

## Original Article

# Diagnostic Radiographs Used in Dentistry and Forensic Dentistry: A Cross-Sectional Survey

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### ABSTRACT

**Introduction:** Radiographs are images produced on the sensitive plate or on the film by X-rays, gamma rays, or similar radiation and are used for medical and dental examination, especially in forensic dentistry. Forensic radiography is the process of taking radiographs. Radiographs can be classified as intraoral radiographs and extraoral radiographs. Radiation from dental X-rays contains only about 2.5% of the radiation dose that received from other medical radiographs. Many teeth, gingival, and periodontal diseases are undetectable with the naked eye, including bone loss, bone infections, tumors, abscess, cyst, granulation, and decay under a filling. X-ray makes it possible to find out problems early; therefore, treatment can start or done earlier to assure the dental health. Quick treatment helps in preventing the complications. X-rays are extremely important for detecting the extent of the caries and in third molar development. X-rays allow the dentist to track the healing progress and find any problems under the mucous surface.

**Aim:** The aim of the study was to create awareness about the radiographs used in dentistry and forensic dentistry and to make mindfulness and teach professionals about the radiographs used in dentistry and forensic dentistry.

**Materials and Methods:** The method involved in this study was an online survey of questionnaires, which involves assessing the awareness and knowledge on radiographs used in dentistry and forensic dentistry. Approval from the institutional ethical committee and informed consent from the participants were obtained. The total number of participants was 100. The data collected was exported to Google sheet and were analyzed by using the software SPSS version 23.

**Results and Discussion:** Among the undergraduate students, 27.27% of the students answered that cone-beam computed tomography (CBCT) was the radiograph used to detect fracture, 24.55% of the students answered intraoral periapical radiograph (IOPA), 8.18% of the population answered orthopantomogram (OPG) and 10% of the postgraduate students answered that OPG was the radiograph used to take mandibular fractures. Among the undergraduate students, 10.91% of the students answered that CBCT was the radiograph used to detect cyst, 9.09% of the students answered IOPA, 27.27% of the population answered CT, 42.73% of the population answered OPG, and 10% of the postgraduate students answered that OPG was the radiograph used to detect cyst. Among the undergraduate students, 38.18% of the students answered that CBCT was the radiograph used to detect the impacted tooth, 25.45% of the students answered IOPA, 13.64% of the population answered CT, 12.73% of the population answered OPG, and 10% of the postgraduate students answered that IOPA was the radiograph used to detect impacted tooth.

**Conclusion:** From the above survey, it is concluded that undergraduate students have less awareness about radiographs used in forensic dentistry than postgraduate students. Furthermore, studies will improve their awareness and knowledge of radiographs used in forensic dentistry.

**KEY WORDS:** Awareness, forensic dentistry, radiographs

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## INTRODUCTION

During the past few decades, the rapid technical development of computed tomography (CT) and magnetic resonance imaging (MRI) has made clinical radiology essential to practicing clinical medicine. However, postmortem imaging is a fairly young field in radiology and combines the fields of

forensic pathology and radiology. The first described forensic CT took place in 1977 in a case of a gunshot wound to the

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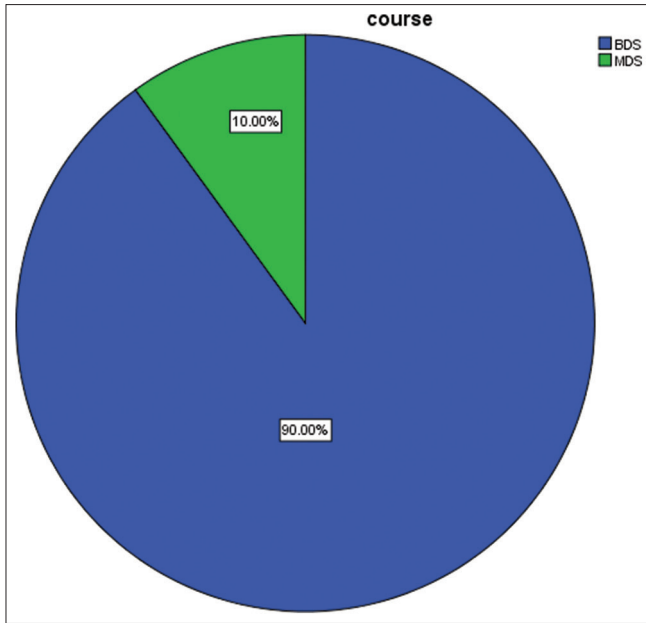


