Pesquisa Brasileira em Odontopediatria e Clínica Integrada 2019; 19:e4024
DOI: http://doi.org/10.4034/PBOCI.2019.191.16
ISSN 1519-0501

ORIGINAL ARTICLE

Angle Class II, Division 2 Malocclusion and Association with Late Eruption

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Academic Editors: Alessandro Leite Cavalcanti and Wilton Wilney Nascimento Padilha

Received: 05 August 2018 / Accepted: 28 December 2018 / Published: 10 January 2019

Abstract

Objective: To verify the dental age of individuals with Angle Class II, division 2 malocclusion. **Material and Methods:** The sample consisted of 200 panoramic radiographs of schoolchildren from the city of Fortaleza in the state of Ceará, in the northeast of Brazil. These radiographs were divided into two groups (N=100): a Control group comprising radiographs of patients with normal occlusion and a CIID2 group comprising radiographs of patients with an Angle Class II, division 2 malocclusion. The Demirjian method was used to identify dental age. All the radiographs were evaluated by a sole duly trained and calibrated technician. The Kappa coefficient for inter-annotator agreement was 0.98 based on the criteria of eruption stage of each tooth. Statistical analysis was performed using the Chi-squared test, Student's t-test and the Mann-Whitney test, with a level of significance of 5%. **Results:** There was a significant statistical difference between the dental ages of the groups tested. The CIID2 group had a lower dental age than the control group, signifying late eruption in patients with an Angle Class II, division 2 malocclusion. **Conclusion:** Patients with an Angle Class II, division 2 malocclusion had a lower dental age than patients with normal occlusion, suggesting that orthodontic treatment should be delayed. The first molars, second pre-molars and canines suffered late eruption.

Keywords: Growth and Development; Malocclusion, Angle Class II; Tooth Eruption.

Introduction

In many clinical situations in both medicine (in the evaluation of growth and development) and dentistry (in the prescription and recommendation of orthodontic therapy), it is important to determine the extent to which a child has evolved towards maturity. This is especially true when clinical considerations are closely linked to craniofacial growth rates, such as in the case of the use of extra-oral traction, functional apparatus, extraction vs. non-extraction, the selection of orthodontic retention and the "timing" of orthognathic surgery. Additionally, in exceptional circumstances, such as forensic medicine, the determination of age and maturity may provide vital data to assist with the identification of an individual [1-6].

Chronological age, registered from date of birth when available, is one of the first items of information collected in a diagnostic evaluation to analyze the development of a child [2,7-9]. Two methods of estimating dental maturity have been described: the direct observation of the process of tooth eruption in the oral cavity; and the use of radiographs. The latter is considered more reliable [2,6,8-10].

The Demirjian method to ascertain dental age using the panoramic radiographs was described for the first time in 1973 with a sample of French Canadian children [9]. The suitability of this method has been tested in several populations and the majority of these studies have indicated differences between chronological age and estimated dental age, using the conversion tables from the original study [6,7,11-17]. Cultural, environmental and ethnic differences between populations may explain the discrepancies observed in the dental ages obtained, meaning that new values and classification criteria are required for specific populations. New conversion values have been proposed for different populations to increase accuracy in specific samples [10,13,17,18].

A study with Brazilian children from the city of Fortaleza has shown that the estimate of dental age using the previously proposed dental maturity conversion tables is not suitable for the population under study [13]. They proposed and validated a scale of values for the conversion of dental maturity to dental age, developed specifically for children from the northeast region of Brazil, and using children from the state of Ceará [13]. The creation of a scale specifically for the population of Ceará stimulated interest in studies in this field and meant further investigation of the factors influencing dental age was required.

The objective of the present study was therefore to verify the dental age in Angle Class II, division 2 individuals, in order to verify if there is a difference in the dental ages of children that can be explained by the presence of this specific type of malocclusion. The hypothesis was that Angle Class II, division 2 individuals did not experience late eruption.

Material and Methods

Study Design and Sample

A cross-sectional and retrospective study was carried out. The sample was derived from the database of a dental imaging service located in Fortaleza, the capital city of the state of Ceará in northeast Brazil, which included 50,000 records of different types of X-rays.

A pilot study was performed with 60 panoramic radiographs, taken from individuals of both groups, with 30 radiographs from each group. This study allowed the sample size to be calculated, with 200 radiographs estimated as an appropriate sample size for the verification of possible differences between the groups.

The present study was therefore performed with 200 panoramic radiographs from schoolchildren of both genders aged from 8 to 12 years, who were born in the state of Ceará and lived in the city of Fortaleza. The parents and grandparents of the children were also born in Ceará. The children did not have a history of orthodontic treatment.

Data Collection

The panoramic radiographs were divided into two groups (n=100) based on occlusion, with the control group comprising patients with normal occlusion and the CIID2 group comprising patients with an Angle Class II, division 2 malocclusion.

The radiographs were taken by a single technician, under standard conditions using the same radiographic equipment. All the clinical assessment and panoramic radiographs were analyzed by a sole duly trained and calibrated technician, giving a Kappa coefficient for inter-annotator agreement of around 0.98, based on the eruption stage of each tooth, according to the previously described criteria [9].

