Analysis of Panoramic Images of Orthodontic Patients

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ABSTRACT

Panoramic imaging is the most widely requested radiographic technique in dentistry. In orthodontics, the clinical and radiographic examinations are routinely carried out along with dental and skeletal photographs as a part of diagnosis and treatment planning. The evaluation of radiographs of patients after orthodontic treatment is important in understanding the possible changes that tend to occur post-treatment. This study aims to analyze the incidental findings present in the radiographs of patients who previously underwent orthodontic treatment. A total of 30 patients (18 females; 12 male) were randomly selected from the Orthodontic clinic at the Department of Orthodontics, Saveetha Dental College and Hospital, Chennai. Two independent examiners analyzed the panoramic radiographs for anomalies and pathologies. The result showed the most common finding, which was periodontal pathology (Generalised bone loss, widening of periodontal ligament space, or both, loss of lamina dura) with a prevalence of 36.7%. All the patients taken into the study had at least one anomaly. In conclusion, the relevant findings were observed in all the radiographs & special care should be taken while evaluating them to diagnose alterations that may require other dental treatments.

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INTRODUCTION

In India, oral medicine and oral radiology (OMR) go hand — in — hand. Specialists in the field of OMR are addressed as stomatologists or oral radiologists as they are experts in the field of both oral medicine and dentofacial radiology. This specialization plays an important role in diagnosis, treatment planning, and non-surgical management of various orofacial conditions (Steele *et al.*, 2015).

Radiographs are the largely employed investigatory technique in the field of dentistry, for diagnosis and treatment planning. From identification of oral disorders like cysts, carcinomas, or any complex pathological conditions to simpler findings like dental caries, it has been widely employed in dentistry. 2-dimensional radiographs such as Intraoral periapical radiograph (IOPA) or orthopantomogram (OPG) and 3-dimensional imaging like CT, cone-beam CT (CBCT), magnetic resonance imaging (MRI), etc., are used based on the clinical intervention (Misra *et al.*, 2015; Rohini and Kumar, 2017). The first line of radiographs advised primarily is the 2-dimensional conventional radiographs. However, for soft tissue pathologies, namely premalignant disorders (Muthukrishnan and Kumar, 2017; Maheswari *et al.*, 2018; Warnakulasuriya and Muthukrishnan, 2018) radiographs are not generally advised. In the case of malignancies with the involvement of lymph nodes or any metastatic conditions, or patients with orofacial pain like neuropathic, 3-dimensional imaging like MRI, ultrasound,

CT, or CBCT can be advised (Subha and Arvind, 2019).

The role of panoramic radiographs in orthodontics is to evaluate the skeletal abnormalities, dental malocclusions and pathologies, growth, and development of the involved patients. Any alteration in the bone or trabecular pattern, anatomical deformities, and complex structures can be visualized in radiographs (Kurol and Owman-Moll, 1998). Panoramic images serve as a correlation with the pretreatment and post – orthodontic treatment evaluation. These radiographs are essential to evaluate the teeth eruption and act as an instrument for the detection of pathologies in the jaws (Bondemark et al., 2006; Muthukrishnan et al., 2016).

Studies show that 80% of the patients undergoing orthodontics treatment are found to undergo age transition between mixed dentition to permanent dentition, a period where there are plenty of dental anomalies observed in the radiographs (Cral et al., 2018). The findings in the radiographs are of particular interest to the dentist as they may indicate pathologies that can be incidental, which may require additional dental treatment.

The study aims to analyze the panoramic radiographs of patients who underwent orthodontic treatment and to rule out all incidental evident findings in post-treatment radiographs.

MATERIALS AND METHODS

A total of 30 participants were randomly selected and taken into the study. The participants were selected from the orthodontics clinic at the Department of Orthodontics, Saveetha Dental College and Hospital, Chennai, India. OPGs of the participants were taken for evaluation and studied retrospectively.

Patients with both pre and post-treatment radiographs and who had come for follow-up between the period of August 2019 to March 2020 were taken into the study.

Patients who underwent orthognathic surgeries, with irregular appointments, or with long – term treatment of more than assigned duration, and patients who discontinued the treatment against medical advice were all excluded from the study.

Two examiners were involved in the study. Both evaluated the radiographs which were grouped as Group A: Post-treatment radiographs of the female population and Group B: Post-treatment radiographs of the male population along with the pre-treatment radiographs respectively.

Before the evaluation of these radiographs, the examiners were asked to analyze other random panoramic images to have an agreement in the diagnosis.

The ethical committee approval (SDC/SIHEC/2020DIASDATA/0619-0320) was obtained from the Institutional Scientific Research Board. Simple random sampling was carried out to eliminate bias.

