

# Prevalence of Radiographic Errors in IOPA

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## Abstract

Radiographs are considered as a crucial aid in diagnosis, intraoral and post operative evaluation of different conditions and dental procedures. Exposing the patient to beams of x ray more than needed is time consuming and increases treatment cost. Some of the errors include cone cut, overlap, elongation, shortening, hazy image, ghost image, artifacts and reversed film. The aim of the study is to determine the prevalence of radiographic errors in IOPA. The study was aimed to investigate the correlation of radiographic errors in IOPA. 100 case reports of patients were obtained from Dental Archive Software and was tabulated in Excel. The data analysis was done using SPSS software. The graphs were obtained and the results were tabulated. Overlap type of error was more prevalent for upto 41%. There were more errors as well like elongation 16%, shortening 17%, hazy image 12%, cone cut 13% and ghost image 1%. 27% of the study population that underwent radiographic errors were between 21 to 30 years. 36% of the errors were caused by molars. Undergraduate students performed more errors in which overlap occurred for 26% while among postgraduate students they occurred for 15%(figure 5). Overlap type of error was the most common cause of radiographic error. Radiographs being one of the golden standards for diagnosis, need to be done with proper knowledge and awareness.

**Keywords:** Radiographs, errors, diagnosis, IOPA, treatment planning

## Introduction

In dentistry, radiographs are an important part of diagnosis and treatment<sup>1</sup>. They help in clinical and anthropological diagnosis. Clinicians should be aware of the positions and processing radiographs<sup>2</sup>. They also help step by step management to maintain the prosthesis like implants<sup>3</sup>. Students should be trained in radiographic techniques in proper position and angulation<sup>4</sup>. IOPA can be used to assess the bone resorption levels to check periodontal health. Improvement in their performance helps reduce exposure to radiation due to faulty radiographs and is important to keep the health of the patient. With the help of the study, students can be made

aware of the common mistakes that are made and this will help them improve their pattern<sup>5</sup>.

The periapical radiograph, using paralleling technique, is considered as the gold standard for measuring the errors<sup>2,6</sup>. Several advanced techniques in radiographs include IOPA, CAD-CAM, MRI etc<sup>7</sup>. Errors like angulation disorders, film bending, reverse film, overlap and cone cut were some of the causes of errors. Anatomical variations like high narrow palate, tori, etc can also cause errors. Changes in the angle between teeth and film also have a significant effect in taking IOPA<sup>8</sup>.

Radiographic techniques and processing errors can highly impact the radiographic interpretation. It is necessary to gather proper radiological information, hence good quality radiographs are important to be taken by avoiding errors<sup>9</sup>. Both paralleling and bisecting angle techniques can have both technical and manual errors. Besides the common errors, processing them incorrectly like image contrast can affect the interpretation.

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They will help evaluate the periodontal status before any prosthetics and can help decide the planning process<sup>10,11</sup>. Any discrepancy in interpretation causes interpretive radiological error. SLOB technique can be used to accurate positioning<sup>12</sup>. As a dental surgeon, they should be aware of processing radiographs. More research is needed to help avoid misinterpretation. It is also important to have radiographs as it will act as a mirror to point out any unseen errors. Radiographs can also help to determine the adaptability of prosthesis<sup>13,14</sup>. Besides this it is important to maintain hygiene between patients when taking IOPA to avoid infections like cellulitis<sup>15,16,17,18</sup>. The aim of the study is to identify and quantify radiographic errors when taking an IOPA, more accurate interpretation with less patient exposure.