Figure 1: The participants from each course

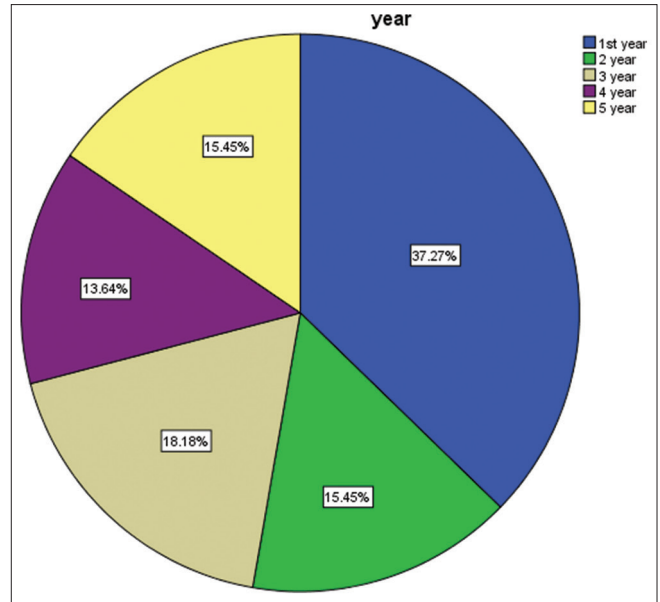


Figure 2: The responses between each year of the students

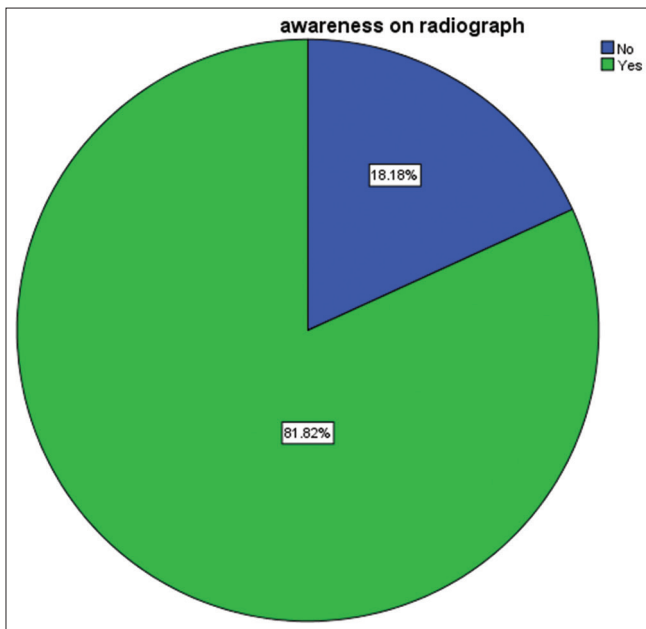


Figure 3: The awareness on radiograph among students

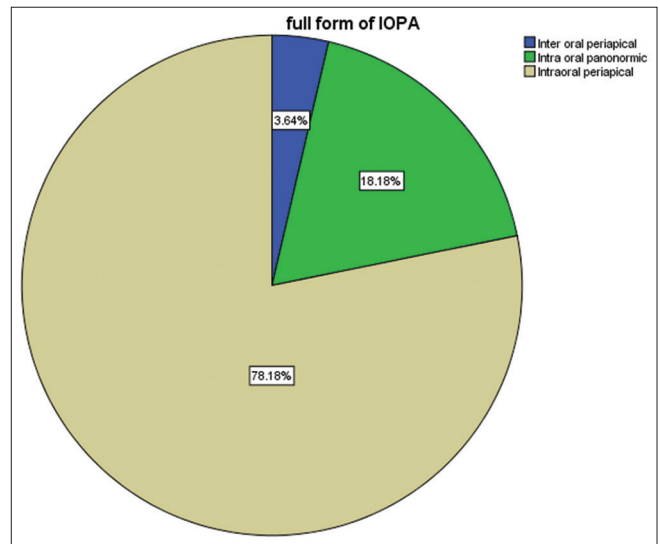


Figure 4: The intraoral periapical radiograph full form answered by students

head. Radiographs are images produced on the sensitive plate or on film by X-rays, gamma rays, or similar radiation and are used for medical and dental examination. Radiography is the process of taking radiographs. Radiographs can be classified as intraoral radiographs and extraoral radiographs.<sup>[1]</sup> Radiation from dental X-rays contains only about 2.5% of the radiation dose that received from other medical radiographs. Many teeth, gingival, and periodontal diseases are undetectable with the naked eye, including bone loss, bone infections, tumors, abscess, cyst, granulation, and decay under a filling.

