

DENTAL DEVELOPMENT ANOMALIES IN CHILDREN OF MATO GROSSO: RADIOGRAPHIC STUDY

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Abstract:

Objectives: The aim of this study was to investigate the prevalence of dental anomalies in children of Cuiabá and then to compare it with the prevalence of these anomalies in the general population.

Study design: It was a retrospective study of 324 digital panoramic radiographs of patients who presented to a Radiology Center in Cuiabá, between 2010 and 2011. The followings were recorded for each subject age, sex and presence of dental anomalies in maxilla or mandible. Were observed dental anomalies involving the number, shape of teeth.

Results: Dental anomalies were found in 97,2% of children. The distributions of dental anomalies were more frequent in girls than in boys, and the maxilla more than mandible. Impacted tooth (36,6%), followed by hipodontia/agenesis (30,5%) and Rotation/lateralization (15%) were the more frequent dental anomalies in the study population.

Conclusion: Early diagnosis of dental anomalies at an early age has great importance because it allows for more comprehensive long-term treatment planning, more favorable prognosis, and, in certain instances, less extensive interception.

Keywords: *Dental Care for Children. Dentition. Tooth Abnormalities. Tooth, Impacted. Tooth, Supernumerary.*

Introduction:

Dental anomalies are caused by complex interactions between genetic, epigenetic and environmental factors during the long process of dental development. This process is multifactorial, multilevel, multidimensional and progressive over time. The development of the human dentition is regulated by tissue interactions and genetic networks similar to those of other ectodermal organs and involves iterative and self-organizing mechanisms crucial for the serial organization of teeth and their shape and renewal^{1-3,7,8}.

These anomalies involve the number of teeth include hypodontia (one or more missing teeth), oligodontia (six or more missing teeth), anodontia (complete absence of teeth), and hyperdontia (one or more extra teeth, also known as supernumeraries). Alterations in the size of teeth include microdontia (teeth smaller than normal) and macrodontia (teeth larger than normal). Both conditions may be either generalized to all the teeth or isolated to one or several teeth. Variations in the position include impacted tooth, ectopic eruption, transmigration, root dilaceration and transposition tooth^{4-5,7}.

Early diagnosis of dental anomalies, particularly in the primary dentition, should allow for more comprehensive long-term treatment planning, more favorable prognosis, and, in certain instances, less extensive interception⁶⁻⁷.

Several different extraoral radiographic techniques have been developed for establishment of diagnostic hypotheses with well established technical principles and precise indications, which have been complemented with recent

Methods of imaging diagnosis (Pedreira et al., 2007).

The advantages of extraoral techniques are related to its simple operation and handling. The fact that the film is not introduced into the patient's mouth is an advantage to avoid the occurrence of gagging and improve the operation in patients with special needs, including significant reduction in the radiation dosage (Pedreira et al., 2007).

The eruption of permanent teeth represents a complex series of events, mostly genetically based, whereby eruptive movements of the tooth germ taking place at a predetermined time and route enable the tooth to find its antagonist at a predetermined occlusal plane. Apart from the eruption process, the successful development of permanent dentition involves the synchronized forward and lateral growth of both the maxilla and mandible, which compensates for the difference in size of the dentition in both bones. As the eruption process is so complex, it is not surprising that problems may arise, which lead to complications including tooth retardation or failure of eruption⁶.

Radiographic examination may reveal numerous developmental dental anomalies that are marked deviations from the normal color, contour, size, number, and degree of development of teeth. Local as well as systemic factors may be responsible for these developmental disturbances. Such influences may begin before or after birth, hence deciduous or permanent teeth may be affected^{9,10}.

Several studies reported the frequencies of various dental anomalies in different populations, but the results are conflicting. The discrepancies in their results were attributed to racial differences, variable sampling techniques, and different diagnostic criteria (Gupta et al., 2011).

Therefore, the objective of this study was to evaluate the frequency of occurrence of dental anomalies of shape, number, and position in the Cuiabá children population through the analysis of digital panoramic radiographs and then to compare it with the prevalence of these anomalies in the general population.

