Communication

Dental arch width in overweight and normal-weight subjects.

Comparación de los anchos de los arcos dentarios en sujetos con y sin sobrepeso

Cynthia Yzquierdo-Correa.[1]
Weyder Portocarrero-Reyes.[1]
Marcos J. Carruitero.[2]
Paola Claudet-Angulo.[1]

Affiliations: [1]Universidad Privada Antenor Orrego. Trujillo, Perú. [2]Dept. of Orthodontics, Bauru Dental School, University of São Paulo, Brazil.

Corresponding author: Weyder Portocarrero-Reyes. La Merced Mz X Lt 10. Dpto 601. Trujillo, Perú. Phone: (51) 991405176. Email: wportocarreror@upao.edu.pe

Abstract: Objective: To compare the width of the dental arches between overweight and non-overweight subjects . Materials and Methods: A cross-sectional comparative study was carried out with 54 subjects from 8 to 13 years of age, 27 normal-weight and 27 overweight. The presence of overweight was assessed according to the Quetelet index. To determine the width of the dental arches, measurements of the upper and lower intercanine and intermolar width were obtained with a digital calibrated Vernier caliper. The comparison between the dental arch width of normal-weight and overweight subjects was performed using the Mann-Whitney U test. Results: Statistically significant differences were found in the intercanine and intermolar widths between overweight and non-overweight subjects ($p<0.05$). Conclusion: The dental arches were wider in overweight subjects compared to those of normal-weight.

Keywords: Dental arch; overweight; malocclusion.

Resumen: Comparar los anchos de los arcos dentarios en sujetos con sobrepeso y sin sobrepeso. Materiales y Método: Se realizó un estudio transversal comparativo. Se evaluaron 54 sujetos de 8 a 13 años de edad, 27 sin sobrepeso y 27 con sobrepeso. La presencia de sobrepeso se evaluó según el índice de Quetelet. Para determinar los anchos de los arcos dentarios, se analizaron, en los modelos de estudio de cada grupo, las medidas de los anchos intercanino e intermolar superior e inferior con un vernier calibrado digital. La comparación de los anchos de los arcos dentarios de los sujetos con sobrepeso y sin sobrepeso se realizó mediante la prueba U de Mann-Whitney. Resultados: Se encontraron diferencias estadísticamente significativas en los anchos intercanino e intermolar entre los sujetos con sobrepeso y sin sobrepeso ($p<0.05$). Conclusión: Los anchos de los arcos dentarios fueron mayores en sujetos con sobrepeso que en sujetos sin sobrepeso.

Palabras Clave: *Arco dentario; sobrepeso; maloclusión.*

INTRODUCTION.

The shape of the dental arch is one of the most important aspects of dentition. Dental arches are dynamic and undergo changes during growth and development.[1] The changes that occur in the dental arches during mixed dentition are consequences of tooth movement and the growth of the supporting bone, as well due to genetic components.[2]

Knowledge and proper evaluation of the factors affecting the shape and width of the dental arch is key to planning malocclusion treatment and achieving successful results regarding aesthetics, function and stability.[1,3,4] Nutritional status is likely to be also involved among these factors, since

the effects of an increase in body mass index in a child can significantly impact on various aspects of health and general whole-body condition, including the stomatognathic system.[2,5]

The severity and frequency of childhood obesity has increased during the last decades.[5-7] The main causes of obesity are the consumption of high-calorie foods and lack of physical activity; however, obesity can also be modulated by genetics, hormonal dysfunctions, and even mental disorders. The health consequences of obesity include diabetes mellitus, cardiovascular disease, asthma, obstructive sleep apnea, infertility and cancer, among others.[5,6]

The level of body fat can influence neuroendocrine events that are responsible for the onset of precocious puberty despite low levels of growth hormone. More specifically, leptin, a hormone produced mainly by adipose tissue, which controls appetite and the accumulation of adipose tissue, could be directly involved in this process.[6,8] The early onset of obesity can increase cervical vertebral maturation and bone size, and an acceleration in skeleton growth.[6]

The correct identification of the shape of the dental arch is an important aspect to consider in order to achieve stable, functional and aesthetic-pleasing results from orthodontic treatment. Not preserving the shape of the arch can increase the probability of recurrence.[3] Overweight subjects who suffer from obstructive sleep apnea have been reported to have wider dental arches,[9] however, no studies have been reported in subjects who do not present such condition.

