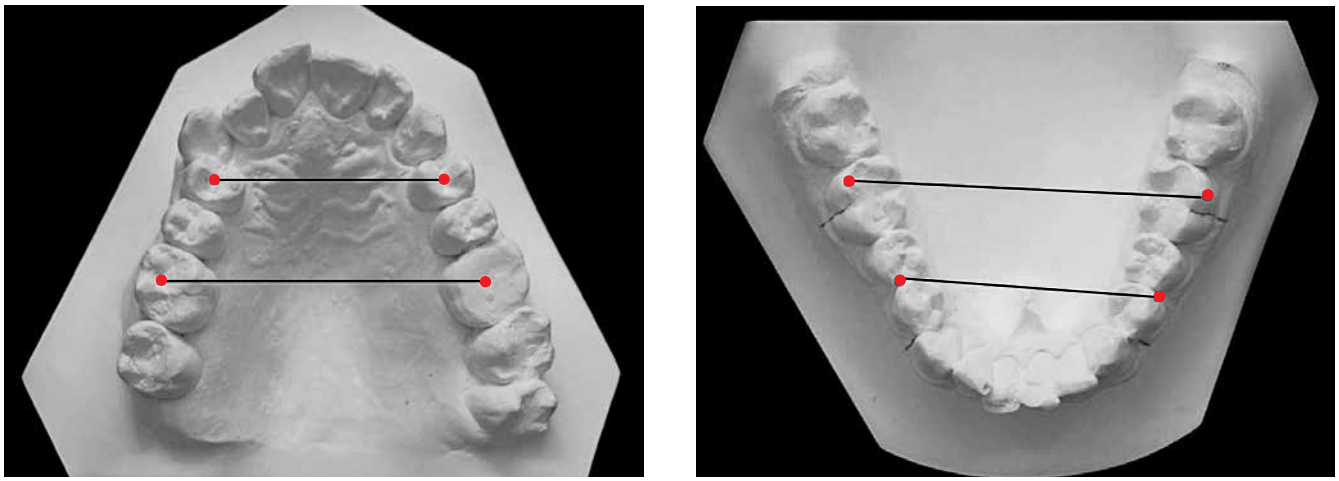


Figure 1 - Permanent dentition measuring points.

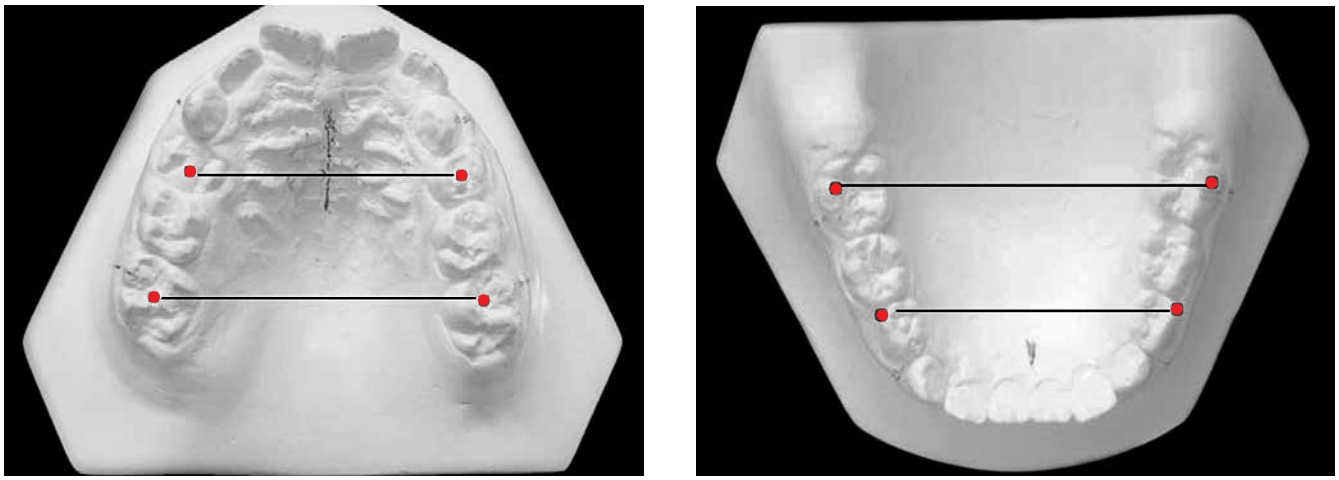


Figure 2 - Mixed or deciduous dentition measuring points.