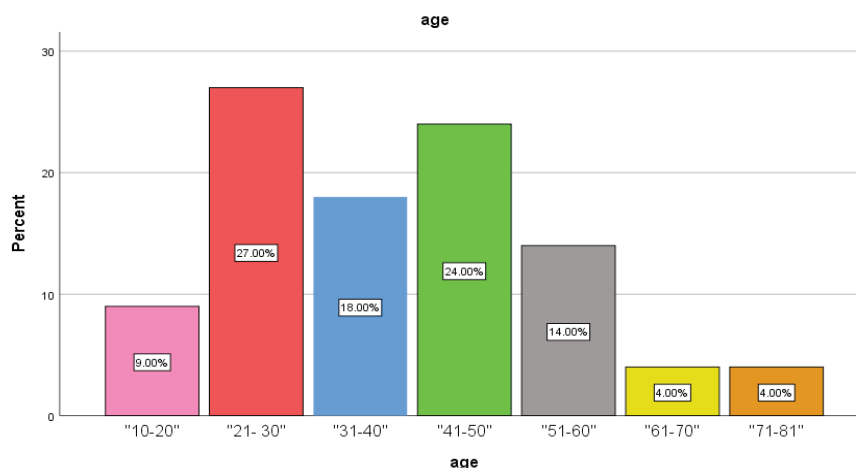
### Materials and Methods

This is a retrospective study which was conducted by using the data collected from the educational software of Saveetha Dental College, Chennai; from June 2010 to April 2020 and it was examined by two examiners. Prior to the start of the study, ethical approval was obtained from Scientific Review Board, Saveetha Dental College, SIMATS university. The study involved a total of 100 sample sizes of patients that had to take IOPAs by undergraduate and postgraduate students. Patients attending the OPD of Saveetha Dental College were enrolled in the study by simple random sampling. 100 case sheets were reviewed of both genders and cross verification was done through radiographs taken of the oral cavity. The external validation can be generalised among the south indian population.

The data was collected from the electronic health records system used at Saveetha Dental College which was used to record and store information and oral health data of the patients reporting to the college. It helps in retrieval of data as starting from diagnosis to treatments rendered, everything is stored and can be accessed by the physicians. The inclusion criteria was patients that took IOPAs. Any other radiographic method other than IOPA were in the exclusion criteria. The data was imported to the software IBM SPSS Version 23.0 and analyzed using descriptive statistics and Pearson’s correlation. Graphs were obtained and the results were tabulated. Statistical significance was set at <0.05. Ethical clearance was obtained and covered under the following ethical approval number - SDC/SIHEC/2020/DIASDATA/0619-0320.

### Results and Discussion

Among the 100 study population taken for the study, it is found that 27% of the study population that underwent radiographic errors were between 21 to 30 years (figure 1), out of which 36% of the population had errors in the molar region (figure 3). 41% of the error was due to overlap which was the most prevalent type of error. Out of the other errors 16% was due to elongation, 17% was due to shortening, 12% was a hazy image, 13% was due to cone cut and 1% was a ghost image due to artifacts. (figure 4). 54% of the study population were females (figure 2). In the study it was found that undergraduates performed more errors in which overlap occurred for 26% while among postgraduates they occurred for 15% (figure 5)



**Figure 1 - Bar chart showing the age groups of the study population between 10 and 81 years between (x axis= age groups and y axis = percentage) 27% of the study population that underwent radiographic errors were between 21 to 30 years**

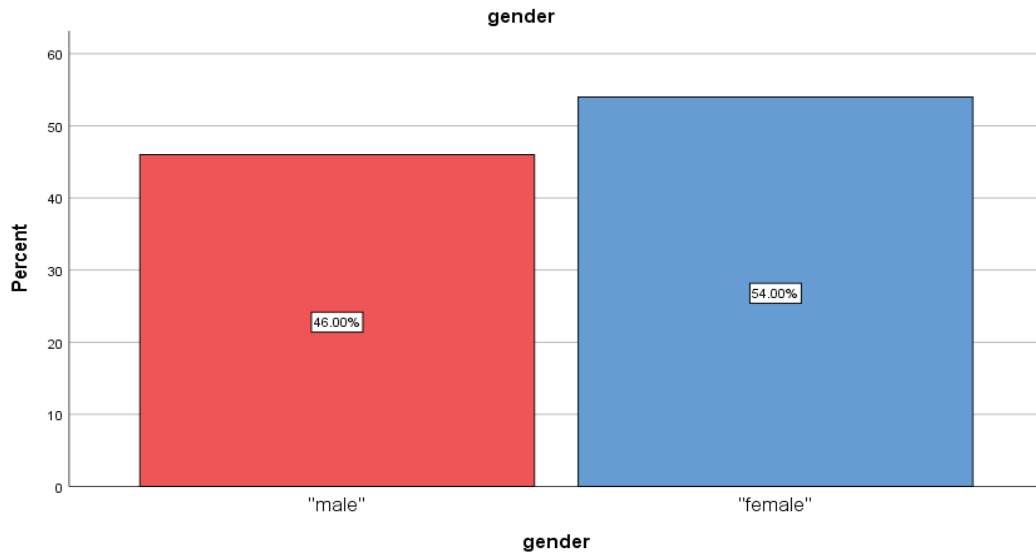


Figure 2 - Bar chart showing the genders of the study population (x axis= gender and y axis = percentage) 54% of the study population were females

