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Radiographical Pathological Incidental Findings before Orthodontic Treatment

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ABSTRACT

Background and objectives: Panoramic as well as Cephalometric radiographs, in combination with a clinical examination, are regularly used as an aid and both are considered as a cornerstone for orthodontic diagnosis and treatment planning. Due to increasing numbers of patients seeking orthodontic treatment, an increase in incidental findings on diagnostic X-rays is suspected. The objective of this study was to determine the diverse incidental pathological findings observed in radiographs taken before orthodontic treatment in Al Baha Region, Saudi Arabia.

Methods: This was a cross-sectional study that investigated 358 panoramic and Cephalometric radiographs who were randomly selected from the Orthodontics Department of Al-Baha University, Faculty of Dentistry Clinic in the period between 2019 and 2022. Only those pathological findings with a possible influence on orthodontic treatment were included and then compared with the patient's record.

Results: The most common findings were thickening of mucosal lining in sinus maxillaries, multiple impacted teeth, dental anomalies and periapical inflammatory lesions. The majority of the periapical lesions and radiopacities were found in the mandible. Both the presence and the number of findings per patient increase with age but there is no association with sex $P<0.001$.

Conclusion: The prevalence of incidental findings in this study was low especially those outside dental arches. In most cases, the findings had no consequence for the orthodontic treatment plan and did not require urgent dental management. Careful radiographic examination in addition to use of advanced radiographic diagnostic methods are required to rule out significant pathological findings before orthodontic treatment.

Keywords: *Treatment, Increase, Careful*

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INTRODUCTION

It is usual practice in orthodontics to complement the clinical examination with other diagnostic images. Radiographs are routinely included in the diagnostic sequence for orthodontic treatment planning; such as intraoral and extra oral radiographs, including panoramic, lateral cephalogram and periapical radiographs. It has been reported that more than 90% of orthodontists order lateral head radiographs and panoramic radiographs for their patients and that panoramic radiographs are the most commonly requested radiographic examination [1-2]. One of the advantages of panoramic radiographs is that they allow for the detection of pathological lesions and dental anomalies. In addition, it distinguishes missing, supernumerary teeth, eruption pattern and malposition of teeth. The panoramic radiograph is also a tool for detection of hard tissue pathology but not sufficient for diagnosis of dental caries or periodontal disease due to the lack of image sharpness [3]. Pathologic abnormalities may also be identified in profile Cephalometric radiographs, taken to study dental and skeletal relationships in orthodontic patients [4]. The expected frequency with which an orthodontist can make incidental findings of pathology or abnormality in an orthodontic patient is of special interest to the clinician because in many cases such findings may require medical or odontological management [5-6]. Numerous oral and dental anomalies are related to age and sex [7], but still few studies have separately evaluated the prevalence of pathologic findings in panoramic as well as in Cephalometric radiographs of patients seeking orthodontic treatment. This study was formulated to evaluate the prevalence and location of incidental pathological findings including odontogenic inflammatory lesions, dental anomalies, impacted teeth, bone pathology, Osteomalacia, maxillary sinus status and TMJ problems in pretreatment orthodontic panoramic as well as Cephalometric radiographs and correlate these findings with patient's record.

MATERIAL AND METHODS

Selection of cases

This a cross-sectional study was constructed based on data available from both Medical and Dental sciences Department and Preventive Dental Sciences Department of Al-Baha University, Faculty of Dentistry in four year period between 2019 and 2022. The study protocol was approved by Al-Baha University Ethical Committee, and all patients/parents gave written informed consent for the use of their orthodontic data for research. From the initial full patients screening (2138) with radiographic images taken during the 4-year study period, 438 patients seeking orthodontic treatment were selected. After applying selection criteria, only 968 patients were eligible for inclusion. By simple random sampling, the sample size required of 358 patients was obtained.

Inclusion Criteria

Panoramic and Cephalometric digital radiographs of good quality.

Exclusion Criteria

Patients with cleft palate, craniofacial anomalies and a history of maxillofacial surgical treatment were excluded. Pediatric patients were also excluded from the study because errors, such as movement and positioning during radiographic processes, were considered to occur at a higher rate in young patients thus affecting the results. All radiographs were obtained, following a standard protocol, with Ortophos XG plus DS/Ceph (Sirona Dental Systems, Bernsheim, Germany) at an adjusted voltage of 60–77 Kv and 8-15 mA, and an exposure time of 9.4-14.1 seconds. The Sirona protocol was adjusted to the patient's age and weight5. Clinical data were obtained from archival records of selected patients. Presence, number, and location of incidental findings were documented. Findings such as caries, missing/supernumerary teeth, and eruption disturbances were not recorded. Inter-observer conflicts were resolved by discussion of each radiograph. All radiographs with pathological findings were reviewed by oral radiologist and then oral pathologist.

Statistical analysis

The data obtained in the present study were collected, tabulated and analyzed statistically using the "SPSS 20" (Statistical Package for Scientific Studies) (SPSS Inc., Chicago, Illinois, USA), the probability value (p -value with 0.05) was used in the assessment of the significance.