RESULTS

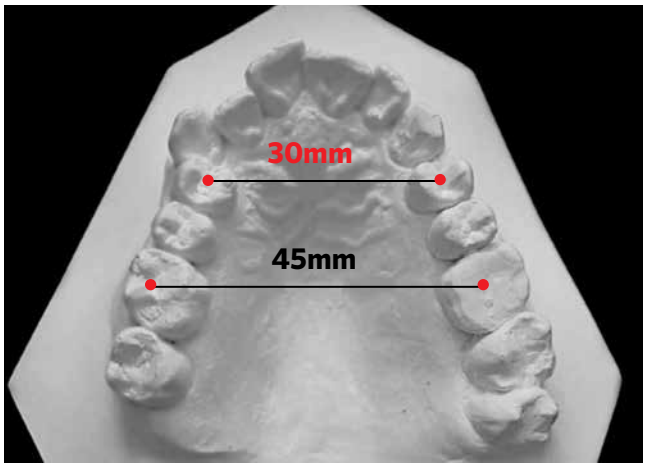
A total of 341 young patient's study models was analyzed according to the described methodology. Two hundred and thirty one patients (67,7%) were considered with equivalent constriction and 110 (32,3%) with anterior constriction.

Both groups were subjected to statistical analysis by obtaining the mean, the standard deviation, the median, the minimum and maximum values and the descriptive level of the Mann-Whitney non-parametric test, as shown in Table 3.

The results show that when comparing the anterior and equivalent constriction groups' values to the interpremolar values there is a statistically significant difference ($p < 0.001$) in the anterior group, with mean values of -3.58 mm (Fig 5).

When comparing the intermolar values, a statistically significant difference ($p < 0.001$) in the equivalent constriction group is found, with mean values of -2.23 mm (Fig 6).

However when the mean values of the difference between the anterior and equivalent constriction and the interpremolar and intermolar regions are compared, it is observed that the anterior constriction's value is less statistically significant ($p < 0.001$) than the equivalent group, with means of -2.84 mm (Fig 7).



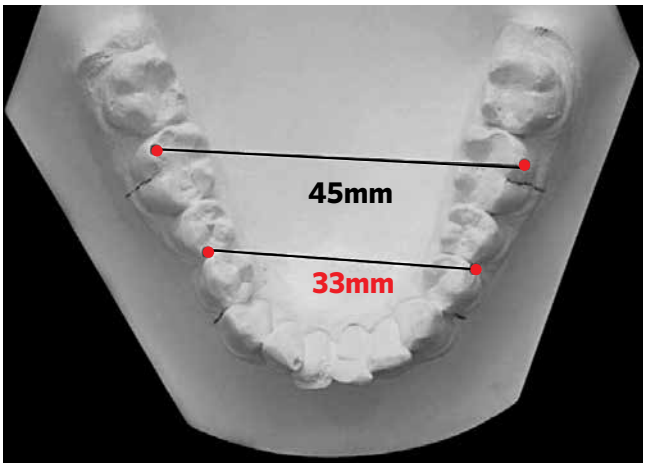
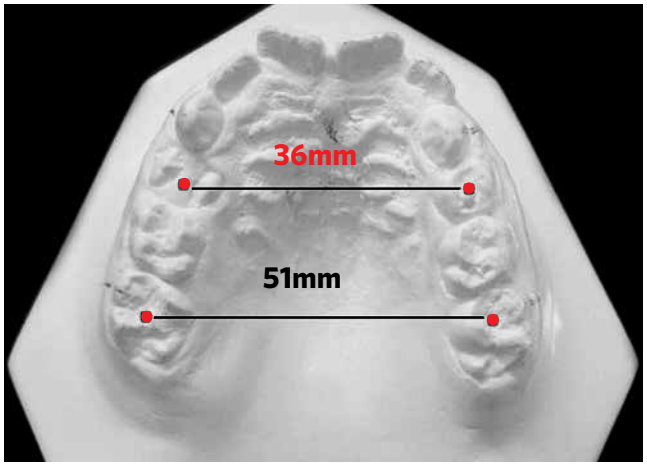


Figure 3 - Korkhaus analysis showing anterior constriction.



