ORIGINAL RESEARCH

Differences in maxillary height in patients with maloclussion versus patients without maloclussion

Diferencias en la altura maxilar en pacientes con maloclusión y sin maloclusión

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ABSTRACT

Maxillary height is an understudied etiological factor of malocclusions since most of the research on the maxilla has been carried out in the sagittal plane. The objective of this research was to assess if there are differences in maxillary height between patients without malocclusion and with malocclusion in a population from Nayarit. **Material and methods:** The size of the sample was 180 lateral X-rays; 45 were of patients without malocclusion so 45 X-rays of each Angle malocclusion were chosen randomly. Descriptive statistics and the ANOVA test were performed in the program SPSS version 18. **Results:** Patients without malocclusion had a difference of 0.5° with respect to the standard of Ricketts, class II malocclusion was the most altered value of maxillary height and Angle class III malocclusion was the one that was closest to the Ricketts standard. **Conclusion:** There are statistical significant differences in maxillary height between malocclusions.

RESUMEN

La altura maxilar es un factor etiológico de maloclusiones poco estudiado, la mayoría de las investigaciones del maxilar son realizadas en el plano sagital. El objetivo de esta investigación es evaluar si existen diferencias en la altura maxilar en pacientes sin maloclusión y con maloclusiones en la población de Nayarit. **Material y métodos:** El tamaño de la muestra fue de 180 radiografías laterales de cráneo, de las cuales 45 eran de pacientes sin maloclusión, por lo que se escogieron de forma aleatoria 45 radiografías de cada maloclusión de Angle. La estadística descriptiva y la prueba de ANOVA se realizaron con el programa SPSS versión 18. **Resultados:** Los pacientes sin maloclusión dental presentaron una diferencia de 0.5° con respecto a la norma de Ricketts. La maloclusión de clase II fue la del valor más alterado en la altura maxilar y la maloclusión de clase III de Angle la que se acercó a la norma de Ricketts. **Conclusión:** Existen diferencias estadísticas significativas en la altura maxilar entre las maloclusiones.

INTRODUCTION

The maxilla is a paired bone located on the upper anterior portion of the face.[1] It develops by intramembranous ossification in two ways: by bone apposition on the sutures and by superficial remodeling.[2] Its growth is directed towards the sutures that join the maxilla with other structures generating a downward and forward rotation in an approximate 50° angle with regard to Sella-Nasion plane.[1,3]

The diagonal growth direction of the maxilla may vary from one individual to the other depending on the degree of development of the perimaxillary fossae since the maxilla is related to the pharyngeal, oral, nasal and orbital cavities; in this manner, its growth is influenced by the growth of these structures as well as by masticatory forces acting upon it.[1]

The vertical growth pattern is established at early ages even before the eruption of the first permanent molars.[4] Most of the vertical malocclusions are the result of different etiological factors during the growth period such as maxillary and mandibular growth and lip and tongue function.[5]

In orthodontics, the relationship between nasal height and dental size dates back to

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the 1940's decade when several studies were conducted looking for a relation between these two measurements.[6] Ricketts, in 1957, introduced his cephalogram in which several cephalometric landmarks and its relations are analyzed.[1] One of those data is maxillary height which is an angle formed by the N-FC-Point A planes.[7]

If the maxillary height angle is diminished (closed), it is related to open bites or a short face in the upper segment; on the contrary, an increased angle (open) is related to deep bites and gingival smiles due to a vertical excess of the maxilla.[7]

Edward Angle's malocclusion classification uses only mesiodistal relationships of the teeth and jaws taking into consideration the position of the first permanent molars which were considered as reference points in the craniofacial architecture.[1] Another definition for malocclusion would be any deviation from normal occlusion of the teeth which would include an abnormal position in relation to their basal bone, to adjacent teeth or in relation to teeth in the opposite arch when in rest.[8,9]