RESULTS

In this study, the prevalence of all incidental findings in digital panoramic and Cephalometric radiographs is 30.16% (108 out of 358). Total of 358 panoramic as well as Cephalometric radiographs (215 women; 143 men) were studied. The mean age of patients in the study was 13.9 years (from 9-37 years). The most prevalent pathological findings were found in maxillary sinus (thickening of mucosal lining and pneumatisation; 20.11%), periapical inflammatory lesions that confirmed by histopathological diagnosis as periapical granuloma (Fig 1 A) and chronic periapical abscess (5.33%), dental anomalies mainly dens in dent (Fig 2 A) and dilacerations (3.35%) and multiple impacted teeth (Fig 2 B) (1.95%). The prevalence of odontogenic cysts that confirmed by histopathological diagnosis as radicular cysts and non-neoplastic bone (cement osseous dysplasia) (Fig 1 B) was very low (less than 1%). The majority of the periapical lesions and pathological findings were found in the mandible. Significant association was found with patient age $P < 0.001$; however, but not with sex ($P > 0.05$). Pathological findings that may affect orthodontic treatment plan were very low (less than 1%) including extracted molars with periapical infections or deeply seated impacted canines suggested for surgical extraction.

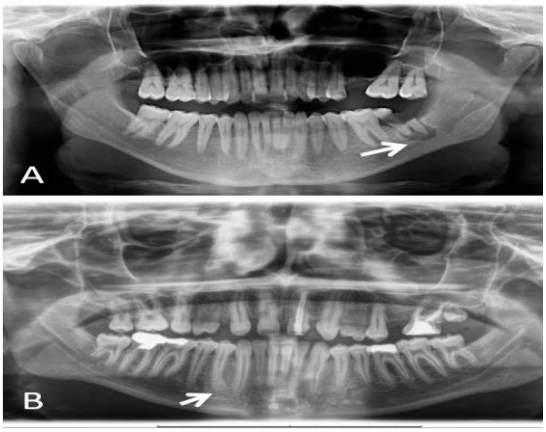

FIG 1. Panoramic radiograph of a 15-year-old female patient with periapical inflammatory lesion (periapical granuloma) (A), panoramic radiograph of 20-year-old male patient with periapical cemental dysplasia (B).

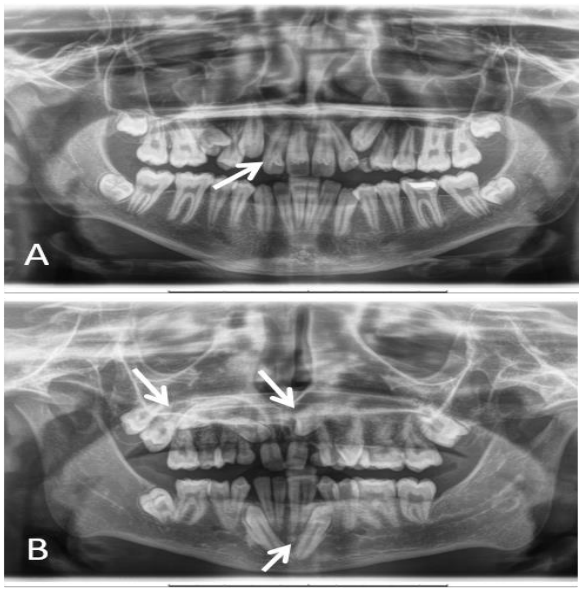

FIG 2. Panoramic radiograph of a 16-year-old female patient with dens in dente (A). Panoramic radiograph of a 21-year-old male patient with deep multiple impacted teeth including upper and lower canines and molars (B)

DISCUSSION

The reported prevalence of incidental findings in digital panoramic and Cephalometric radiographs were variable that might be related to differences in population, sample size, study design and observer experience. In the present study, the prevalence of findings were about 30.16%, was less than similar values reported previously, probably because of the less age range (9–37 years) in this study compared with other studies [8]. In the present study, the observer was an oral pathologist with more than 20 years of experience and expertise in the interpretation of radiographic images.

The airway was the main location for incidental findings detected in the present study, including thickening of mucosal lining and pneumatisation. This result is similar to other studies for incidental findings at the level of the maxillary sinus [9-10]. Regarding developmental dental anomalies, in this study a less prevalence of dental anomalies was found, which was in contrast to the value reported in the meta-analysis of Pakbaznejad Esmaeili E, [11] for different populations, in which significant differences among continents and between genders were detected. In the present study, the percentage of incidental findings was little higher in women (51.37%) than in men (48.63%), but the difference was not statistically significant for the presence of findings. One of the most important outcomes of our study was the significant association between age and presence or number of incidental findings ($P < 0.001$). This is probably because the development of more complex lesions is expected, and the probability of incidental findings is increased, in patients with advancing age. In recent years, the demand for orthodontic treatment and therefore orthodontic imaging has increased in adults [12-13]. One limitation of this study was the observation of incidental findings in two-dimensional (2D) images, while three-dimensional (3D) images, with CBCT, provide further information for diagnostic hypothesis and location of anomalies. Although CBCT imaging is increasingly utilized in diagnosis and treatment planning in orthodontics, it is not yet a routine diagnostic tool [14-15]. A common error in the present study was that the tongue was not placed in contact with the hard palate during exposure, a result also in concordance with other findings. An incorrect tongue position can affect diagnoses of apical periodontitis and assessments of root anatomy and resorption, findings that might be of importance for orthodontic treatment and one of the reasons for taking the radiographs [16]. The discrepancy between the orthodontic records and the observations made by the oral radiologists in this study may be due to differences in opinion on what is a pathological finding of importance for orthodontic treatment planning as well as differences in experience and skill in interpreting panoramic radiographs.

CONCLUSIONS

Orthodontists should to be aware of pathological findings in pretreatment orthodontic cases to avoid such findings that will interfere with treatment planning.

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