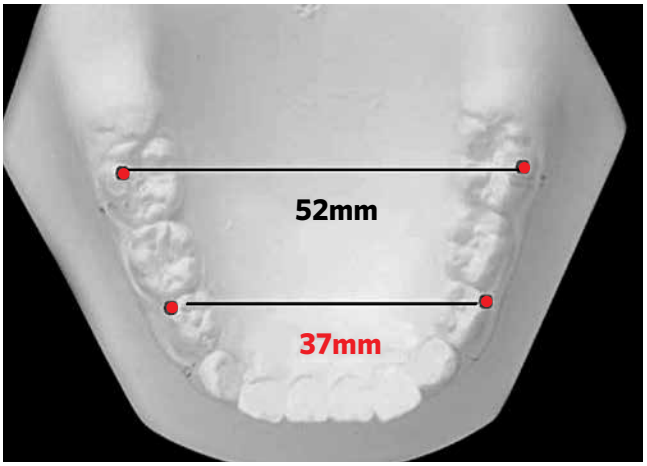


Figure 4 - Korkhaus analysis showing equivalent constriction.

Table 1 - Example of a diagnosed anterior constriction, as shown on Figure 3.

Patient	anterior	posterior	constriction
1500	-3mm	0mm	anterior

Table 2 - Example of a diagnosed equivalent constriction, as shown on Figure 4.

Patient	anterior	posterior	constriction
1500	-1mm	-1mm	equivalent

These results clinically demonstrate that constriction in the premolars region is statistically significantly lower in the anterior constriction group than in the equivalent constriction group, meaning that constriction should not be treated as an unique group or even the same apparatus used to treat both groups.

DISCUSSION

The maxillary constriction has always been subject of many studies and concerns among orthodontists, being the median palatal suture the anatomical structure of greater importance for these evaluations.

The palatal suture joins the right and the left jaws through their interdigitations. When the patient is young these interdigitations are weak and almost flat, and with growth and craniofacial development this relationship gets increasingly closer and stronger until the final bone is consolidated in puberty.

Table 3 - Comparison between the constriction groups in relation to interpremolar and intermolar measurements.

VARIABLE	Constriction	n	Mean	SD	Median	Minimum	Maximum	p*
Interpremolar	Anterior	110	-3.58	1.40	-3.50	-7.00	2.50	<0.001
	Equivalent	231	-1.90	1.49	-1.50	-10.50	0.00	
Intermolar	Anterior	110	-0.75	1.31	-0.50	-5.00	6.50	<0.001
	Equivalent	231	-2.23	2.30	-1.50	-13.00	5.00	
Dif. between measurements	Anterior	110	-2.84	1.36	-2.75	-9.00	3.00	<0.001
	Equivalent	231	-0.33	1.78	0.00	-6.50	8.00	

(*) Descriptive level of probability of the Mann-Whitney non parametric test.

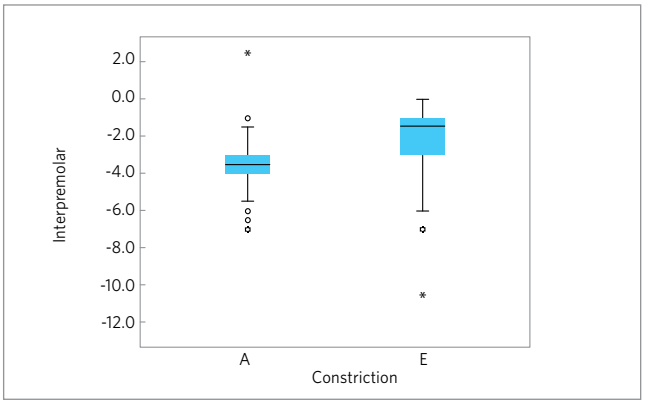


Figure 5 - Box-plot for the interpremolar region, according to the Anterior (A) and Equivalent (E) constriction group.

