Comparison of the population occlusal characteristics in 3 Brazilian regions

Comparação das características oclusais da população em 3 regiões Brasileiras

Comparación de las características oclusales de la población en 3 regiones Brasileñas

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Abstract

The objective of this work was to determine the prevalence of individual traits of malocclusion in a sample of three Brazilian regions orthodontic patients and to detect interregional population differences in the prevalence of certain occlusal characteristics. The present study was based on the examination of dental casts, intraoral photographs and panoramic radiographs of 947 orthodontic patients from 3 cities: 363 from Fortaleza (CE), 270 from Maringá (PR) and 314 from Bauru (SP), respectively, representing the Northeast, South and Southeast Brazilian regions. The relationship of the first maxillary and mandibular molars according to Angle's classification, overjet, overbite, crowding, posterior crossbite and maxillary median diastema were examined. The chi-square and ANOVA tests were used to determine potential differences in the distribution of malocclusion when stratified Brazilian regions. Class I malocclusion was found in 499 (52.69%), Class II in 395 (41.71%) and Class III malocclusion in 53 (5,59%) subjects of all examined. Deep overbite (3.59%), midline diastemas (5.17%) and posterior crossbite (4.75%) were observed more frequently in Bauru; however, in Maringá, normal overbite (13.3%) and open bite (4.75%) were more prevalent. The results of this study showed that Class I malocclusion was the most prevalent, followed by Class II and Class III malocclusions. These occlusal relationships evaluated in the three Brazilian regions follow the same pattern of frequency as the result presented by the general population of the sample.

Keywords: Epidemiology; Orthodontics; Malocclusion.

Resumo

O objetivo deste trabalho foi determinar a prevalência das características individuais das más oclusões numa amostra de pacientes ortodônticos provenientes de 3 regiões brasileiras e comparar os resultados com outros autores. O presente estudo foi baseado no exame de modelos dentários, radiografias intrabucais e panorâmicas de 947 pacientes ortodônticos provenientes de 3 cidades: 363 de Fortaleza (CE), 270 de Maringá (PR) e 314 de Bauru (SP) representando respectivamente as seguintes regiões brasileiras: Nordeste, Sul e Sudeste. Foram examinados o relacionamento do primeiro molar superior com o primeiro molar inferior de acordo com a classificação de Angle, trespasse, sobressaliência, apinhamento, mordida cruzada posterior e diastema superior. Os testes do qui-quadrado e ANOVA foram usados para determinar as potenciais diferenças na distribuição da má oclusão quando estratificadas regiões brasileiras. A má oclusão de Classe I foi encontrada em 499 (52,69%), Classe II em 395 (41,71%) e Classe III em 53 (5,59%) de todos os pacientes examinados. A

mordida profunda, diastema anterossuperior e mordida cruzada posterior foram observados com maior frequência em Bauru, entretanto, em Maringá a sobressaliência normal (13.3%) e a mordida aberta (4.75%) foram mais prevalentes. Os resultados deste estudo mostraram que a má oclusão de Classe I foi a mais prevalente, seguida pela Classe II e III. Estes relacionamentos oclusais avaliados em três regiões brasileiras mostraram o mesmo padrão de frequência que o resultado apresentado pela população geral da amostra.

Palavras-chave: Epidemiologia; Ortodontia; Má oclusão.

Resumen

El objetivo de este trabajo fue determinar la prevalencia de características individuales de maloclusiones en una muestra de pacientes ortodónticos de 3 regiones brasileñas y comparar los resultados con otros autores. El presente estudio se basó en el examen de modelos dentales, radiografías intraorales y vistas panorámicas dentales de 947 pacientes de ortodoncia de 3 ciudades: 363 de Fortaleza (CE), 270 de Maringá (PR) y 314 de Bauru (SP), respectivamente, representando las siguientes regiones Brasileño: Noreste, Sur y Sureste. La relación entre el primer molar superior y el primer molar mandibular se examinó de acuerdo con la clasificación de Angle, superposición, resalte, apiñamiento, mordida cruzada posterior y diastema superior. Se utilizaron pruebas de Chi-cuadrado y ANOVA. Se encontró maloclusión de clase I en 499 (52,69%), clase II en 395 (41,71%) y clase III en 53 (5,59%) de todos los pacientes examinados. La mordida profunda, el diastema anterosuperior y la mordida cruzada posterior fueron más frecuentes en Bauru, sin embargo, en Maringá, el resalte normal (13,3%) y la mordida abierta (4,75%) fueron más prevalentes. Los resultados de este estudio mostraron que la maloclusión Clase I fue la más prevalente, seguida de la Clase II y III. Estas relaciones oclusales evaluadas en las tres regiones brasileñas siguen el mismo patrón de frecuencia que el resultado presentado por la población general de la muestra.