X-rays make it possible to find out problems early; therefore, treatment can start or done earlier to assure dental health.<sup>[2]</sup>

Quick treatment helps in preventing the complications. X-rays are extremely important for detecting the extent of the caries and in third molar development. X-rays allow the dentist to track the healing progress and find any problems under the mucous surface.

Types of intraoral radiographs are bitewing, periapical, and occlusal radiographs. Types of extraoral radiographs are panoramic, lateral oblique, posteroanterior mandible, reverse Townes, occipitomental, submentovertex, and cephalometry. Some advanced imaging techniques are CT, cone-beam CT (CBCT), orthography, and positron-emission tomography (PET), MRI, digital imaging, ultrasound, and sialography.<sup>[3]</sup> The most commonly used radiographs in dentistry are bitewing, orthopantomogram, intraoral periapical radiograph, and occlusal radiograph.

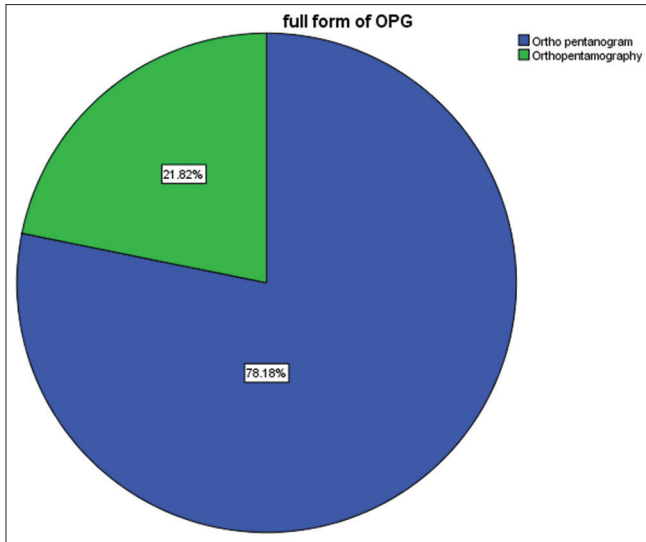


Figure 5: The orthopantomogram elaboration among students

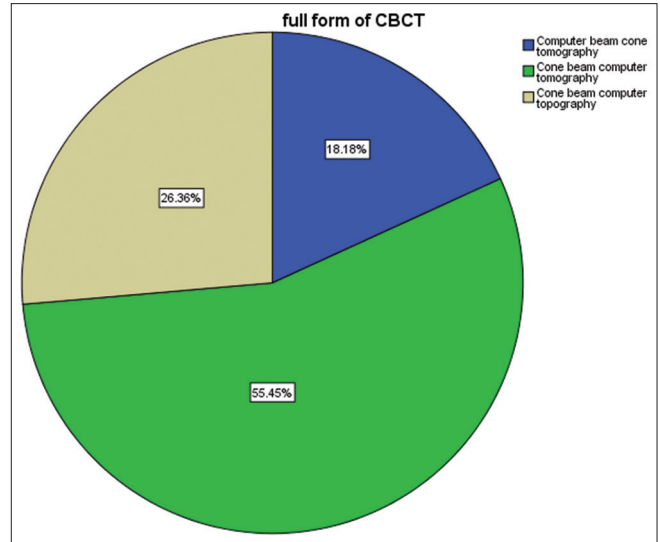


Figure 6: The cone-beam computed tomography full form which has answered by students