In a class II malocclusion, anteroposterior molar relationships are correct: the mesiobuccal cusp of the permanent first molar is in the same position as the buccal groove of the lower first molar.[10] Maloclussion consists in individual tooth malpositions, anomalies in vertical or transverse relations or the sagittal deviation of the incisors.[1]

Class II malocclusion is the abnormal sagittal relationship of the first molars; the buccal groove of the mandibular first molar is located distal to the mesiobuccal cusp of the upper first molar.[1,11] Maxillary height can be affected in class II patients specially in oral breathers where the lower position of the mandible as a condition to have a free airway forces the molars to continue their passive eruption, creating more alveolar bone and the anterior teeth respond in the same way thus consolidating a vertical growth.[12]

The facial vertical changes in patients with an enlarged adenoid tissue can be modified if the surgery is performed before four years of age. If it is performed after four years of age the facial vertical growth continues as if the surgery had not been performed.[13]

In class III malocclusion the buccal groove of the lower first molar is located mesial to the mesiobuccal cusp of the upper first molar. The incisor relationship is usually inverted: the upper incisors occlude lingually to the lower.[1] Among the etiology of class III there is a lack of maxillary vertical development that causes a counter-clock wise mandibular rotation.[11]

MATERIALS AND METHODS

This is a descriptive, cross-sectional, retrospective and observational study. The study universe was 445 lateral headfilms from which 400 were pretreatment orthodontic radiographs taken between the year 2008 to 2013; 45 radiographs were from patients with no malocclusion and without orthodontic treatment taken for other purposes between 2000 and 2002. The sample size was 180 lateral headfilms from which 45 were from patients without malocclusion so 45 radiographs were chosen randomly for each Angle malocclusion.

The inclusion criteria were all lateral headfilms from patients older than 18 years old. The exclusion criteria were all radiographs from patients with tooth agenesis, craniofacial anomalies and spotted or stained radiographs.

The following angles were used: facial depth, maxillary depth and maxillary height. The facial depth angle was constructed with the intersection of Frankfort plane with Nasion-Pogonion plane. Maxillary depth is the angle formed by Frankfort plane and the N-A Angle. Maxillary height is formed by the Nasion-FC and Fc-A *(Figure 1)*.

The material was a 0.3 Pelikan stilograph, a 40 watt neon light negatoscope, cephalometric tracing ruler and cephalometric paper. The anatomical points, planes and measurements were performed by one person only. The data was captured in the register forms and tabulated with Microsoft Excel. Descriptive statistics and the ANOVA test were performed with SPSS software.

RESULTS

The normal values for maxillary height in patients of 18 years of age or older is $56° \pm 3°$. The media for patients with no malocclusion was $56.5° \pm 3°$, the minimum was $52°$ and the maximum was $65°$. In patients with Angle class I maloclussion maxillary height the media was $63.8°$ with a standard deviation of $3°$, the maximum was $73°$ and the minimum $53°$.

In Angle class II malocclusion the average was $64.3°$ with a $4°$ standard deviation, the minimum value was $52°$ and the maximum, $76°$. For class III maloclussion, the media was $62.3°$ and the standard deviation, $3°$. The maximum value was $70°$ and the minimum, $51°$.