Palabras clave: Epidemiología; Ortodoncia; Maloclusión.

1. Introduction

Epidemiological studies are important tools for the knowledge of the treatment needs and evaluating the established measures for these treatments. The health authorities recommend the carrying out of epidemiological surveys of the main oral diseases at the ages of 5, 12 and 15 years old and in the age groups of 35-44 and 65-74 years in a period between

5 and 10 years (Frazão et al., 2002). The knowledge of oral health status in different population groups based in epidemiological surveys is fundamental for the actions proposals development adapted to their needs and risks as well as the comparisons possibility that allow the evaluation of these actions impact in the individual's life (Frazão et al., 2002; Freitas et al., 2002).

The establishment of malocclusions classification in Brazil is of great difficulty because Brazil presents great racial miscegenation, being necessary to consider the regional differences (Ribas et al., 2004). Therefore, it is necessary to characterize the differences in the distribution of malocclusion types among genetically well-defined populations and those that underwent interracial crosses to compare the presented predominance and to identify the current malocclusion pattern in the population to be studied.

Based on the observation of these regional singularities in Brazil, whether economic, cultural and/or genetic or the few researches that performed a comparative analysis in the epidemiology of the malocclusion among Brazilian regions, the objective of this study was to compare the prevalence and the most frequent occlusal traits, besides verifying if there are regional differences in the prevalence of such occlusal characteristics in three different Brazilian cities.

2. Methodology

This retrospective (Pereira et al., 2018) study was approved by the Ethics Committee on Human Research at Ingá University Center Uningá, Maringá, PR, Brazil, under number 9159/2-2012.

This was a quantitative study (Pereira et al., 2018), since its objective was to obtain a sample of the distribution of malocclusions in 3 Brazilian regions.

The sample was obtained from 947 completes pretreatment orthodontic files (lateral cephalograms, panoramic radiographs, dental casts and intra and extraoral photographs) of 3 post-graduation centers, distributed as follows: 363 orthodontic files from Uningá, units of Fortaleza (Fortaleza, Ceará, Brazil); 270 orthodontic files from Inga University Center (Maringá, Paraná, Brazil) and 314 orthodontic files from Bauru Dental School (Bauru, São Paulo, Brazil) representing Northeast, South and Southeast Brazilian regions respectively. These orthodontic files included subjects in the deciduous, mixed and permanent dentition with at least three and a maximum of 56 years old. They included subjects of both sexes, as well as the ethnicities: white, black and mestizo, except for the indigenous one.

As a methodology for evaluating dental casts and radiographs, a previously calibrated single evaluator (M.A.) performed the examinations and analyzes of the orthodontic files, using a pencil, rubber, digital caliper, millimeter ruler and noted in a specific card prepared to this propose. The examiner selected each pair of dental casts and evaluated them in occlusion. The following measures were made and then compared in the dental casts: molar relationship (as described by Angle (Angle, 1899)), dental spacing (multiple spaces between teeth), anterior open bite (when maxillary and mandibular incisors do not contact vertically), dental crowding (crooked teeth), overjet (horizontal distance between upper and lower teeth), overbite (amount that the maxillary incisors overlap the mandibular incisors) and crossbite. The panoramic radiographs were also evaluated, performed in a dark room using the negatoscope.

The ANOVA statistical test was used in addition to the Chi-square tests. All statistical analyses were performed with Statistica software (Statistica for Windows 7.0; Statsoft, Tulsa, USA). Results were considered statistically significant at $P<0.05$.

3. Results

Class I molar (mesiobuccal cusp of the maxillary first molar occludes in the mesiobuccal sulcus of the mandibular first molar) relationship was the most frequent (499 subjects, 52.69%) while Class II (mesiobuccal cusp of the maxillary first molar occludes mesially to the mesiobuccal sulcus of the mandibular first molar) was found in 41.71% (395 subjects) and Class III (mesiobuccal cusp of the maxillary first molar occludes distally to the mesiobuccal sulcus of the mandibular first molar) was found in 5.59% (53 subjects) (Table 1). When the sample was individually evaluated among the 3 Brazilian regions, it can be seen the following molar relationship distribution:

• Fortaleza (CE) (Northeast Region) – Class I (20.16%, 191 subjects); Class II (15.73%, 149 subjects) and Class III (2.42%, 23 subjects).

