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Original Article

# Dental developmental anomalies and post-eruption dental disorder: a series of panoramic radiographs

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Panoramic radiographs are complementary exams to evaluate oral alterations in an early manner, these changes can be dental developmental anomalies, and post-eruption dental disorder. **Aim:** This study evaluated the findings in panoramic radiographs and correlated the variables of gender and dental location. **Methods:** A retrospective study was through the observation of 1.111 panoramic radiographs from the Radiology Department in Brazil. It was included patients from 5 to 79 years of age of both gender, and it classified the anomalies in shape, size, and number and post-eruption dental changes in and correlated with gender and location. Patients with syndromes were excluded from the sample. **Results:** The majority of the sample was composed of fameles 752 (67.7%), as to the frequency of dental developmental anomalies related lesions 684 cases (61.6%) and post-eruption dental disorder 567 (51.8%), in the radiographs. The most prevalent change was endodontic treatment (32.6%), followed by root dilaceration (25.9%), and included tooth (19.5%). The most prevailing alteration when correlated with the gender variables was the cyst root ($p<0.01$) in females, and orthodontic treatment ($p=0.02$) in males and the variable location in the mandible was root dilaceration, giroversion, impacted tooth, taurodontia, microdontia, and endodontic treatment ($p<0.01$). **Conclusion:** Our findings provide evidence that dental developmental anomalies e post-eruption dental disorder are frequent alterations in the population with particular characteristics of distribution by sex and location.

**Keywords:** Radiography, panoramic. Tooth abnomalities. Diagnosis, oral.

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## Introduction

Panoramic radiography is an extraoral procedure of simple execution, in which it visualizes the whole maxillo-mandibular complex[1-3]. This technique uses an external image receptor that moves in synchronism around the head of the individual, significantly reducing the discomfort of the radiographic examination to the patient, in addition to subjecting the patient to minimal ionizing exposure[4]. Panoramic radiography is the complementary examination of routine, used both for diagnosis and treatment planning, moreover, this exam may reveal some radiographic findings, which are relevant for patient prevention[3].

Extensive research has provided shown that panoramic radiographs are useful for the discovery of numerous pathological changes, such as ectopic tooth germs, calcification in root canals, retained teeth, supernumeraries, root dilacerations, odontomas, periapical lesions, among others[3,5,6]. Dental developmental anomalies (DDA) and post-eruption dental disorder (PEDD) are the radiographic findings that the early diagnosis that can occur with the use of this examination[3,7].

DDA is a multifactorial disease change caused by genetic, epigenetic, and environmental factors. These can include changes in number, shape, dimensions, and structure of teeth[5,7,8]. PEDD was associated environmental factors, and without associated with dental development. Currently, clinical dentists are working to prevent dental and oral diseases that can lead to tooth anomalies or more severe changes within the oral mucosa, where panoramic radiographs are presented as the main exam. However, most epidemiological studies with large cohort have been demonstrated mainly in syndromic patients, children patients or before orthodontic treatment[3,4,9,10]. Thus, the objective of our study was to characterize the epidemiological profile through a large cohort of non-syndromic patients and in a wide range of ages, through a survey of panoramic radiographs correlating developmental dental anomalies and post-eruption changes and associating them with gender and location.

## Materials and methods

A retrospective study was performed based on radiographic findings of 1.111 digital panoramic radiographs from a radiology clinic in the brazilian northeast, from January 2013 to December 2014. This research study was approved by the Human Research Ethics Committee of Federal University of Maranhão (620.034/2014), the Free and Informed Conscience Term was waived.

The eligibility criteria required that the individuals be of both sexes, with ages over 5 years, that the radiographs present high contrast and minimal distortion, and patients with syndromes were excluded from the sample. The radiographs analyzed were taken in patients of both genders, ages ranging from 5 to 79 years, divided into 4 groups; group 1: from 5 to 13 years (children), group 2: 14 to 18 years (adolescents) (Statute of the Child and Adolescent- Brazil), group 3: 19 to 59 years (adults) and group 4: 60 to 79 years (aged).

This evaluation was carried out by two appropriately calibrated examiners. This calibration was performed by the analysis of 30 pairs of panoramic radiographs, from the same examiners randomly selected, twice, with an interval of 15 days between the analyses, supervised by a radiology specialist. The digital radiographs were saved in digital files in an appropriate quality for peer review of all cases, as seen in (figure 1), where they were then checked, and in case of disagreement, a third examiner would perform the evaluation.