The aim of the present study is to compare the width of the dental arches in overweight and normal-weight subjects.

MATERIALS AND METHODS.

Design and sample

A comparative cross-sectional study was carried out. The study protocol and informed consent were evaluated and approved by the Research Unit of the Antenor Orrego Private university, Resolution 1376–2015–FMEHU-UPAO.

The sample consisted of 54 subjects (25 males and 29 females) from 8 to 13 years of age (10.54±1.40 years)

consecutively selected and divided into two groups: 27 normal-weight (10.54±1.40 years: 11 males, 11.09±1.58 years; 16 females, 10.19±1.22 years) and 27 overweight (10.52±1.40 years: 14 males, 10.50±1.45 years; 13 females, 10.54±1.39 years). To determine the size of the sample we considered a power of 80% and a confidence level of 95% to estimate a difference of 1.4mm between overweight and normal-weight subjects, thus the minimum sample sizeper group was 27. Participants belonged to a registered public school in the Local Educational Management Unit of the city of Trujillo-Peru.

The parents signed an informed consent for the children´s participation in the study. The inclusion criteria were: apparent good general health status, dentition with complete eruption of deciduous canines or permanent canines, and permanent first molars in both arches.

The exclusion criteria were: subject with atypical oral habits, with a history of maxillary surgery, trauma, and current and former users of orthodontic or orthopedic appliances.

Determination of overweight

Overweight was determined by the body mass index proposed by Quetelet.[10] Subjects were classified as normal-weight or overweight.

Determination of dental arch width

Plaster models of the dental arches were obtained from the study subjects. Measurements of intercanine and intermolar distances were taken for each model, in millimeters, using a digital calibrated Vernier caliper according to the following measurement criteria:

Upper and lower intercanine distance: Linear distance between the cusps of the contralateral canines.[2]

Upper and lower intermolar distance: Linear distance between the main pits of the first right and left first molars.[2]

Reliability of the method

To evaluate the reliability of the method, measurements of the intercanine and intermolar distances of twenty study models that did not participate in the investigation, taken at two different times with a two weeks interval were used. The agreement between these measurements was evaluated using the intraclass

Table 1. Comparison of dental arch width in overweight and normal-weight subjects.

Tooth	Weight status	n	Mean	Me	SD	Min	Max	*p**
Upper Intercanine Width	Normal-weight	27	33.41	34.08	2.94	22.52	36.64	< 0.001
	Overweight	27	37.40	37.19	1.45	35.01	40.15	
Lower Intercanine Width	Normal-weight	27	27.15	26.73	2.08	24.15	33.99	< 0.001
	Overweight	27	29.85	29.66	1.67	27.06	33.99	
Upper Intermolar Width	Normal-weight	27	49.11	50.09	3.42	39.10	52.41	< 0.001
	Overweight	27	53.99	53.48	2.60	50.54	59.57	
Lower Intermolar Width	Normal-weight	27	44.04	44.76	3.16	35.89	47.79	0.026
	Overweight	27	45.90	46.06	3.23	36.59	50.40	

*: U de Mann-Whitney. **SD:** Standard Deviation. **Me:** median. **Min:** minimum. **Max:** maximum.

correlation coefficient test, resulting in good agreement, with values higher than 0.766 ($p<0.05$).

Statistical analysis of information

The collected data were processed in the statistical program SPSS Statistics version 22.0 (IBM Corp, Armonk, New York, USA).