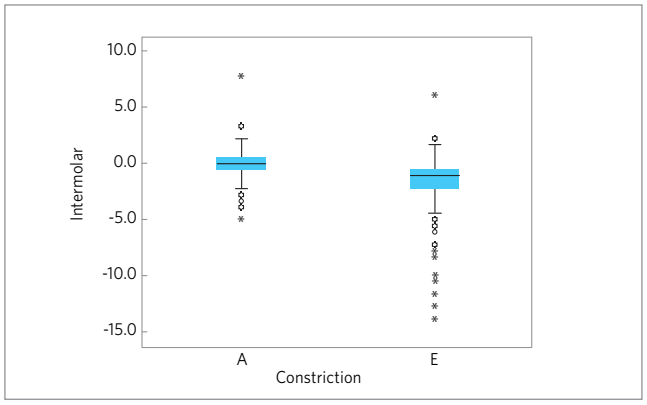


Figure 6 - Box-plot for the intermolar region, according to the Anterior (A) and Equivalent (E) constriction group.

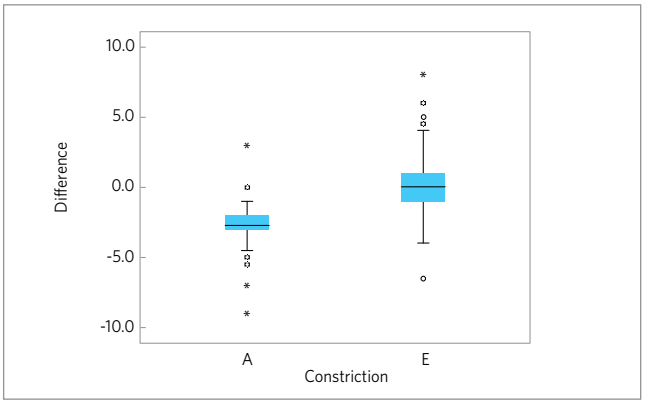


Figure 7 - Box-plot for the difference between measurements, according to the Anterior (A) and Equivalent (E) constriction group.

Several studies investigated the etiology of the maxillary constriction, and the authors were unanimous in accepting a relationship to oral breathing, harmful habits, atypical phonation and swallowing, among others as causative factors.

Other studies showed that the association of the maxillary constriction with Class II and III malocclusions were generally associated with a transverse problem, i.e., with a maxillary constriction. In the orthodontic treatment, before treating the anteroposterior problems, the transverse unlocking of the maxilla through maxillary expansion[1-5,7,8,9] must be performed, so that the mandible can "fit" correctly in the maxilla within three dimensions: transverse, sagittal and anteroposterior. However, this maxillary constriction should be evaluated through the analysis of study models, so that the amount and location of these alterations can be diagnosed.

The Korkhaus analysis of the study models provides this complete evaluation, helping the diagnosis of anterior and posterior maxillary constriction in relation to the mandible and their separate respective values[6].

Hence the aim of this study was to verify whether there were statistically significant differences between the anterior and posterior constriction within two specific constriction groups.

The first group was called anterior, for maxillary constriction presenting anterior values lower than the posterior values. The second group was called equivalent, for anterior and posterior constriction presenting with similar values.

When both groups were compared within themselves in the anterior and posterior regions, a statistically significant difference in the anterior constriction was found, with the mean value of -2.84 mm. This means that these patients with anterior constriction require a greater expansion therapy in this region, thus suggesting individualization of the region and amount of expansion.

Therefore, the differential diagnosis when performing the individualization of the maxillary constriction in the anterior (interpremolar) and posterior (intermolar) regions has its clinical importance recognized.

CONCLUSION

The results showed that 32.3% of the diagnosed patients presented with a greater constriction in the anterior region, and this difference was statistically significant lower with mean values of -2.84 mm.

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