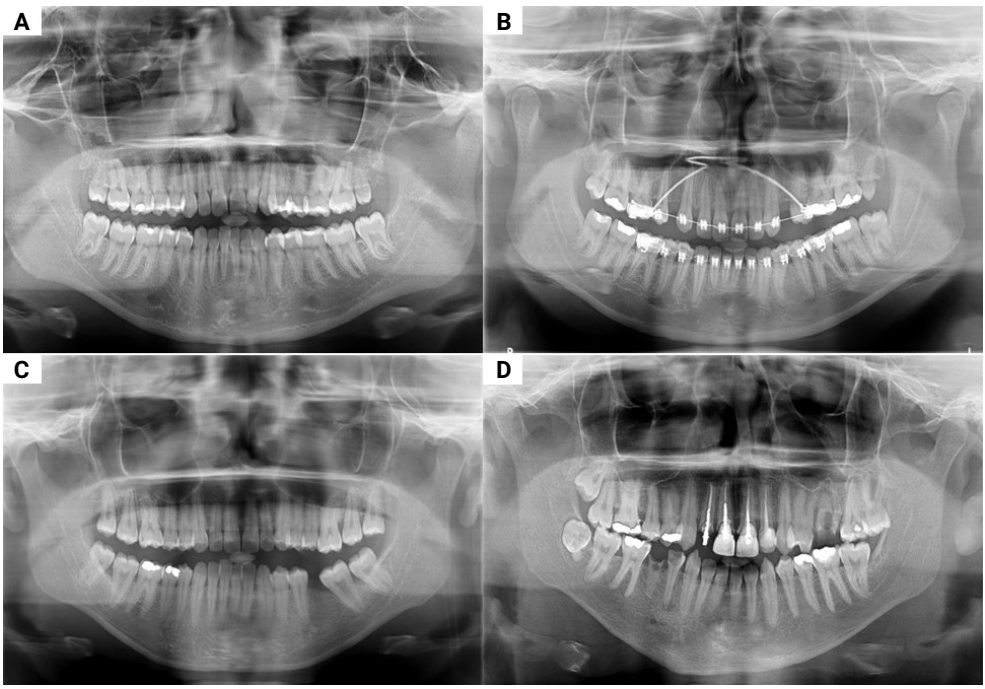


**Figure 1.** Radiographic findings of dental changes. A) Microdontia in the upper second molars. B) Upper third molar microdontia and orthodontic treatment. C) Presence of taurodontia on the lower second molars. D) Residual roots in the left upper second premolar and right lower second premolar, gyroscopic rotation in the left upper first molar, impacted right lower third molar and orthodontic treatment in the upper incisors.

The changes for analysis were divided into two major groups: 1) dental developmental anomalies (DDA), and 2) post-eruption dental disorder (PEDD). In the DDA we sought: a) changes in number (Hypodontia and Hyperdontia; b) changes in size (Microdontia and Macrodontia, transposition, included teeth, impacted teeth,); c) changes in shape (Twinning, Fusion, Concrescence, hypercementosis, Taurodontia, Dilaceration, and Supranumerary Roots), demonstrated. The PEDD was also analyzed for the occurrence of types of dental intervention, including the presence of periapical lesions, radiolucent lesions (suggestive of cysts) and odontomas, residuais roots, the presence of anterior endodontic treatment, and orthodontic treatment (Figure 2).

Then all changes were tabulated in the Excel spreadsheet and later analyzed by the SPSS statistics program (version 17.0). The variables collected included gender, den-

tal arch of the evaluated changes and detection of dental development anomalies, and post-eruption dental disorder. Initially, descriptive statistics of the data were performed using absolute frequency and percentage. Categorical variables were compared between genders and dental arches using the Chi-square or Fisher's Exact Test. The significance level adopted was 5% ($p<0.05$).

## Results

The clinical features are present, it observed that most samples were composed of female individuals (719 cases, 64.7%,), and males (392 cases; 35.3%). Regarding the age group, we noticed that the majority of the group was formed by adults (592 cases; 53.3%), followed by adolescents 284 cases (25.5%), children 184 cases (16.6%), and elderly 51 cases (4.6%), representing 25.5%, 16.6% and 4.6% respectivelyof the sample.

Most radiographs panoramics were characterized DDA was related in 684 cases (61.6%), reveled for analysis of dilacerations (288 cases; 25.9%), followed by included teeth (217 cases; 19.5%), gyroversion (195 cases; 17.6%), impacted teeth (156 cases; 14.0%), taurodontia (88 cases; 7.9%) and hypercementosis (76 cases; 6.8%). Otherwise, when the less frequent DDA, reveled for analysis of dens invaginatus and tooth transposition, which were report with only (1 case; 0.1%), macrodontia had (6 cases; 0.5%), supernumerary (22 cases; 2.0%), microdontia (59 cases; 5.3%) and agenesis (70 cases; 6.3%). Subsequently, DDA was correlating with gender, where we observed that there was no statistically significant difference (Table 1).

