ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 04, pp.49534-49536, April, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

RADIATION RISKS IN ORTHODONTICS

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ARTICLE INFO

Article History:
Received 18th January, 2017
Received in revised form
18th February, 2017
Accepted 22nd March, 2017
Published online 30th April, 2017

Key words:

Radiation Exposure,
CBCT,
Orthodontics.

ABSTRACT

Aim: To assess the radiation risk in Orthodontic patients.
Materials and Methods: 116 patient records were assessed . 94 patients were advised CBCT for non Orthodontic reasons while 22 Orthodontic patients were advised CBCT. These patients were assessed for the number of 2D radiographs taken before advising a CBCT.
Results: It was observed that multiple radiation exposure was done for the orthodontic patient. Most of the 2D radiographs taken before advising CBCT was IOPAs and OPGs for Non Orthodontic patients while it was IOPAs, OPGs and LatCephs for Orthodontic patients. For the non Orthodontic patient the mean number of 2D radiographs advised before taking CBCT was 2.19 (SD 1.90) while for the Orthodontic patient the mean number of 2D radiographs taken were 4.73 (SD 1.83) The radiation exposure was however still quite low. The amount of radiation was also calculated using "radiationcalculator.com".
Conclusion: There is still a distinct possibility to reduce the radiation for the Orthodontic and Non Orthodontic patient.

Citation: Sujatha Ponnusamy, K. Vijaya Lakshmi, K.S. Premkumar and S. Sumalatha, S. 2017. "Radiation risks in orthodontics", *International Journal of Current Research*, 9, (04), 49534-49536.

INTRODUCTION

Over the past decade, cone beam computed tomography (CBCT), specifically for imaging the maxillofacial region, has been developed. (April A. Brown *et al*., 2009) CBCT images provide useful datasets to generate both two-dimensional (2D) planar projection (Hilgers*et al*., 2005; Farman*et al*., 2006; Moshiri*et al*., 2007; Kumar*et al*., 2007) and three-dimensional (3D) surface or volume rendered images, (Lagravère*et al*., 2006) for use in orthodontic assessment and treatment planning.The corner stone to successful orthodontic treatment is accurate diagnosis and fundamentally sound treatment planning which requires radiological investigations. Thus, Orthodontic patients are routinely advised radiographs. Most commonly these radiographs include the lateral cephalograms and the orthopantomogram. However certain patients may require additional radiographs like IOPA, PA Ceph, Occlusal view etc. Sometimes these data may still be insufficient and the patient may still be referred for a CBCT. Taking a CBCT would definitely provide greater data but has the disadvantage of greater radiation and would also render the previous radiation exposure untenable. CBCTs are generally advocated in Orthodontics for asymmetry, Cleft Lip and Palate, Orthognathic Surgery, root resorption detection and impacted teeth. Risk is age-dependent, being highest for the young and least for the elderly.(Sedentexct) Hence with the majority of the Orthodontic patients being of the younger age group, the clinician has to prudent while suggesting the diagnostic aids. Conventional two-dimensional (2D) radiographic imaging techniques (panoramic radiography, cephalograms, occlusal, and periapical radiographs have been traditionally used in orthodontics for several decades. CBCT is fast becoming the imaging modality of choice in clinical cases requiring extensive 3D views, especially in patients with craniofacial asymmetries (1), TMJ disorders (2,3), tooth impactions (4) and respiratory issues involving the sinuses and airways (5). CBCT now affords 3D visualization and quantitative analysis of skeletal versus dental effects of maxillary expansion. [8] Hence the aim of this study was to assess the incidence of this multiple exposure for Orthodontic patients.

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MATERIALS AND METHODS

Patient data regarding their history of exposure in relation to dental radiations were taken from the Oral Medicine & Radiology department of Ultra s Best Dental Science College &Maeoris Dental Implants& Esthetic Care Centre Pvt Limited. 116 patient records were assessed. They were CBCTs for various reasons. They were assessed and divided into Orthodontic and Non Orthodontic requirements/requisitions. 94 patients/CBCTs belonged to the Non Orthodontic category and they primarily were for trauma. 22 CBCTs belonged to

Orthodontic category. The records of 116 patients who the clinician/Orthodontists felt that CBCT were required were identified for previous radiographs (2D). Further "radiationcalculator" website was used to assess the severity of the radiation for the patient. This is based on age and gender of the patient.The radiographs taken were documented as IOPAs, OPGs lateral cephalograms etc. These data along with the age and gender of the patient were fed into the data base of radiation calculator to assess the severity. The calculator utilizes age and gender to assess the radiation severity.