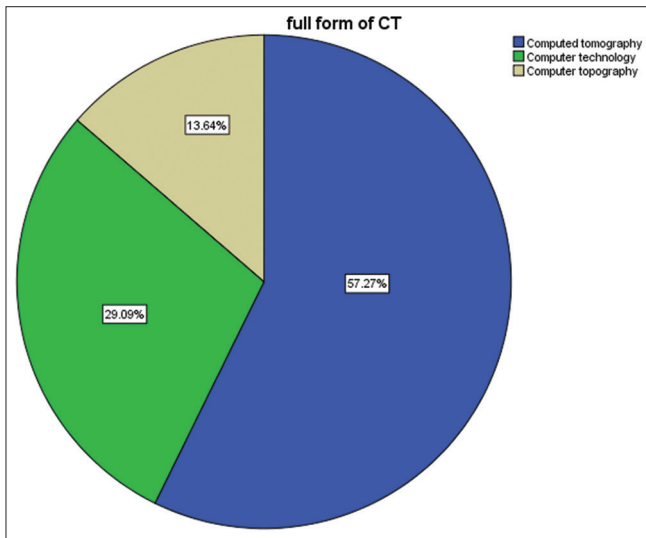


Figure 7: The computed tomography abbreviation responded by students

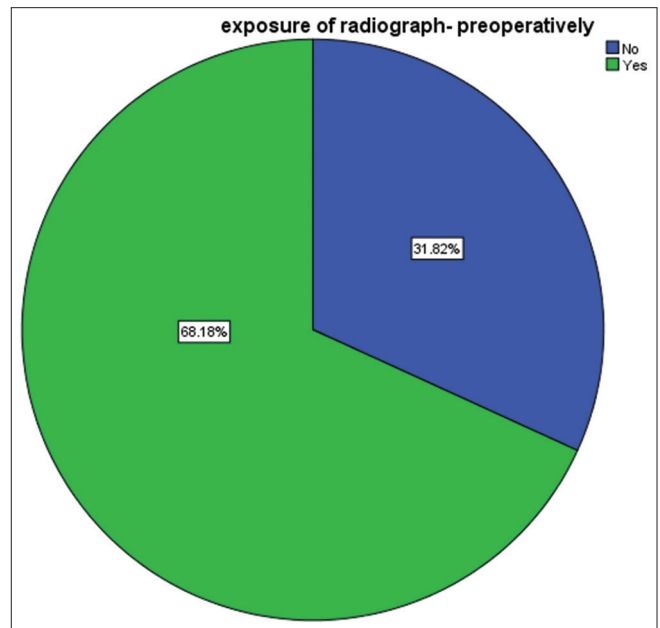


Figure 8: The exposure of radiographs

Intraoral radiographs are radiographs taken by placing the X-ray film inside the mouth.

### PERIAPICAL RADIOGRAPHS

Periapical radiographs show a small section of the oral cavity. It captures a whole tooth with its root and along with the surrounding periapical tissues. Periapical radiograph can be performed by paralleling technique or bisecting angle technique.<sup>[3]</sup>

### PARALLELING TECHNIQUE

In this technique, the X-ray film is held in a film holder that is parallel to the tooth surface and the X-ray beam is directed at 90° to the tooth surface and the X-ray film. The optimum distance between the film and the device is 30 cm. This is the most accurate and reproducible technique.<sup>[4]</sup>

a. Bisecting angle technique: It is an old method in which radiographs can be produced without the use of a film

holder. The film is placed closest to the tooth surface and the X-ray beam is directed at the 90° bisecting the angle between the film and tooth surface.<sup>[5]</sup> Not an accurate technique

- b. Bitewing radiographs: This radiograph shows the crowns and crest bone level. It is used to diagnose caries, overhangs, calculus, and bone loss (<4 mm). The patient has to bite on the wing holding the film against the maxillary and mandible teeth. The beam is directed between contact points periradicular to the film in the horizontal plane.<sup>[6]</sup>
- c. Occlusal radiographs: This radiograph covers a larger area. It is used to localize the impacted teeth and salivary calculus. The film is placed parallel to the occlusal plane. It gives a good cross-sectional view of mandibles and maxilla.<sup>[7]</sup>