Materials and Methods:

It was a retrospective study of 324 digital panoramic radiographs (151 males and 173 females) aged 8-12 years taken of patients who presented to radiology center –IRHPA, between 2010 and 2011. Digital panoramic radiographs were used to identify the dental anomalies of permanent teeth in number, shape, and position.

As inclusion criteria, all the radiographs should present necessarily technical standard of good quality with maximum clarity, minimal distortion and average degree of density and contrast. Exclusion criteria of the subjects included any significant medical history, history of extraction or orthodontic treatment, patients belonging to the teenagers and adults age groups (over the 12 years old) and patients having cleft lip and palate.

All radiographs were examined carefully by two trained examiners and the variables and dental anomalies were recorded for each subject: Age, sex and presence of dental anomalies in maxilla or mandible. The analysis were done in a computer with monitor 14" darkened environment for better visualization and interpreted by two investigators who used the Microsoft Office Picture Manager image handling capabilities with expansion and manipulation of brightness and contrast for a better diagnosis.

Dental anomalies representing variations in tooth shape, number and position were recorded according to the criteria described by Kreiborg et al, 1994:

1. Shape anomalies: microdontia, macrodontia, root dilaceration, fusion, germination, concrescence, dens in dente, dens evaginatus, taurodontism;
2. Number anomalies: hypodontia (agenesis), oligodontia, anodontia and hyperdontia (supernumeraries);
3. Positional anomalies: Rotation (giroversion/lateralization), impacted tooth, ectopic eruption and tooth transposition.

The criteria followed for assessment of each group of anomalies are mentioned below.

Shape anomalies: For evaluating microdontia, only gross deviations in sizes easily discernible by clinical judgment were accepted. Macrodontia: single tooth larger than normal. Root dilaceration is an abrupt change in the axial inclination between the crown and the root of a tooth. Fusion is characterized by the union of two adjacent teeth. This union of two separate tooth germs may be either complete or incomplete. Fused teeth have separated or shared pulp chambers and canals. Gemination is currently recognized as an attempt by a single tooth bud to divide, with a

resultant formation of either a large tooth with a bifid crown or two completely divided teeth throughout the crown and root. Concrescence of teeth is a condition showing a union of adjacent teeth by only cementum. Taurodontism is a condition where tooth is enlarged at the expense of the root. Pulp chamber is increased with apical displacement of the pulpal floor. Dens evaginatus is a developmental condition characterized by a cusp like supernumerary focal enamel protrusion on the occlusal or lingual surface of the crown. Dens invaginatus is a developmental anomaly resulting in a deepening or invagination of the enamel organ into the dental papilla prior to calcification of the dental tissues.

Number anomalies: These anomalies were established by counting the teeth present clinically and confirming the number by radiographs. Hypodontia (agenesis) describes a situation where the patient is missing 6 teeth or fewer. The condition of missing over 6 teeth, is termed oligodontia. We classed both oligodontia and anodontia under "oligodontia". Hiperdontia: presence of supernumerary tooth.

Positional anomalies: Tooth rotation was considered subjectively as any evident (until 45°-lateralization, over 45 ° giroversion) mesiolingual or distolingual intra-alveolar displacement of tooth around its longitudinal axis. A tooth was categorized as impacted tooth when the tooth was obstructed in its path of eruption by an adjacent tooth, bone, or soft tissue. Eruption of any tooth in an abnormal position was considered to represent ectopic eruption. Tooth transposition is defined as the positional interchange of two neighboring teeth and especially of their roots, or the development or eruption of a tooth in a position normally occupied by a non-neighboring tooth.

Structural anomalies were not observed in this study.

In this study we did not apply statistical analysis, only descriptive analysis.

Results:

Regarding gender, 151 (46,60%) of the 324 children were males and 173 (53,40%) females.

Assessing the shape anomalies, it was observed seven occurrences of microdontia, which most prevalent age was 11 years with three

occurrences. Root dilaceration was found in 73 occurrences, being the most prevalent age was 10 years with 39 occurrences and the jaw region was more prevalent. There was no cases of macrodontia, germination, concrescence and dens evaginatus.