Statistical analysis was done with SPSS v20.0 software, and the frequency distribution of the collected data was calculated and analyzed. Kappa statistics were performed for the calculation of interexaminer agreements. The reliability of the interexaminer agreement for the two researchers for detecting the pathologies was 100% (kappa 1.00) and 94.69% (kappa 0.7) respectively. The overall agreement was found to be 87%, corresponding to a kappa index of 0.6.

RESULTS AND DISCUSSION

The result of the study shows out of 30 OPGs, 18 of them were females and 12 were males.

Participants of the study were differentiated into two groups based on gender. Group A comprises the female population and Group B comprises the male population.
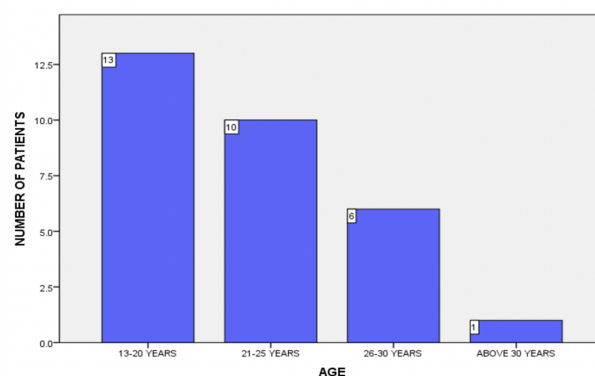

Figure 1: Bar chart showing the distribution of the study population based on age

The demographic data of the study population — age and gender are explained in figures. Figure 1 shows between 13-20 years of age, 43.3% (n=13), 21-25 years of age 33.3% (n=10), 26-30 years of age had 20% (n=6) and above 30 years of age 3.3% (n=1) prevalence was observed. The X-axis shows the age of the study population classified into four age groups, and the Y-axis shows the number of patients. The highest prevalence of 13 patients underwent orthodontic treatment between the age of 13-20 years (43.3%). Figure 2 The X-axis shows

the gender of the study population classified as male and female and the Y-axis shows the number of patients. Grey bar denotes the female patients and red bar denotes the male patients. On comparing the female (Grey) and the male (Red) patients, female patients (n=18) were found to undergo orthodontic treatment in a larger number than male patients (n=12). shows 60% (n=18) of prevalence in the female population, which is higher than the male population, 40% (n=12).

Association between the age and gender of the population have been studied. Between the age group

13-20 years, 9 (30%) were female and 4 (13.3%) were male, between 21-25 years of age 6 (20%) were female and 4 (13.3%) were male and between 26-30 years of age, 2 (6.67%) of female and 4 (13.3%) male patients were present. Above 30 years of age, 1 (3.3%) female patients were observed. (Figure 3)
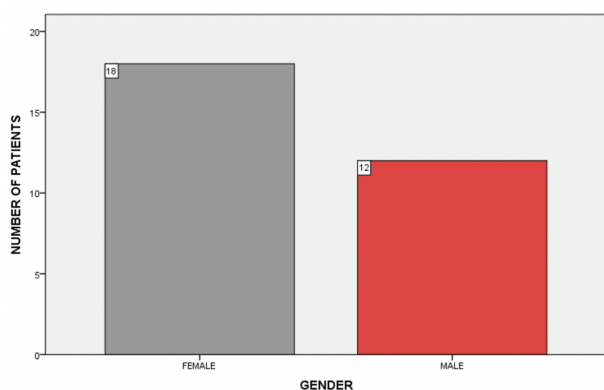

Figure 2: Bar chart showing the distribution of the study population based on gender

A brief description of the frequency and percentage of the incidental findings of Group A and Group B are given in Table 1. Comparing the groups' A and B, it is observed that group A had 20.5% of periodontal pathologies namely, bone loss, periodontal ligament space widening, and loss of lamina dura than group B which had 16.1% of the findings. Ankylosis was observed in the study, which was only 1 in number (1.4%).

Cral et al. (2018) did a similar study in the Brazilian population and found out that the patients with the correlation of the pre-treatment and post-treatment had incidental findings like root resorption (2.4%), osteosclerosis (12%), pulp stones (2.8%) and apical endodontic lesion (1.6%)