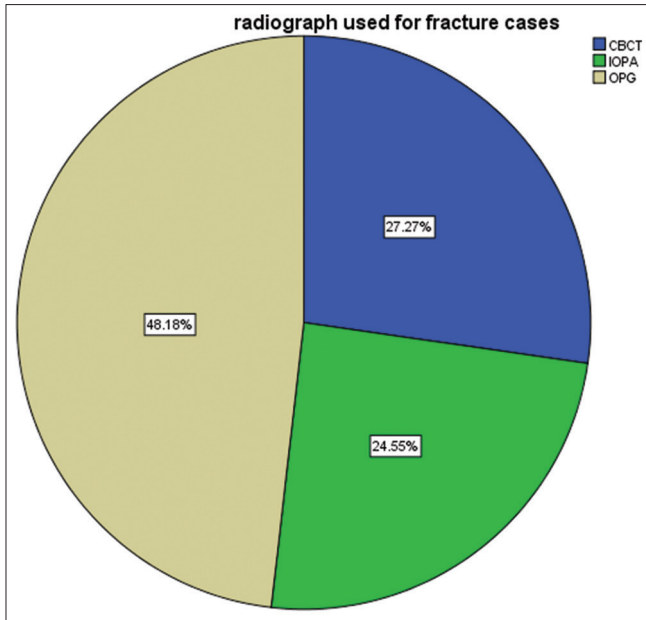


Figure 9: That where radiographs used

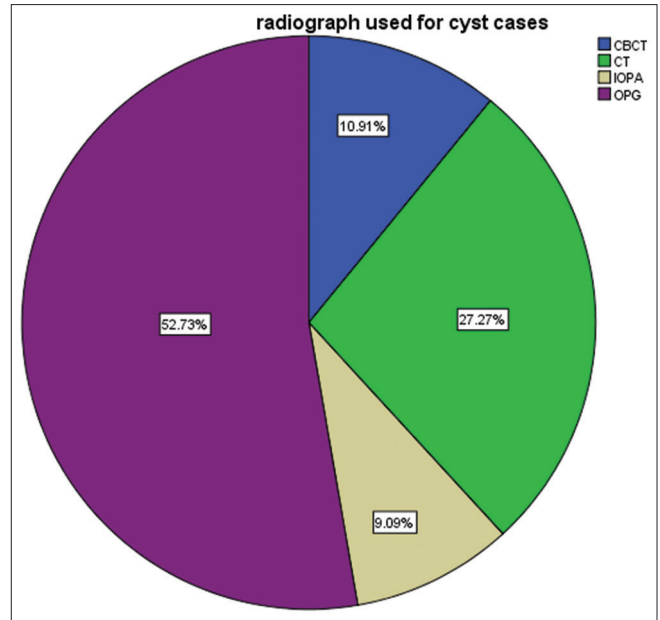


Figure 10: The radiographs used for cyst cases

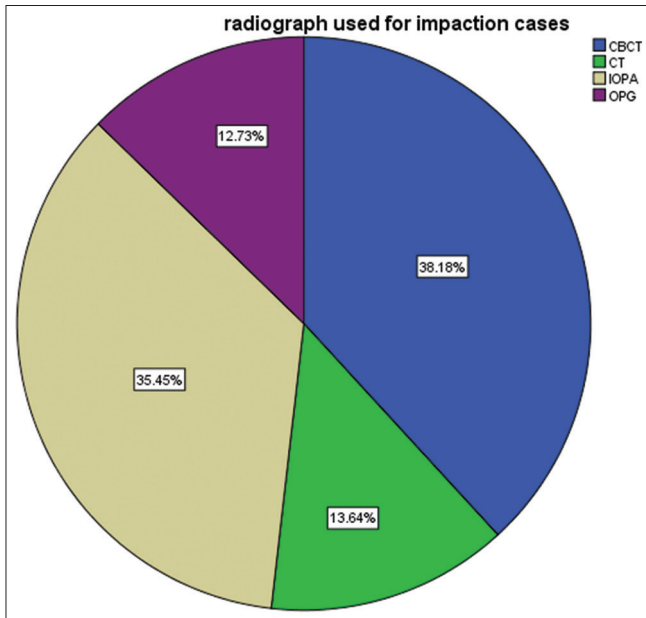


Figure 11: The responses for radiographs used for impaction cases

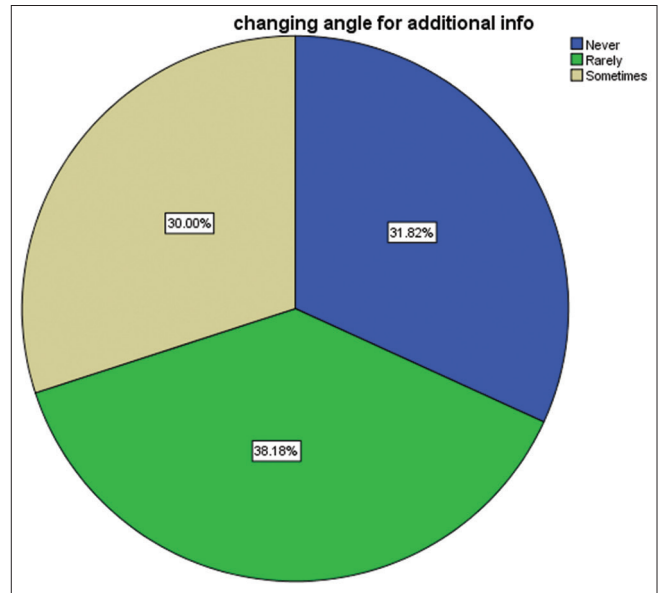


Figure 12: The angulation of radiographs answered by students

Extraoral radiographs are radiographs taken by placing the X-ray film outside the mouth.

### PANORAMIC RADIOGRAPHS

These radiographs are usually referred to as dental panoramic tomography (DPT) or orthopantomogram (OPG). The machine has a moving center of rotation which accommodates the arch shape of the jaws.<sup>[8]</sup> This radiograph technique is based on tomography.