Hypodontia/ Agenesis totaling 342 occurrences, the most prevalent age was 12 years old with 23 occurrences being 13 of them in girls and the region most prevalent was the maxilla.

Oligodontia was observed in nine subjects, the most prevalent age was 11 years with 8 occurrences. Hyperdontia / supernumerary in a total of 16 occurrences, the most prevalent age was 10 years with 7 events. There was no cases of anodontia.

A total of 24 cases of ectopic eruption was found in children with 12 years old in 17 cases. Impacted tooth was observed in 411 cases in the prevalent age of 11-12 years with 337 occurrences, being 173 in girls, and the most prevalent area was the jaw with 307 cases. Tooth rotation/ giroversion was observed in a total of 57 cases, which the most prevalent age was 10 years with 36 cases, being higher prevalence in girls with 25 cases, and the jaw with 19 cases the most prevalent area. Tooth rotation/ lateralization observed in a total of 169, in the most prevalent age of 12 years with 75 cases, being more prevalent among boys with 40 cases and the jaw most prevalent area with 30 cases. Transposition tooth was found only in three cases at the age of 9 years, all in girls and in the region of the maxilla. Frequency of dental anomalies was noted in 315 individuals. Three or more anomalies was located in 55,20% of individuals (Table 1).

Table 1. Distribution of patients with dental anomalies

Dental anomalies	N°	%
At least one anomaly	53	16,35%
Two anomalies	83	25,40%
Three anomalies	85	26,20%
More than three anomalies	94	29,00%
Total of subjects with anomalies	315	97,20%
Total this study	324	100%

The distribution and prevalence of the developmental dental anomalies are shown in Table 2.

Table 2. Dental anomalies found in 324 digital panoramic radiographic

Dental Anomalies	Male/female	max/jaw	total
Number anomalies			
Hypodontia/agenesis	132/210	187/162	342
Oligodontia	1/ 8	7 /2	9
Anodontia	0	0	0
Hyperdontia/supernumerary	7 / 9	10 /6	16
Shape anomalies			
Microdontia	1 / 6	3 / 4	7
Macrodontia	0	0	0
Gemination	0	0	0
Fusion	1 / 0	1 / 0	1
Concrescence	0	0	0
Root dilaceration	19/54	44/29	73
Dens evaginatus	0	0	0
Dens invaginatus	7 / 3	7 / 3	10
Taurodontism	0 / 1	0/ 1	1
Positional anomalies			
Ectopic eruption	10 / 14	11/ 13	24
Impacted tooth	206/205	104/307	411
Tooth transposition	0 /3	3 / 0	3
Rotation/giroversion	15/42	45/12	57
Rotation/lateralization	87/82	59/110	169
TOTAL			1123

Discussion:

The origin of dental anomalies of developmental reflects a change either in the number, size, shape, or location of teeth, or structural changes. Early recognition on preoperative radiographs will minimize the problems. A dentist can find dental developmental anomalies in everyday practice. They may present as an isolated abnormality or as

part of various syndromes. The possible etiological factors are unclear and may be associated with varied dental problems. Gomes et al., 2009; Guttal et al., 2010; Sekerci et al., 2011

Several studies have employed panoramic radiographs for analysis of images within the pattern of normality and identification of dental and maxillomandibular alterations. Benediktsdottir et al., 2003; Pedreira et al., 2007; Gomes et al., 2010.

The current study tries to ascertain the frequency of developmental dental anomalies in the children population like other studies. Kramer et al., 2008; Altug-Atac et al., 2007; Kapdan et al., 2012.

In this study we found 1123 dental anomalies in 315 digital panoramic radiographs (97,2%). These results disagree to Altug-Atac et al., (2007), that studied panoramic radiographs of 3043 Turkish children (1658 girls, 1385 boys), found that 5.46% of the total group had at least 1 developmental dental anomaly. According Altug-Atac et al., (2007) hypodontia was the most common developmental dental anomaly in the Turkish population, followed by microdontia. In our study, the developmental dental anomaly was more common in the Cuiabá population was the impacted tooth, followed by hypodontia/agenesis and rotation/lateralization. All these results were the more frequent in females.