**Table 1.** Incidental findings prevalence of DDA their predilection for female or male patients

| | Gender | | | | P value |
|---|---|---|---|---|---|
| | Female (n = 719) | | Male (n = 392) | | |
| | N | (%) | N | (%) | |
| Dilaceration root | 187 | (26.0) | 101 | (25.8) | 0.986 |
| Included tooth | 137 | (19.1) | 80 | (20.4) | 0.642 |
| Dental gyroversão | 125 | (17.4) | 70 | (17.9) | 0.908 |
| Impacted tooth | 97 | (13.5) | 59 | (15.1) | 0.532 |
| Taurodontia | 57 | (7.9) | 31 | (7.9) | 0.916 |
| Hypercementose | 46 | (6.4) | 30 | (7.7) | 0.504 |
| Agenesis | 49 | (6.8) | 21 | (5.4) | 0.408 |
| Microdontia | 41 | (5.7) | 18 | (4.6) | 0.516 |
| Supernumerary | 13 | (1.8) | 9 | (2.3) | 0.739 |
| Macrodontia | 6 | (0.8) | 0 | (0) | 0.072 |
| Transposition | 1 | (0.1) | 0 | (0) | 0.647 |
| Dens in dente | 1 | (0.1) | 0 | (0) | 0.647 |

DDA were compared it with the location in the maxillo-mabibular complex (Table 2). Among the most frequent disorders correlated with the mandible and we find dilaceration ($p<0.01$), dental gyroversion ($p<0.01$), impacted tooth ($p<0.01$), taurodontia

(p<0.01), hypercementosis (p=0.03). Otherwise, when assessed maxilla the most frequentely lesion was microdontia (p<0.01).

**Tabela 2.** Incidental findings prevalence of DDA their predilection for maxila or mandible

| | Maxilla | | Mandible | | P value |
|---|---|---|---|---|---|
| | n | (%) | n | (%) | |
| Dilaceration root | 138 | 12.4 | 220 | 19.8 | <0.001 |
| Included tooth | 163 | 14.7 | 166 | 14.9 | 0.904 |
| Dental gyroversão | 73 | 6.6 | 150 | 13.5 | <0.001 |
| Impacted tooth | 74 | 6.7 | 128 | 11.5 | <0.001 |
| Taurodontia | 39 | 3.5 | 75 | 6.8 | <0.001 |
| Hypercementose | 30 | 2.7 | 50 | 4.5 | 0.030 |
| Agenesis | 39 | 3.5 | 38 | 3.4 | 1.000 |
| Microdontia | 43 | 3.9 | 17 | 1.5 | <0.001 |
| Supernumerary | 15 | 1.4 | 9 | 0.8 | 0.305 |
| Macrodontia | 2 | 0.2 | 5 | 0.5 | 0.226 |
| Transposition | 1 | 0.1 | 0 | 0 | 0.5 |
| Dens in dente | 1 | 0.1 | 1 | 0.1 | 0.75 |

PEDD was related in 567 cases (51.8%), revealed in the analysis that most patients had orthodontic treatment (362 cases; 32.6%), followed by periapical lesions (183 cases; 16.5%), orthodontic treatment (175 cases; 15.8%), presence of residual roots (108 cases; 9.7%). Radiolucent lesions and odontomas were less frequent (0.6% and 0.2%, respectively).

PEDD were correlation between with sex (Table 3), where the presence of endodontic treatment might have been more frequent in famele (p=0.02), while radiolucent lesions exclusive to male (p=0.01). The odontoma was a lesion exclusively to famele, although it did not reach a statistically significant difference.

**Tabela 3.** Comparative analysis between genders of the prevalence of PPED and occurrence of types of dental intervention.

| | Gender | | | | P value |
|---|---|---|---|---|---|
| | Female (n = 719) | | Male (n = 392) | | |
| | N | (%) | N | (%) | |
| Periapical lesion | 117 | (16.3) | 66 | (16.8) | 0.874 |
| Radiolucent lesions | 0 | (0) | 5 | (1.5) | 0.001 |
| Odontoma | 2 | (0.3) | 0 | (0) | 0.418 |
| Residual root | 65 | (9.0) | 43 | (11.0) | 0.351 |
| Endodontic treatment | 231 | (32.1) | 131 | (33.4) | 0.708 |
| Orthodontic treatment | 127 | (17.7) | 48 | (12.2) | 0,022 |

Comparative analysis of PPED between locations showed that the maxilla was often more affected compared to mandibular (p=0.01) (Table 4). Periapical lesions were more frequent in the mandible, as well as the presence of residual roots, although these data did not reach statistical significance. Some lesions were evaluated by this study, but we could not find any cases in this sample, such as germination and dental fusion lesions.