### PARALLAX TECHNIQUE

This technique involves two radiographs with change in positions of X-ray tube (e.g. DPT and periapical). The object

that is away from the X-ray beam will appear to move in the direction of the tube shift.<sup>[9]</sup>

### Lead aprons: (0.25 mm lead equivalent)

The 10-day rule is no longer used in forensic or dental radiology. In a well-maintained, well-collimated equipment, the risk of damage is minimal. Application of all normal principles to pregnant women (use lead apron if the primary beam is directed at the fetus) is a must.<sup>[10]</sup>

This study aims to create awareness about the radiographs used in forensic dentistry and to make mindfulness about the radiographs used in dentistry. This research is needed to improve the knowledge on dental radiographs. This research also fulfills the deficiency of work on knowledge about

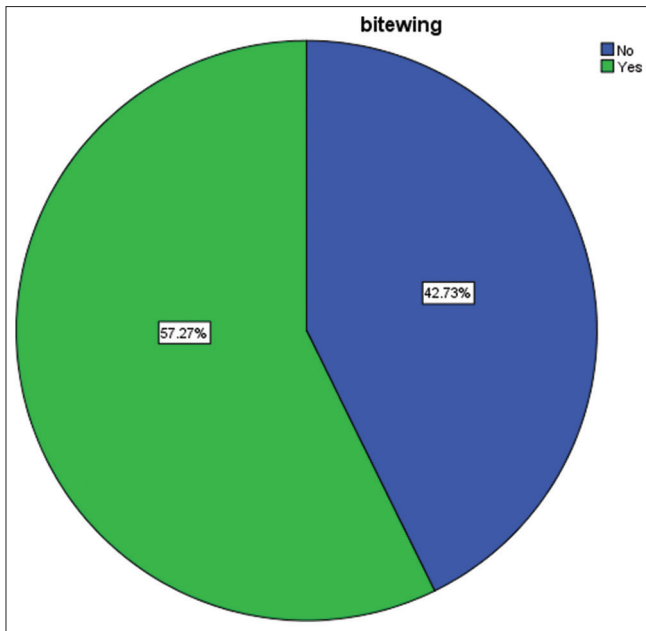


Figure 13: The bitewing radiographs awareness

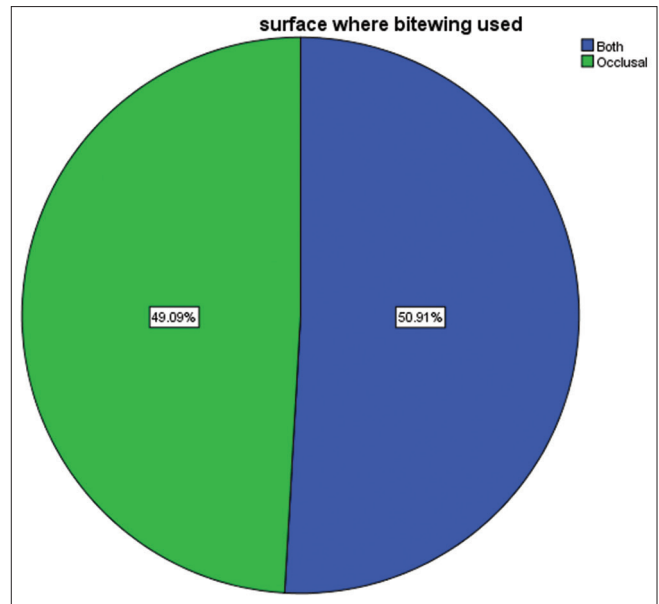


Figure 14: The surfaces where bitewing used

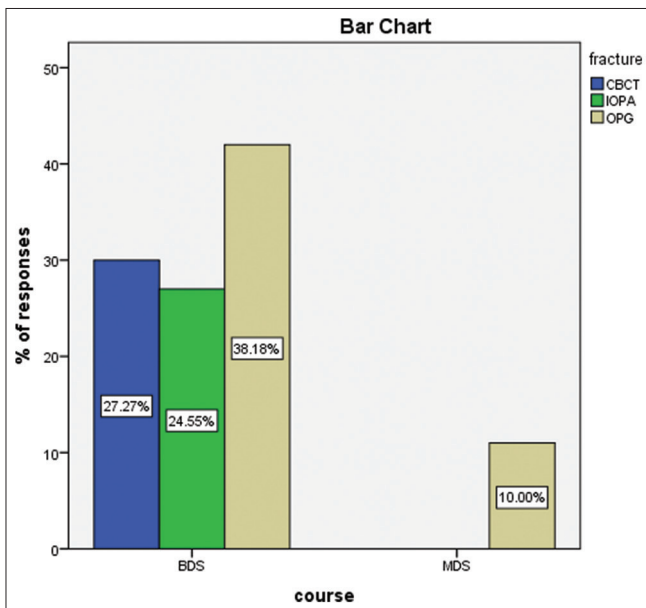


Figure 15: The association graph of radiographs used for fracture

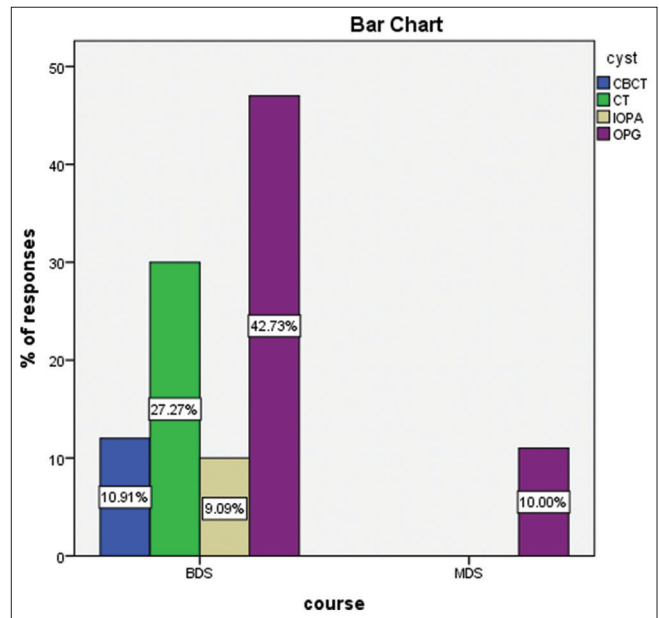


Figure 16: The association graph of radiographs used for cyst

radiographs. The ongoing development of imaging and the recent integration of cross-sectional imaging methods into the medicolegal workflow have resulted in an increasing number of forensic institutes acquiring dedicated CT and MRI scanners. The purpose of this article is to evaluate the different aspects of postmortem imaging and to detail the necessary cooperation between radiologists and forensic pathologists for mutual learning and accurate science to form a new subspecialty: forensic radiology.