• Maringá (PR) (South Region) – Class I (15.31%, 145 subjects); Class II (11.93%, 113 subjects) and Class III (1.26%, 12 subjects).

• Bauru (SP) (Southeast Region) – Class I (17.21%, 163 subjects); Class II (14.04%, 133 subjects) and Class III (1.90%, 18 subjects).

Six hundred and sixty-two (69.9%) subjects presented dental crowding at the examination, and in the sample from Fortaleza, this occlusal trait was the most frequently

found: 245 (25.87%), while Maringá and Bauru presented 185 (19.53%) and 232 (24.49%) subjects respectively (Table 1). However, there was no significant difference between the studied populations.

Table 1 - Distribution of malocclusions type and crowding among the studied populations in the Three Brazilian Regions.

	Fortaleza	Maringá	Bauru	Total	P
Class I	191 (20.16%)	145 (15.31%)	163 (17.21%)	499 (52.69%)	0.883
Class II	149 (15.73%)	113 (11.93%)	133 (14.04%)	395 (41.70%)	
Class III	23 (2.42%)	12 (1.26%)	18 (1.90%)	53 (5.59%)	
Crowding	245 (25.87%)	185 (19.53%)	232 (24.49%)	662 (69.90%)	0.164
No Crowding	118 (12.46%)	85 (8.97%)	82 (8.65%)	285 (30.093%)	

Source: Authors.

Open bite was found in 107 subjects (11.29%). This malocclusion was distributed among the Brazilian region as follows: Fortaleza presented 38 subjects (4.01%) and Maringá 45 (4.75%), while Bauru presented 24 subjects (2.53%)(Tables 2 and 3).

Table 2 - Open Bite and deep overbite distribution among the studied Populations in the Three Brazilian Regions.

VARIABLES	Fortaleza	Maringá	Bauru	Total	P
Open bite	38 (4.01%)	45 (4.75%)	24 (2.53%)	107 (11.29%)	**0.002***
No Open bite	325 (34.31%)	225 (23.75%)	290 (30.62%)	840 (88.70%)	
Deep overbite	17 (1.79%)	7 (0.73%)	34 (3.59%)	58 (6.12%)	**0.000***
No deep overbite	346 (36.53%)	263 (27.77%)	280 (29.56%)	889 (93.87%)	

* Statistically significant for $p < 0.05$. Source: Authors.

Table 3 - Open bite Distribution in subjects older than 12 Years old in the Three Brazilian Regions.

VARIABLES	Fortaleza	Maringá	Bauru	Total	P
No Open bite > 12 years old	227 (32.89%)	168 (24.34%)	226 (32.75%)	621 (89.99%)	0.077
Open bite >12 years old	24 (3.47%)	27 (3.91%)	18 (2.60%)	69 (9.99%)	

Source: Authors.

Overbite was found in 58 subjects (6.12%) and it was distributed in the following way: Fortaleza (17 subjects, 1.79%), Maringá (7 subjects, 0.73%) and Bauru (34 subjects, 3.59%) (Table 2).

In relation to the overjet, it was found that people from Fortaleza presented a normal value (1-3mm) in 138 subjects (14.57%) (Table 4). One hundred and sixty-three (17.21%) had an increased overjet, while 40 (4.22%) had a decreased overjet. Overjet was negative in 22 subjects (2.32%). One hundred and twenty-six (13.30%) subjects from Maringá presented a normal overjet in, 98 (10.34%) had an increased overjet while 31 (3.27%) had a decreased overjet. Fifteen (1.58%) subjects had a negative overjet. In Bauru, 110 (11.61%) subjects presented a normal value to overjet, 145 (15.31%) subjects presented an increased overjet, while 47 (4.96%) had a decreased overjet. Overjet was negative in 12 (1.26%) subjects.

Table 4 - Overjet distribution among the studied Populations in the Three Brazilian Regions.

Overjet	Fortaleza	Maringá	Bauru	Total	P
Normal overjet	138 (14.57%)	126 (13.30%)	110 (11.61%)	374 (39.49%)	
Increased Overjet	163 (17.21%)	98 (10.34%)	145 (15.31%)	406 (42.87%)	
Decresead Overjet	40 (4.22%)	31 (3.27%)	47 (4.96%)	118 (12.45%)	0.038*
Negative Overjet	22 (2.32%)	15 (1.58%)	12 (1.26%)	49 (5.17%)	

*Statistically significant for p <0.05. Source: Authors.