Considering the shape anomalies, dilacerations of the roots comprised 22,53 % of the anomalies. It was noted more in females than in males, and was more common in maxilla, following by microdontia in a total of seven occurrences. Our findings agree with Guttal et al., 2010 and Kapdan et al., 2012, and disagree with Salcido-garcía et al., 2004, Ezoddini et al., 2007.

We agree with Cantekin et al., 2012 that realized a retrospective study and assessed 1,291 digital orthopantomograms (678 males and 613 females), taken at the Faculty of Dentistry, Ataturk University, Erzurum, and concluded that the hypodontia/agenesis was found more frequently in females than in males.

Kim, 2011, evaluated the presence of hypodontia by using panoramic radiographs in 3,055 patients (mean age, 15.1 years; range 9~30)

from two geographically separated orthodontic clinics: 1,479 from University Hospital and 1,576 from a private clinic. The overall prevalence of hypodontia, excluding the third molars, was 11.3%, and there was no statistically significant association with the type of dental clinic, gender, or malocclusion patterns. In both sexes, 86.0% of patients with hypodontia were missing one or two teeth. In our study, we found 342 occurrences of hypodontia/agenesis, more common in females, 12 years and in maxilla.

The treatment of hypodontia/agenesis generally requires a multidisciplinary approach including orthodontic correction, or prosthetic replacement with a removable or fixed appliance. Age of the patient, number of missing teeth, carious teeth, and condition of supporting tissues, occlusion and interocclusal space are the important factors determining treatment planning. Salcido-garcía et al., 2004

Gupta et al. 2011 reported the prevalence of supernumerary teeth by race; the prevalence among the white population ranged from 1% to 3% while in the Turkish population, the total percentage was 0.36%.

Various reports of hyperdontia are mostly in children or the adolescent population. Its prevalence ranges from 0.1 to 3.8% (Kumar et al., 2012) but it is increasingly common in patients with cleft lip and cleft palate. Salcido-garcía et al., 2004. In our study, we observed supernumerary teeth in 2,2% of the individuals. Hyperdontia was noted in a total of 16 supernumerary cases, the most prevalent age 10 years (7 occurrences). It is speculated that they represent a third dentition and thus are different in origin from supplemental teeth. In a literature review of multiple supernumerary teeth occurring in the absence of a syndrome, found the anterior maxilla to be an unusual site for this occurrence as found. Kumar et al., 2012

A series of population studies show males more frequently have supernumerary teeth than females as well as larger teeth than females. In patients with supernumerary teeth, the other teeth in the dentition are larger than those of controls Brook, 2009. This is not observed in our subjects.

Throughout human evolution, reductions in the number of teeth and size of the jaws have

occurred, along with a decrease in the surface area needed for mastication. It is believed that evolution with regard to reduction in tooth numbers will continue (Gupta et al., 2011).

It is interesting to note that Sacal et al, 2001 reported that supernumerary teeth and congenitally missing permanent teeth are two of the most common dental anomalies seen in children. He suggested that these anomalies can be detected with 2 anterior occlusal radiographs and 2 bitewing radiographs.

Of the total study sample, 97,2% of the patients had at least one dental anomaly; 29% of the patients had more than three dental anomalies. Girls were affected more frequently than boys, and affected girls had more congenitally missing teeth than affected boys, the maxilla was more affected than the mandible (Table 2), agreeing with Rolling and Poulsen, 2009.

Our results disagree with Miloglu et al., 2010 had studied 2,251 patients and 214 (9.5%) were found to have root dilaceration. Root dilacerations were determined in 276 (4.3%) of 6386 teeth, belonging to a total of 2251 patients. Anomalies were found in 9.8% of males, compared with 9.3% of females, a difference that was not statistically significant ($p>0.05$). Root dilacerations were distributed fairly evenly between the maxilla and mandible.