## MATERIALS AND METHODS

The method involved in this study was an online survey of questionnaires, which involves assessing the awareness and

knowledge on radiographs used in dentistry. Approval from the institutional ethical committee and informed consent from the participants were obtained. The total number of participants was 100. The sampling method used in this study was simple random sampling. A set of 12 questionnaires were prepared in Google Forms, the link of the same was circulated among the study population and the data were collected for a duration of 1 month in April 2021. The data collected were exported to Google sheet and were analyzed using the software IBM® SPSS® Statistics 23. The data were analyzed and represented by pie charts. The statistical analyses performed in this study were descriptive analysis and Chi-square analysis.

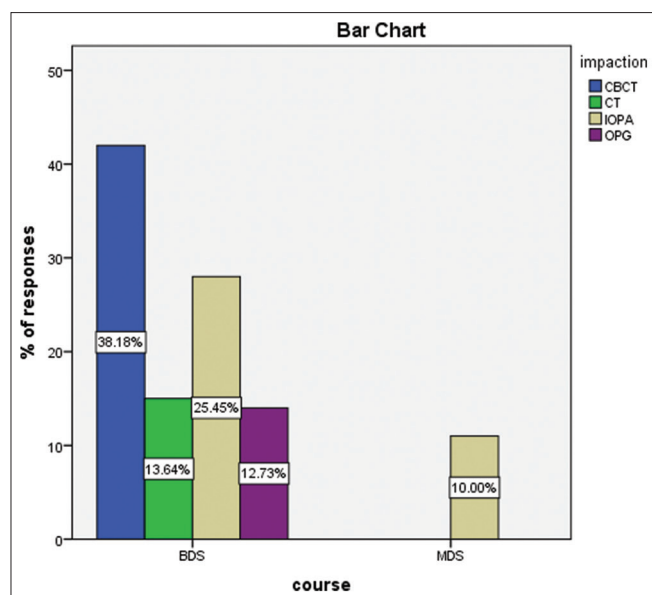


Figure 17: The association graph of radiographs used for impaction

## RESULTS AND DISCUSSION

Among the total population, 90% of the students were studying BDS and 10% were studying MDS. Among the total population, 37.27% were studying 1<sup>st</sup> year, 15.57% studying 2<sup>nd</sup> year, 18.18% studying 3<sup>rd</sup> year, 13.64% studying 4<sup>th</sup> year, and 15.45% studying 5<sup>th</sup> year. Among the total population 81.82% of the students were aware of radiographic techniques and 18.18% of the students were not aware. Among the total population, 78.18% of the population were aware of the answer about the full form of intraoral periapical radiograph (IOPA) as intraoral periapical, 18.18% answered intraoral panoramic, and 3.64% answered interoral periapical. About 78.18% of the total population was not aware and answered orthopantomogram was the full form of OPG and 21.82% answered orthopantomography.