Posterior crossbite was found in 94 (9.92%) subjects. Fortaleza presented 26 (2.74%) subjects with this malocclusion, while Maringá presented 23 (2.42%) and Bauru 45 (4.75%) (Table 5).

Ninety-seven (10.24%) subjects presented midline diastemas. Twenty-seven (2.85%) subjects from Fortaleza had this feature, while in Maringa and Bauru, 21 (2.21%) and 49 (5.17%) presented respectively (Table 5).

Table 5 - Crossbite and midline diastema distribution among the studied Populations in the Three Brazilian Regions.

Variables	Fortaleza	Maringá	Bauru	Total	X^2	DF	P
Crossbite	26 (2.748%)	23 (2.428%)	45 (4.751%)	94 (9.927%)	10.514	2	**0.005***
No Crossbite	337 (35.586%)	247 (26.082%)	269 (28.405%)	853 (90.073%)			
Midline diastema	27 (2.851%)	21 (2.217%)	49 (5.174%)	97 (10.242%)	14.711	2	**0.000***
No midline diastema	336 (35.48%)	249 (26.29%)	265 (27.98%)	850 (89.75%)			

*Statistically significant for p <0.05. Source: Authors.

4. Discussion

Since malocclusion affects a large segment of the population, it is, by definition, a public health problem (Massler & Frankel, 1951), being this way of interest of the community to know its frequency. A systematic and well-organized dental care program for any target population in a community requires some basic information, such as the prevalence of the condition to be assessed (Aikins & Onyeaso, 2014).

Angle Class I was the most prevalent malocclusion (52.69%), followed by Angle Class II (41.71%) and then by Angle Class III (5.59%). These results are in agreement with some Brazilian studies (de Souza et al., 2008; Martins & Lima, 2009; Monini et al., 2010) and also international studies from several different countries (Ahangar-Atashi et al., 2017; Borzabadi-Farahani et al., 2009; El-Mangoury & Mostafa, 1990; Garner & Butt, 1985; H. Horowitz, 1970; Proffit et al., 1998; Silva & Kang, 2001; Thilander et al., 2001). However,

Freitas et al. (2002) and de Oliveira Waked et al. (2010) found that Angle Class II was the most prevalent malocclusion.

When evaluating the Brazilian regions separately, it is observed that the prevalence of Angle Class I, II and III occlusal relationships follow the same order of frequency as the result presented by the sample population as a whole. There was no statistically significant difference between then. Martins et al. (1998) stated that the low values for the Class II frequency are a classification methodology problem, where the canines can have a class II relationship and the molars are in a Class II relationship, leading to a classification error.

Dental crowding was found in 69.9% of the cases, similar to other studies (de Oliveira Waked et al., 2010; Freitas et al., 2002; Martins & Lima, 2009). However, other studies found different results. Vellapally et al. (2014) stated that dental crowding is the most common malocclusion trait among adolescents (84.9%), while Thilander (Thilander et al., 2001) found a dental crowding incidence of 52.14% in Colombian adolescents. When evaluating the studied sites individually (Fortaleza-CE, Maringá-PR and Bauru-SP), it can be observed that the crowding prevalence follows the same order of frequency as the result presented by the sample population as a whole (Table 1).

Deep overbite was found in 6.12 of the total collected sample. This result was similar to that obtained by Ahangar-Atashi et al. (2017), whose result was 5.17%. However, some authors have found different results, where sometimes achieving higher (de Oliveira Waked et al., 2010; Horowitz, 1970; Martins & Lima, 2009; Thilander et al., 2001) or lower (Borzabadi-Farahani et al., 2009) results. This difference among the results is probably due to the methodology used for the deep overbite diagnosis. In this research, we performed a methodology similar to that used by Gandini et al. (1994), which divided the deep overbite index into normal, moderate and accentuated and then classified as accentuated, overbites greater than 6mm. Evaluating the studied sites individually (Fortaleza-CE, Maringá-PR and Bauru-SP), deep overbite was more prevalent in Bauru (Table 2).