RESULTS

116 patients who had CBCT were identified. Their records were retrieved to assess the number of radiographs. It was seen that each Orthodontic patient had 4.73(SD1.83) radiographs before a CBCT was advised. It was also observed that the routine number of radiographs for an Orthodontic patient was 4 radiographs. The number of radiographs taken for the Non Orthodontic patient was 2.19 .Though the "radiationcalculator" website indicated that only in 2 patients out of the 22 Orthodontic patients the amount of permissible radiation was crossed, the mean and SD of the permissible radiation was .67 (.37SD) which is approximately 67% of the permissible radiation. However in the Non Orthodontic category the mean and SD of the permissible radiation was .26 and .18. which is only approximatedly 26% of the total radiation.

Table 1. Mean radiation exposure permissible

Number of CBCTs	Number of radiographs	Mean and SD	Permissible radiation-mean and SD
22	104	4.73(1.83)	.67(.37)

DISCUSSION

CBCTs are gaining popularity in optimizing the placement of skeletal anchorage devices and implants (King*et al*., 2007; Kurodа*et al*., 2007; Madrigal*et al*., 2008; Nickenig and Eitner, 2007) However, there appears to be a lack of awareness and some controversy regarding the use of CBCT for routine orthodontic treatment because of its inherent limitations, e.g., radiation dose (Farman and Scarfe, 2006; Silva*et al*., 2008) Some of the proven advantages of CBCT (Hechler, 2008; Holberg*et al*., 2005) and its increasing patient popularity have led to a rising trend towards incorporating CBCT for all orthodontic patients. However, as responsible health care providers, we must not neglect fundamentals such as the ALARA principle - "as low as reasonably achievable." It is necessary that all applications and limitations of this new technique be addressed systematically and critically. (National Council for Radiation protection and Measurements.Radiation protection in Dentistry. Bethesda: National Councilfor Radiation Protection and Measurements, 2003)It is critical to have universal guidelines on when to suggest a CBCT. However it is also equally important on how soon a CBCT should be suggested. For example, in cases of canine impaction, the general dentist or the Orthodontist should have guidelines or protocols to advise CBCTs. Thus it is important for general dentists and Orthodontists to identify cases that will benefit from the use of CBCT based on the current evidence and avoid unnecessary radiation exposure, especially for the younger patient population, when possible. (Tadinada*et al*., 2016)From this study it can be seen that an average of 4.73 radiographs were advised for an Orthodontic patient before a CBCT was suggested. Though this may not seem huge, it is very important for the clinician to understand that once the CBCT is taken, these radiographs are not of significant diagnostic value. Hence in order to minimize the radiation to the Orthodontic patient, there should be every effort taken to ensure that CBCTs are suggested prudently and also as soon as a clinical requirement is identified. An average of 2.19 radiographs were taken before a CBCT was advised for a Non Orthodontic patient. This amount to about 26% of the total permissible radiation. This smaller number when compared to the Orthodontic patient is purely because of the higher age group of the Non Orthodontic patient.It can also be observed that dental radiography results in nearly 67% of the permissible radiation for an Orthodontic patient who has been advised CBCT. Since majority of our patients are of the younger age group, radiation is a major issue and every step has to be taken to minimize unnecessary radiation.

Although radiation doses in dental radiography are low and may not present any risks, exposure to radiation should be minmised as far as possible. (National Council for Radiation protection and Measurements.Radiation protection in Dentistry. Bethesda: National Councilfor Radiation Protection and Measurements, 2003; Danforth andTorabinejad, 1990; Torabinejad*et al*., 1989)CBCT scans allow the orthodontist to assess the patient's hard and soft tissue in three dimensions (3D).5 The accuracy and reliability of such images have been tested and were found to be adequate for implant planning, periodontal disease quantification, and assessment of tumor/lesion volumes. (Lagravère*et al*., 2006; Tadinada*et al*., 2016)CBCT application as a craniofacial diagnostic tool often has been underutilized, with the orthodontist gathering 3D data and then synthesizing conventional two-dimensional (2D) films with which he or she is more familiar (eg, lateral headfilms, panoramic radiographs). These reconstructed images are accurate and reliable when compared with conventional radiographs and simulate the way lateral cephalometric or panoramic films are magnified and distorted. This so-called "bridge" from 3D to 2D images has helped orthodontists use the advantages of CT scans without having to add a lateral cephalometric exposure for craniofacial diagnosis.(King*et al*., 2007; Kurodа*et al*., 2007)

Conclusion

An average of 4.73 radiographs were advised before a CBCT was suggested. Every effort should be made to further minimize this number. This would involve educating the screening clinician to the practical and clinical requirements of CBCT.

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