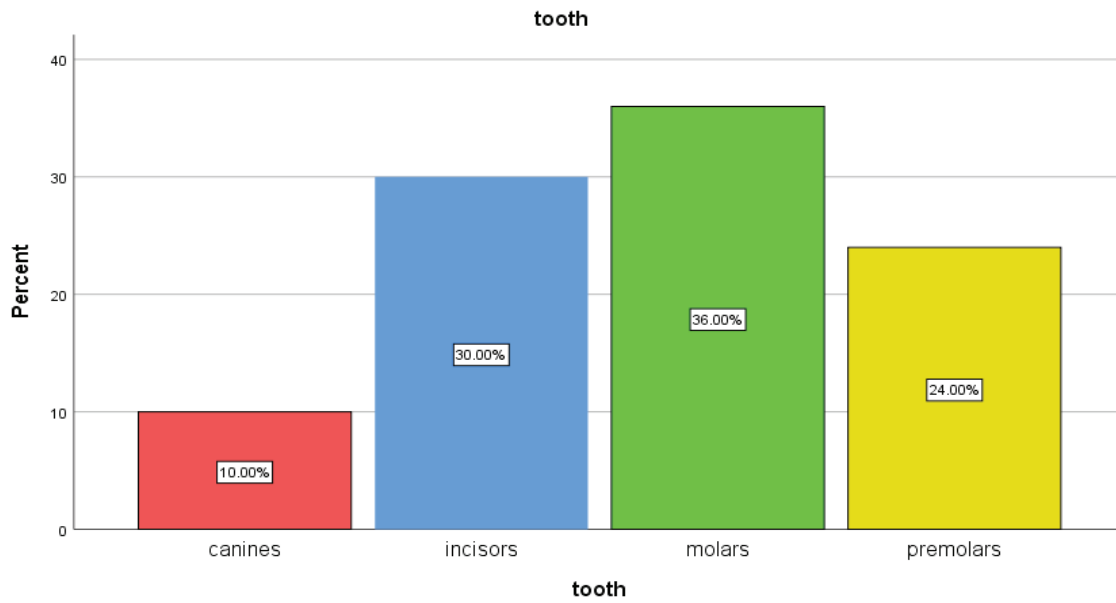
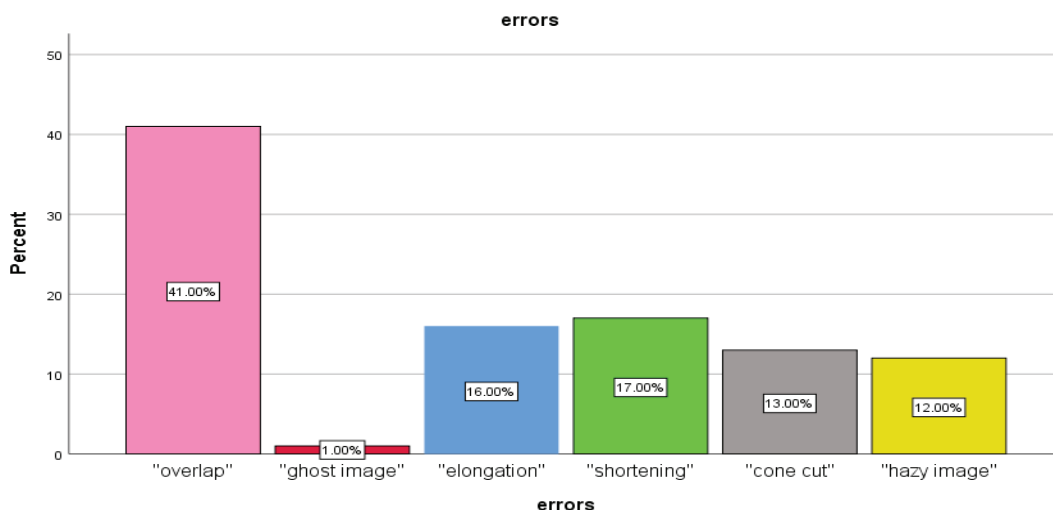
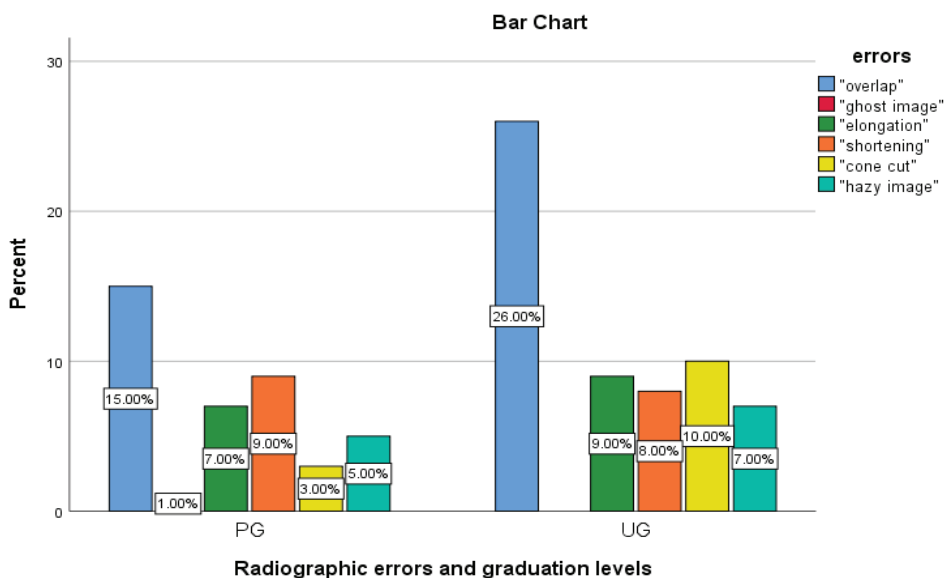