Open bite was found in 11.29% of the total collected sample, similar to that obtained by some authors (de Oliveira Waked et al., 2010; Freitas et al., 2002; Thilander et al., 2001). Nevertheless, other authors (Ahangar-Atashi et al., 2017; Borzabadi-Farahani et al., 2009; Martins & Lima, 2009; Mtaya et al., 2009) found different results. These different results are probably due to age differences in the samples. Some studies were limited to younger patients and others with no age limit. In our study, Maringá obtained the highest percentage of open bite (Table 3). The sample obtained from Maringá-PR has the lowest mean age among the three cities from this study, and according to Freitas et al. (2002), some cross-sectional studies

have shown a decrease in the frequency of some malocclusions due to occlusion maturation, among them the anterior open bite. The main reasons for these malocclusions decrease are the growth and dental changes and the decrease of deleterious habits that occur with aging.

One can say that a higher prevalence of open bite in Maringá could be attributed to the lower mean age of the sample in this locality, but the conclusion is that there is a higher prevalence in that city since there were no significant differences in the three evaluated regions (Tables 2 and 3).

The most frequently diagnosed finding for overjet was an increased overjet in 42.8% of all patients examined (Table 4). This result is similar to some studies (Celikoglu et al., 2010; Francisconi et al., 2014; Martins & Lima, 2009), however, other authors (Ahangar-Atashi et al., 2017; Borzabadi-Farahani et al., 2009; Helm, 1977; Horowitz & Doyle, 1970; Thilander et al., 2001) found different results. Gandini et al. (1994) stated that only 18.22% of the children aged 6-12 years had an increased overjet. Normal overjet was found in 39.4% of subjects, similar to those found by several authors (Monini et al., 2010; Reyes et al., 1980), but other authors (Helm, 1977; Hill, 1992) found different results. The prevalence of the edge to edge incisal relationship (12.46%) was higher than negative overjet (5.17%). This edge to edge incisal relationship was similar to that found by Reyes et al. (1980) and higher to Gandini et al. (1994) results. Negative overjet was similar to that found by Silva Filho, Silva, Rego, & Capelozza Filho (2010), however different from Ahangar-Atashi et al. (2017).

These differences from our results in relation to those obtained by other authors can be based on the use of different age groups and the performed methodology. Korkhaus (1928) stated that there is an overjet spontaneous improvement occurring concomitant with aging, as well as Hill (1992) showed a reduction in accentuated overjet rate with aging. When evaluating the studied sites individually (Fortaleza, Maringá and Bauru), it can be observed that although with lower mean age, Maringá presented a higher rate of normal overjet, where the differences between the three cities were statistically significant (Table 4).

Posterior crossbite was observed in 9.92% of the subjects, including the unilateral and bilateral ones. Some authors (de Souza et al., 2008; Thilander et al., 2001) found similar results, however, different from other authors (Borzabadi-Farahani et al., 2009; de Oliveira Waked et al., 2010; Freitas et al., 2002). When evaluating the studied sites individually (Fortaleza, Maringá and Bauru), it can be observed that the prevalence of posterior crossbite was higher in Bauru, where the differences between the three cities were statistically significant (Table 5).

Midline diastema was observed in 10.24% of the subjects, similar to Martins & Lima (2009), however Thilander et al. (2001) found different results. Cal Neto et al. (2010) stated a physiological reduction of diastema with increasing age. He also observed that concomitant to craniofacial maturation, the diastema diminishes so that the 7% between 12 and 18 years of age would be the pathological diastema. Therefore, it is needed a detailed examination of the patient to diagnose the diastema correlation with the development phase of the occlusion. When evaluating the studied sites individually (Fortaleza, Maringá and Bauru), it can be observed that the prevalence of midline diastema was higher in Bauru, where the differences between the three cities were statistically significant (Table 5).

As a suggestion for future research, we suggest to the authors to include Midwest and North Brazilian regions to undertake a complete prevalence of malocclusion in Brazil.

5. Final Considerations

Class I malocclusion was the most prevalent, followed by Class II and Class III malocclusions. These occlusal relationships evaluated in the three studied cities follow the same pattern of frequency as the result presented by the general population of the sample.

Bauru (SP) presented a higher prevalence of posterior crossbite (4.75%) and midline diastemas (5.17%) than the other evaluated sites.

Open bite total rate was 11.29% and deep overbite was 6.12%. Deep overbite was more prevalent in Bauru (3.59%), meanwhile, open bite was more prevalent in Maringá.

Increased overjet rate was 17.21% in Fortaleza (CE) and 15.31% in Bauru (SP), however, in Maringá (PR) normal overjet was more prevalent (13.3%).

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