The Demirjian method was used to obtain dental age [9]. In this method the seven teeth on the left side of the jaw are examined (except for the third molar) and classified into an eight-stage system (from A to H) based on stage of formation, with stage A corresponding to initial signs of calcification on the upper part of the dental crypt and H signifying that the apex of the root is completely closed. Each stage corresponds to a gender-specific score. The total of these scores for the seven teeth gives an estimate of dental maturity on a scale of 0 to 100. In the original study, the authors provided graphs and tables for both genders, while in the present study a table specifically for children from Ceará was used for both genders [13].

Data Analysis

The data obtained in the present study was organized into a database form using the STATA 10.0 Software (StataCorp LLC, Texas, USA). Statistical analysis was performed using the Chi-squared test for gender, the Kolmogorov Smirnov and Student's t-test for independent samples for chronological age and dental age, and the Mann-Whitney test for the difference between chronological age and dental age, with a level of significance of 5%.

Ethical Aspects

This study was approved by the Ethics in Research Committee of Fortaleza University (Protocol No. 272/2004).

Results

Of a total of 200 panoramic radiographs analyzed, ninety (45%) were taken from male children and 110 (55%) were taken from female children. The average chronological age was 11.48 (± 0.87). The sample exhibited normal distribution, respecting all the required characteristics such as symmetry and kurtosis. There was no significant statistical difference between the groups for this variable (Table 1).

Table 1. Comparative results of gender, chronological age and dental age.

Variables	Control N (%)		Class II, Division 2 N (%)		p-value
Gender					
Male	43 (47.8)		47 (52.2)		0.570
Female	57 (51.8)		53 (48.2)		
	Mean ± SD		Mean ± SD		
Chronological Age	11.50 ± 0.86		11.45 ± 0.86		0.696
Dental Age	10.87 ± 1,55		10.19 ± 1.22		0.001
	Median	Q_{25-75}	Median	Q_{25-75}	
Difference Chronological age and Dental age	0.65	-0.37/1.47	1.1	0.43/2.00	0.01

When comparisons were performed for each group in isolation to test for a significant statistical difference between chronological and dental age, significant values were obtained for both groups ($p < 0.001$). A significant statistical difference was found between the groups for dental age. There was a significant statistical difference between the groups for the two ages (chronological and dental) (Table 1).

In terms of dental age and type of occlusion, there were significant statistical differences between the groups for the first molars ($p=0.001$), the second pre-molars ($p=0.008$), and the canines ($p<0.001$). All of these elements had lower values in the group with Angle Class II, division 2 malocclusion.

Discussion

The hypothesis of this study that Angle Class II, division 2 individuals did not experience late eruption, was rejected. The results showed that the maturity and developmental patterns of teeth in children with an Angle Class II, division 2 malocclusion tends to occur later than in individuals with normal occlusion. However, this finding could not be compared with those of other studies, as no articles dealing with this specific theme were found.

As no significant statistical difference was found for gender and chronological age among the groups, the sample was considered sufficiently homogenous. Comparison with dental age could therefore be safely carried out, as there was no possibility of these variables influencing the difference between the groups. A noticeable characteristic in individuals with an Angle Class II, division 2 malocclusion was the presence of deep overbite. This may explain the differences between the groups. In seeking explanations for the findings of the present study, an association can be made with another study that evaluated the vertical growth patterns of the face [19]. In this study, a

disparity was observed between the growth spurts of adolescents with skeletal open bite and those with deep overbite. Individuals with skeletal open bite began their growth spurts before those with deep overbite. In contrast, no difference was found between individuals with long and short facial height [20].

Despite this, the elements that most suffered from the influence of malocclusion in the present study were the first molars and the second pre-molars, followed by the canines. This fact may explain the existing relationship between malocclusion and deep overbite. The lack of complete eruption of these support pillars (the posterior teeth, which allow the lifting of the bite), and the fact that the incisors are the first teeth to complete their eruptions in individuals with an Angle Class II, division 2 malocclusion, may be determined by deep overbite. It is probable that a difference would also be observed among the second molars if the sample was to include older schoolchildren than those used in the present study, as these dental elements are the last to erupt, and were not evaluated here.

While it cannot yet be confirmed, it is believed that delaying the beginning of the orthodontic treatment of Ceará individuals with an Angle Class II, division 2 malocclusion is recommended, as these patients experience a late growth spurt and delayed dental eruption. Evaluating dental maturation is a useful initial diagnostic step when assessing skeletal growth. The calcification stages provide reliable diagnostic information with which to determine the pubertal growth spurt [21].

Panoramic radiographs were used to evaluate dental maturity as they are a normal part of clinical orthodontics in which the jaw region is clearly visible. The present method was chosen due to the reliability of its evaluation, with no possibility of the results suffering the influence of shortened or lengthened radiographs [8]. The criteria are based on the shape and proportion of the root length, using the relative value at the height of the crown, rather than absolute length.

This finding may be used in a range of clinical situations, as the analysis of growth and development is of great importance in a variety of health areas. In orthodontics, many researchers have studied the ideal time for beginning treatment with orthopaedic and functional braces. Maturity may have an influence on diagnosis, goals, planning and treatment. However, new studies with different populations and malocclusions should be carried out in order to strengthen the scientific knowledge base. The sampled region may represent a limitation of this study.

Conclusion

The group of patients with an Angle Class II, division 2 malocclusion incisal had a lower dental age than the group with normal occlusion, suggesting that orthodontic treatment should be delayed. The dental elements that suffered late eruption were the first molars, the second pre-molars and the canines.

Financial Support: None.

Conflict of Interest: The authors declare no conflicts of interest.

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