Among the total population, 55.45% answered that cone-beam computed tomography was the full form of CBCT, 8.18% of the population answered computer beam cone tomography, and 26.36% of the population answered cone-beam computed topography. Among the total population, 57.27% answered computed tomography was the full form of CT, 29.03% of the population answered computer technology, and 13.64% of the population answered computed topography. Among the total population, 68.18% of the students said that they were exposed to radiograph while in preoperative cases and 31.82% answer they were not exposed to radiograph.

Among the total population, 48.16% of the students answered that OPG was the type of radiograph used for mandibular fracture cases, 27.27% of the population answered CBCT, and 24.55% answered IOPA. Among the total population, 52.73% answered that OPG was the type of radiograph used for identifying cyst, 10.91% of the population answered CBCT, 27.27% answered CT, and 9.09% of the population answered IOPA. Among the total population 38.18% not aware of what type of radiograph we use for impaction, they answered CBCT,

13.64% answered CT, 12.73% answered OPG, and 35.45% of the total population aware that IOPA was the radiograph used for identification of impacted tooth.

Among the total population, 38.18% rarely changed the angle to take radiographs for additional information, 31.82% never used that method, and 30% of the total population sometimes used different angles of radiograph for additional information. Among the total population, 57.27% of the students were aware of the bitewing radiograph and 42.73% of the population was not aware of the bitewing radiograph. Among the total population, 50.91% answered that bitewing radiographs will be taken for both occlusal and proximal area and 49.09% answered that bitewing radiographs were used to assess the occlusal surface of the tooth.

Among the dental students, the undergraduate and postgraduate students were separated into groups. Among the undergraduate students, 27.27% of the students answered that CBCT was the radiograph used to detect fracture, 24.55% of the students answered IOPA, 38.18% of the population answered OPG, and 10% of the postgraduate students answered that OPG was the radiograph used to take mandibular fractures. Among the undergraduate students, 10.91% of the students answered that CBCT was the radiograph used to detect cyst, 9.09% of the students answered IOPA, 27.27% of the population answered CT, 42.73% of the population answered OPG, and 10% of the postgraduate students answered that OPG was the radiograph used to detect cyst. Among the undergraduate students, 38.18% of the students answered that CBCT was the radiograph used to detect the impacted tooth, 25.45% of the students answered IOPA, 13.64% of the population answered CT, 12.73% of the population answered OPG, and 10% of the postgraduate students answered that IOPA was the radiograph used to detect impacted tooth which shown in the [Figures 1-17].

A new technique for placing extraoral films was proposed by Newman and Friedman. The extraoral periapical technique was used in many cases to perform diagnostic imaging in patients. In cases where intraoral film placement is difficult, this technique may be recommended as an alternative to the traditional intraoral periapical technique.<sup>[11]</sup> Imaging's specificity was also found to be limited, indicating the need for more accurate diagnostic methods in questionable situations. In cases of tumors of the lower alveolus with definite bone invasion, aggressive surgical therapy, such as segmental or hemi-resection of the mandible, is needed. Mandibular resection can be restricted in the case of carcinomas of the buccal mucosa and tongue.<sup>[12]</sup>

In case of any missing, individual or the particular person is died in some natural calamities, here the diagnostics pre- and postoperative radiographs of that particular person are used as identification materials. Although maintaining the case records and the huge data of the missing or lost individual, forensic dentistry plays a major role in identification. Why, here the diagnostic character of the radiographs has done as survey means, through these identification landmarks and the diagnostics features in case any other cases are reporting

related to forensics, as a dentist we need to know about the radiographic features and landmarks for identifying the person or individual.

Regarding the recent excess attention that has been promoted by several crime scene television productions and the undeniable rapid and expansive development in the field of postmortem imaging, forensic and radiologic knowledge has to be combined to assure high-quality case management in forensic pathology so that few general dental pathology cases such as cyst and lesion also play an identification points in few cases. Therefore, direct and precise communication between the forensic pathologist and the investigating radiologist is necessary to successfully cope with these challenges.

## CONCLUSION

From the above survey, it is concluded that the undergraduate students have less awareness when compared to the postgraduate students. The gradual variation may be due to the unequal population of undergraduate and postgraduate students. Furthermore, studies will make more understanding and knowledge about the concepts for the studies. In future, related to general and forensic dentistry studies must be done to improve the diagnostic results between the dentists.

## FINANCIAL SUPPORT AND SPONSORSHIP

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## CONFLICTS OF INTEREST

There are no conflicts of interest.

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