**Tabela 4.** Comparative arch analysis of the prevalence of PPED and occurrence of types of dental intervention.

| | Location | | | | P value |
|---|---|---|---|---|---|
| | Maxilla | | Mandible | | |
| | (n = 452 ) | | (n = 403) | | |
| | n | (%) | n | (%) | |
| Periapical lesion | 1 | 0.2 | 1 | 0.2 | NA |
| Radiolucent lesions | 94 | 20.8 | 119 | 29.5 | 0.103 |
| Odontoma | 63 | 13.9 | 69 | 17.1 | 0.668 |
| Residual root | 2 | 0.4 | 3 | 0.7 | NA |
| Endodontic treatment | 292 | 64.6 | 211 | 52.4 | 0.0001 |

## Discussion

Dental anomalies are multifactorial and complex changes involving genetic, epigenetic and environmental factors throughout the dental development process[6,8]. These anomalies can develop from simple changes of shape or position to changes so complex that they lead to the disorganization of structures such as dentin and enamel[8,11]. In this study, were characterized the large cohort of non-syndromic patients and in a wide of ages, through a survey of panoramic radiographs correlating developmental dental anomalies and post-eruption changes and associating them with gender and location.

Among the developmental disorders that had the greatest expression was root dilaceration with a total of 25.9% of the cases, being more prevalent in females, despite not having a statistically significant difference, these data were similar to those found by Ledesma-Montes et al., where they also correlated these alterations with other DDA[12]. Regarding the location 19.8% of the cases were in the mandible, a systematic review showed that the most affected teeth are the lower third and second molars, followed by upper premolars and upper incisors respectively, thus showing the highest frequency in the lower arch[7,13,14].

Taurondontia is a morphological anomaly in which the pulp cavity is vertically elongated, so clinical diagnosis becomes impossible, and radiographic diagnosis is essential[15]. In our study, it was noted the presence of taurodontia in only 7.9% of cases, where it presented with a predominance in the mandible. Although this anomaly is related mainly as a marker of orofacial anomalies, it was noted that even in a normal population it can be a complication mainly for endodontic treatment, due the taurodontia was decreased the root surface area and for prosthetic treatments that require an adequate occlusal load[15,16].

Hypercementosis is described as enlargement or increase in the deposition of cementum around part or all of the root[17]. In our study, hypercementosis when observed showed that the mandible was more affected than the maxilla, these data corroborate with reports in the literature that demonstrate the mandible as the most affected region[7,17]. Impacted tooth refers to a tooth that cannot erupt within the expected time until its normal position[3]. Our sample observed that 14% had this change and was more frequent in the jaw region. This predilection for the mandible is mainly caused by lower third molars, which may encounter physical barriers and changes in tooth position for the eruption[3]. Microdontia was observed with a most frequency in the maxilla. This alteration was unique DDA correlated with the maxilla, mainly because it is an area more susceptible to the size/form anomaly in the upper anterior region, such as the conoid teeth and a high prevalence of upper third molar with microndontia. Given the smaller diameter of the upper region in some patients, as in the case of patients with an ogival palate[18].

PPED most commonly found were endodontic treatments where we found a percentage of 32.6% and is more correlated to the maxilla. Although the lower molars appear like the teeth most prone to endodontic treatment, when it shows an overview the maxilla is more stricken[19]. A possible explanation for this might be that region is more prone to trauma which would cause pulp necrosis and extensive carious lesions leading to endodontic treatment.

Radiolucent lesions showed low incidence reported in the literature and this result is similar to the results[3]. Radiolucid lesions were associated with the root apex are caused by reactions of periapical tissue to inflammatory stimulus, but may mimic more severe lesions such as lymphomas and oral metastasis, as described in other studies[20,21].

Our study has some limitations, digital panoramic radiography which is not as clear as those of intraoral radiographs, distortion in the upper and lower anterior region, and limitation of three-dimensional visualization of structures, especially in cases where there is a need for vestibule-lingual location. However, to provide an initial diagnosis it becomes of great relevance.

In summary, our study provide evidence of panoramic radiographic exams at the initial moment of the consultation, proving that DDA related lesions (61.6%), and PEDD (51.8%) are very frequent changes in the brazilian population with particular characteristics of distribution by sex and localization. In addition, the most frequent alterations were endodontic treatment, followed by root dilaceration, and included tooth.

## Conflict of interest

The authors state that they have no potential conflict of interest that could bias the results obtained in the current study.

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