Current data in the literature show that fusion in the permanent dentition are observed in 0.0~0.8% of the general population with no gender predilection. Sekerci et al., 2011. In the present study, the prevalence of fusion in the permanent dentition of patients between 8 to 12 years old was 0.3%. Due to this low prevalence, the importance of these anomalies tends to be underestimated.

It is not easy to choose an appropriate sample to examine the frequency of impacted teeth. To determine the actual prevalence of tooth impaction, a representative and randomized sample of the general population is required. The most common practical approach is to examine radiographs from specific populations, which will inevitably involve the risk of bias in the data analysis. Fardi et al., 2011.

Taking into account the source of the analyzed data, which were derived from our radiologic clinic, the limited age range of the examined sample and the limited exclusion criteria, one might consider that the results of this study are not representative of the general population. The low age limit of our sample is due to the inclusion of patients having supernumerary teeth, which are typically diagnosed during childhood.

Positional anomalies constituted the most dominant group in occurrence. In 324 subjects analyzed, we observed 664 cases of positional anomalies. Impacted tooth type was most prevalent in this study group. Teeth rotation/lateralization was reported to be the second most common anomaly in this study. In the recent study by Guttal et al. (2010) in the Indian population, none of these positional anomalies that were found to be significantly prevalent in our study were considered. Although the sample size of the above study was large, the overall number of subjects with anomalies was much lower ($380/20382=1.88\%$). In our study we found 664 positional anomalies in 324 panoramic radiographs. Therefore, further investigations regarding positional anomalies are important.

To compare the prevalence found in this study with the different frequencies reported in the dental literature from other studied populations, one should consider the methodology used for detection of these anomalies as well as the clinical differences of the epidemiological studies, including sample selection, definition of impacted tooth and the age range of subjects. The high number of positional anomalies may be due not to the exclusion of third molars in this study.

The literature review of impacted teeth demonstrates that this is a very rare dental abnormality, which is inconsistent with the high incidence found in the present study. As was the case in other studies, we observed increased percentages in male patients, which suggests a genetic component. Fardi et al., 2011.

Ely et al., 2006 studied a sample of 85 dental transpositions in 75 subjects (27 male, 48 female; mean age at diagnosis 12.25 years) involving both maxillary and mandibular arches was analysed using dental panoramic radiographs

and clinical records. Transposition affected the maxillary dentition (76 per cent) more frequently than the mandibular dentition (24 per cent). Papadopoulos et al., 2010 realized a meta-analysis and revealed that tooth transposition has a mean prevalence of 0.33%. This prevalence seems to be the same between the two genders. However, tooth transposition appears more frequently in the maxilla than in the mandible. This study revealed 0,9% of tooth transposition, in females and maxilla, agreeing with the two authors mentioned above.

The prevalence of dental anomalies observed in this study (97,2%) was greater than that reported by Esenlik et al (0,4%), Altug-Atac and Erdem (5.46%), and Kramer et al (2.5%). These results may reflect racial characteristics, but the differences should be interpreted in accordance with the methodology used. The hypotheses to these results can be that a high proportion of children with dental anomalies, were conducted on children who attended clinical services. This fact could have led to overestimation of outcomes in relation to the general population.

Our data show that the prevalence of tooth impaction is a common dental anomaly. The early recognition of tooth impaction is very important from a therapeutic point of view. Impacted teeth result in many complications and their early detection is imperative. The results of this study were similar to the data reported in other studies, while the dissimilarities may be attributed to the sample selection, method of the study and area of patient selection, which suggest racial and genetic differences.

Dental developmental anomalies are clinically evident. They can be the cause of various dental problems. Careful observations and appropriate investigations are necessary to diagnose the condition and institute appropriate treatment.

Our study emphasizes the importance of encouraging parents to take their children to the dentist at an early age. In addition, we emphasize the need for a panoramic radiograph as an important auxiliary resource for a detailed and careful clinical examination by the dentist.

Conclusion:

According to the results observed in this study, we can conclude that dental anomalies were more frequent in girls and, the most frequent dental anomalies were hypodontia, agenesis, rotation and lateralization.

Address for Correspondence

Competing Interests:

None declared.

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