Patients without maloclussion exhibited a media of $0.5°$ over the normal values presented by Ricketts and the same standard deviation of $3°$. The values for patients with maloclussion were bigger than Ricketts normal values and bigger than the ones for patients
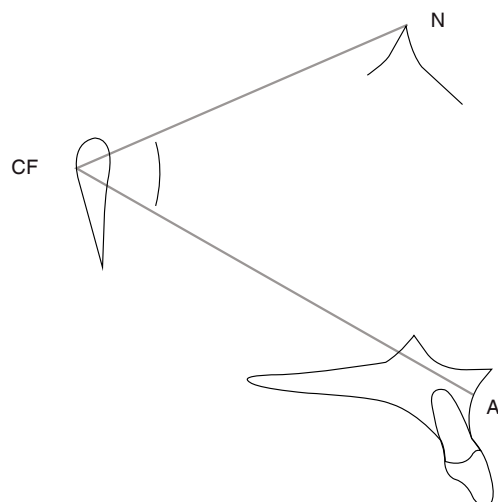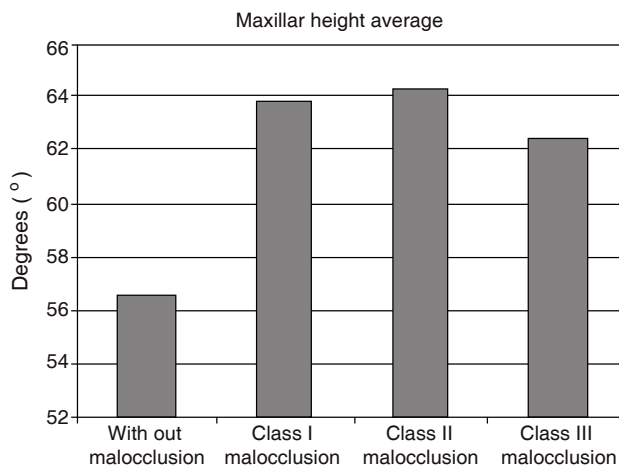
Figure 1. Maxillary height.

Figure 2. Maxillary height average in patients without malocclusion and patients with malocclusion.

without maloclussion. The difference between the normal values and the patients with Angle class I maloclussion was 7.8°. In patients with Angle class II it was 8.2° and in Angle class III, 6.3°.

When the ANOVA test was applied between study grouos significant statistical differences were found (p ≤ 0.01). Maxilary height in patients with maloclussion from this study is altered with a greater maxillary descence in class II malocclusions and less descence in class III patients *(Figure 2)*.

DISCUSSION

There are several studies that refer to maxillary anteroposterior growth but there are few studies of its vertical growth.[14] Wendell L. Wylie found that facial vertical dimension is smaller in orthodontically treated patients than in those we no orthodontic treatement.[6] In this research, the group without malocclusion showed a smaller maxillary height than patients with some kind of malocclusion. In 2012 Londoño et al concluded upon studying the maxilla vertical dimensions that its variations are not related with different kind of malocclusions because there are no statistical significant differences.[14] The results from this study differ from those of Londoño since they presented significante differences between malocclusions. In class I and class II malocclusions it is common to observe vertical growth patterns.[5] In 2004, Chavez et al.[15] performed a study in Angle class I Peruvian children between ages 12 and 13 in which maxillary height in relation to Ricketts normal value turned out to be greater with a mean of 58.1° and a standard

deviation of 3.3°. Compared to a study performed in Nayarit, the Peruvian population showed 5.7° less than the population from Nayarit, Mexico.

García and Travesi, in 1996, found in Spanish patients that maxillary height was an average 57.25° with a standard deviation of 3.32,[16] values that coincide with those found in Peruvian patients but differ from the population from Nayarit, Mexico.

When comparing the studies from the population that attends the postgraduate clinic of the Autonomous University of Nuevo Leon ,[17] with that of the Autonomous University of Nayarit it was found that Angle class II malocclusions are the ones that present greater maxillary growth.

In the study conducted by the Autonomous University of Nuevo Leon,[17] it was found that class II dolicofacial patients the average value for maxillary height was 59° whereas in the present study an average of 64.3° was found.

CONCLUSIONS

Patients without malocclusion did not present an altered maxillary height in regard to Ricketts values. However, patients with Class I, II and III malocclusion presented higher values than the standard deviation.

Statistical differences where found when comparing the values for maxillary height in patients without malocclusion and patients with malocclusion.

Class II malocclusion presented higher values of maxillary height which may cause a downward rotation of the mandible. In Class III malocclusion the values for maxilary height were lower than the rest of the malocclusions which could cause an upper anterior

rotation of the mandible and become an ethyologic factor for this malocclusion.

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