Figure 3 - Bar chart showing the affected tooth region among the study population (x axis= tooth and y axis = percentage) 36% of the radiographic errors were in the molar region



**Figure 4 - Bar chart showing the different radiographic errors (x axis=radiographic errors and y axis = percentage) 41% was due to overlap, 16% was due to elongation, 17% was due to shortening,12% was a hazy image, 13% was due to cone cut and 1% was a ghost image due to artifacts.**



**Figure 5 -Bar graph representing the correlation of radiographic errors among undergraduates and postgraduates where X axis is the radiographic errors and graduation levels and Y axis is the percentage of occurrence of the radiographic errors.The radiographic errors by postgraduates were overlap (15%), ghost image(1%), elongation(7%), shortening(9%), cone cut(3%) and hazy image(5%). The radiographic errors by undergraduates were overlap (26%), elongation(9%), shortening(8%), cone cut(10%) and hazy image(7%). The radiographic errors among postgraduates appear to be less compared to undergraduates, however there were no statistically significant differences between the two groups .(PearsonChi square test; P = 0.474.P>0.05) In the study it was found that undergraduate students were more prone to have radiographic errors than postgraduate students.**

As a dental surgeon one should be aware of taking and processing radiographs. They should be aware of the different techniques and methods to obtain proper radiographs<sup>15</sup>. Radiography serves as a key diagnostic tool in dentistry; it renders to good and quality radiographs.

27% of the study population that had errors in radiographs were between the age of 21 to 30 years. Though in previous studies, the errors ranged between 30 to 50 years there was not much significance to age<sup>15,16</sup>. Some of the reasons observed due to having the need to take radiographs can be due to calcification, anatomical variations, periodontal health problems, dilacerations and other morphological problems. IOPAs are contradicted among pregnant women. Complications can also increase with age<sup>19</sup>.

54% of the females were more prevalent to having errors in IOPA and 46% were males. In several studies, the gender prevalence is random as well, as they are caused due to random selection and less significant<sup>20,21</sup>. 41% of the errors were due to overlap as they were highly prevalent. Discrepancy in improper angulation of the receptor caused inevitable errors. Usually radiographs are taken among patients to confirm depth of caries, missing teeth and other problems in the teeth. Accordingly treatment planning is done to maintain aesthetics and maintain function<sup>22,23,24</sup>. Angulation errors can be caused due to patient movement, improper arch alignment and crowding. (figure 4)

In a study by Greer, cone cut was one of the most commonly encountered radiographic faults upto 35.4%<sup>25</sup>. Though in the present study, cone cut happened for 13%, Elangovan et al attributes to factors such as cone cut not covering the area of interest due to minimal expertise. This will result in errors when the film is not immersed in the developing solution<sup>26</sup>.

16% of the error showed elongation. They usually affected the maxillary molars, which causes decreased angulation. The error is due to limited skill of the personals (figure 3).

In the study conducted by S. Elangovan in 2017, stated the errors were common due to lack of experience and poor knowledge<sup>17,26</sup>. In the study it was found that undergraduates performed more errors in which overlap occurred for 26% while among postgraduates they occurred for 15%(figure 5).

In dentistry, radiographs have become a very essential diagnostic aid. Good quality radiographs without faults help in giving a proper treatment planning<sup>27</sup>. This is a serious problem, while some show a significant number of radiographs had faults. IOPAs with technical defects like cane cuts, overlaps, elongation, shortening and so on<sup>28</sup>. Errors on taking radiographs will require repetition and increase patients' radiation exposure. However there are fewer studies to evaluate radiographic errors in dentistry<sup>11,29</sup>. Patel et al evaluated the frequency of errors that will require retakes in paralleling intraoral radiographic techniques<sup>18,30</sup>.

## Conclusion

Overlap of images was the commonest radiographic error observed in this study. Accurate diagnosis to perform dental procedure, requires radiographs to evaluate success in procedures and to record dental and health status. The clinicians need to realise the value of understanding the basic knowledge of IOPAs and their accurate diagnosis. This study should help reduce the chance of facing radiographs. They should understand that theoretical approach along with practical experience always yields good response.

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