The means, medians, standard deviations, minimum and maximum values were calculated. When applying the Shapiro-Wilk test, the data did not follow a normal distribution, so the Mann-Whitney U test was applied to perform comparisons between both groups ($p<0.05$).

RESULTS.

Statistically significant differences were found in the dimensions of the dental arches between overweight and normal-weight subjects ($p<0.05$). The intercanine and intermolar widths were higher in overweight than in normal-weight subjects. In the normal-weight group, the upper intercanine width was 33.41+/-2.94mm, and in the overweight group it was 37.40+/-1.45mm ($p<0.001$).

The lower intercanine width was 27.15+/-2.08mm in the normal-weight group, and 29.85+/-1.67mm in the overweight group ($p<0.001$).

The upper intermolar width was 49.11+/-3.42mm in normal-weight children, and 53.99+/-2.60mm in the overweight group ($p<0.001$). Finally, the lower intermolar width, was 44.04+/-3.16 mm in the normal-weight group and 45.90+/-3.23mm in the overweight group ($p=0.026$). (Table 1).

DISCUSSION.

Obesity has become a public health problem, and childhood obesity, as defined by the body mass index, has increased in severity and frequency in the last four decades.[5] The underlying cause is the excessive intake of food and a sedentary lifestyle, resulting in a chronic energy imbalance,[8] which can have repercussions on the development of some structures of the oral cavity, such as the dental arches.

In orthodontics, the correlation between obesity and early bone maturation is a controversial topic.[6] In the present study we compared the dental arch width in overweight and normal-weight children from 8 to 13 years of age. Larger widths in the canine and molar region were found both in the upper and lower arches in overweight compared to normal-weight subjects. These results could be explained by earlier skeletal maturation of the maxilla and mandible in overweight subjects.[6]

No studies similar to the present study have been reported; however, Maeda *et al.,*[9] evaluated the dimensions of dental arches in obese and non-obese patients with obstructive sleep apnea and concluded that obese patients had a larger tongue and wider dental arches compared to non-obese patients.

The authors suggest that the increase in tongue size could be due to an increase in the distribution of fat in the lateral and anteroposterior portions of the tongue caused by overweight, which could make the dental arches wider.

A relevant feature of the present study is that the age group evaluated in this study ranged from 8 to 13 years of age, a period related to puberty, when there is a tendency for the transversal development of the arches, as these dimensional changes with age occur during the periods of greatest growth, such as the transition between mixed and permanent dentition.[4,6] Louly *et al.,*[2] found that there is a greater increase in the anterior segment of the maxillary arch with the eruption of incisors and permanent canines between the ages of 9 to 12 years. Likewise, Giuca *et al.,*[6] states that environmental factors, such as the percentage of body fat, could influence the neuroendocrine events responsible for the onset of precocious puberty.

A limitation of the present study is its cross-sectional design, with longitudinal studies being necessary to corroborate the dimensional changes of the arches over time in the presence of overweight, and also to consider other factors, such as genetics, socioeconomics, nutritional status and environmental factors related to bad habits, among others. Also, any diagnosis of a problem related to the patency of the upper airway should be considered, as this can influence not only the size of the maxilla but also the size of the dental arches.[9]

The results of the present work show that dental arch width is associated with overweight; As such, it could impact on craniofacial growth and lead to the early skeletal maturation of the maxilla and mandible, and therefore could also influence further development of the dental arches.[6] Therefore, the clinician should take into account overweight in their diagnosis and orthodontic treatment plan. In this regard, the clinician should make individualized dental arches during orthodontic treatment, in consideration of the various factors involved in their morphology, and which could contribute to the stability of the treatment.

CONCLUSION.

Dental arch width is greater in overweight subjects than normal-weight subjects. It is suggested that during orthodontic treatment, the clinician should include individualized dental arches analysis considering the various factors involved in their morphology.

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