Apajalahti and Peltola (2007) did a study in orthodontic patients to check for apical root resorption using radiographs (OPG and IOPA) He concluded that the degree of root resorption increased

with increase in the duration of the orthodontic treatment and suggested IOPA is the method used to determine them accurately.
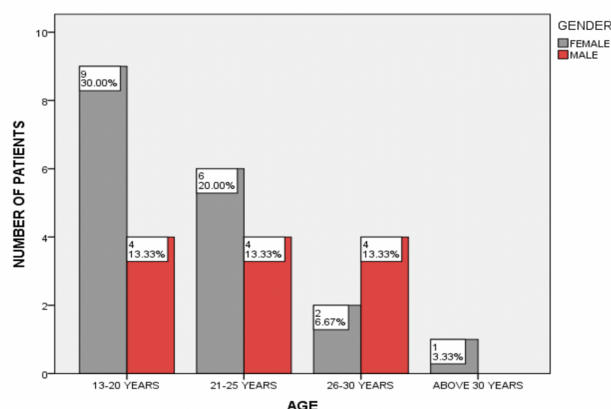

Figure 3: Bar chart showing the association between the age and the gender of the patients

Han (2005) stated that tooth intrusion causes four times more root resorption than extrusion. Levander (1998) stated that patients with longer duration of treatment and continuous orthodontic movements are prone to have higher chances than the ones whose treatment is performed with pause, which allows the cementum to recover (Levander, 1998). In recent times, there are researches showing idiopathic external root resorptions at the cervico-apical region of multiple teeth which were identified with the help of conventional radiographs (Choudhury et al., 2015). Such pathologies need to be analyzed carefully.

Over time, the dental pulp undergoes physiological changes due to its ageing. With the influence of other factors such as caries, periodontal diseases, the deposition of mineralized tissue in the form of nodules in the interior of the pulp cavity may occur (Nixon et al., 1993; Fachin et al., 2002).

Medications commonly prescribed in orthodontics are for control of pain following mechanical force application to teeth. Recent evidence demonstrated the mechanisms behind the inhibition of tooth movement by nonsteroidal anti-inflammatory drugs (NSAIDs). The levels of matrix metalloproteinases were found to be increased, along with elevated collagenase activity, followed by a reduction in procollagen synthesis, which is essential for bone and periodontal remodelling (Diravidamani et al., 2012; Venugopal and Maheswari, 2016; Chaitanya et al., 2017, 2018). Long term usage of such medications can cause periodontal pathologies, and in our study, it accounts for about 36.7%.

Few authors consider OPG is not an accurate radiographic modality to identify the root morphology

Table 1: The association of the incidental findings present in the study between Group A and Group B in frequency and percentage

Findings	Female (group A)	Male (group B)	Total
Periodontal Pathology (Bone loss, pdl space widening, loss of lamina dura)	14 (20.5%)	11 (16.1%)	25 (36.7%)
Pulpal Pathology (Dental caries, periapical lesions, pulp stones)	10 (14.7%)	7 (10.2%)	17 (25%)
Osteitis (Condensing osteitis, idiopathic osteitis)	2 (2.9%)	3 (4.4%)	5 (7.3%)
Hypercementosis	2 (2.9%)	1 (1.4%)	3 (4.4%)
Ankylosis	1 (1.4%)	0 (-)	1 (1.4%)
Loss of Tooth Structure (Attrition)	4 (5.8%)	2 (2.9%)	6 (8.8%)
Root Resorption	8 (11.7%)	3 (4.4%)	11(16.1%)
Total	41 (60.3%)	27 (39.7%)	68 (100%)

because of a resultant two-dimensional image and overlapping of the structures and recommend for 3-dimensional imaging modalities (Patil *et al.*, 2018). However, our study showed 16.1% of root resorption in panoramic radiographs, which accounts for the second-highest observed incidental findings.

Maintenance of good oral hygiene is advised to patients during and after the orthodontic treatment. Excellent oral care was emphasized as it consisted of brushing the teeth twice daily using a soft bristle brush, flossing daily, and advised scaling at accurate intervals in having satisfying oral hygiene (Dharman and Muthukrishnan, 2016; Subashri and Maheshwari, 2016).

This article reports retrospective investigations done only with the information obtained in the radiographs. Clinical evaluation of the population was not done to evaluate the presence of periodontal findings. Examination for periodontal pocket or attachment loss if examined clinically can help in ruling out the periodontal anomalies.

Radiographs also showed image distortion of 15-20%. In the future, considerations for a larger population, long-term follow up and clinical evaluation can be useful to investigate other anomalies and helpful in the prevention of such changes to the oral cavity.

CONCLUSION

From the study conducted on comparing the pre-treatment and post-treatment radiographs of orthodontic patients, it is understood that possible changes like dental caries or pdl space widening can progress in the oral cavity post orthodontic therapy. The study showed the highest prevalence of 36.7% with periodontal anomalies. Analysis with pretreatment and posttreatment radiographs of orthodontic patients is of importance because incidental findings like pulpal pathologies etc. may require an endodontic treatment in order to prevent any further odontogenic damage.

Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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