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Faulty radiographs: A retrospective radiographic analysis

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Abstract

Aim: The aim of this study was to assess the ability of taking and processing of intraoral periapical radiographs (IOPA) by the dental college students.

Materials and Methods: This study was conducted in the Department Of Oral Medicine And Radiology Meenakshi ammal dental college Chennai. A total of 2013 periapical faulty radiographs were included in the current study which was taken and manually processed by dental Students. All intraoral periapical radiographs were taken using bisecting angle technique with Kodak E speed film, 70kvp, 8MA and exposure time 0.4 seconds.

Results: A total of 2013 faulty radiographs were included in the study of which 1008 were of maxillary radiographs which had cone cut in 35.4%, elongation 32.5%, foreshortening 1.7%, overlap 5.7%, reverse film 0.4%, incorrect film placement 21%, light 6.9%, dark 3.7%, finger print 0.1%, light exposed 1.8%, light spots 0.2%, dark spots 0.3%, brown stains 3.2%, artifacts 0.9%.

Out of 1005 mandibular radiographs, radiographic faults among the mandibular radiographs had cone cut in 46%, elongation 11.4%, foreshortening 0.6%, overlap 4.2%, reverse film 0.6%, incorrect film placement 36.9%, light 3.2%, dark 2.9%, light exposed 1.2%, light spots 0.2%, dark spots 0.3%, brown stains 3.6%, artifacts 0.6%.

Conclusion: This study has classified and evaluated all the faults that can occur in recording a dental radiograph. Hence this will help us to overcome the faults in practising dental radiograph by the dental students.

Keywords: quality assurance, faulty radiographs, intraoral periapical radiograph, radiographic errors, dental students

Introduction

In dentistry, radiographs have become inseparable part for diagnosis and treatment ^[1]. As a dental surgeon, he/she should be aware of taking and processing radiographs ^[2]. The institution train their students to develop technical application skills as well. Although standard for subjective quality rating of dental radiographs have defined ^[3, 4], there is nonetheless, widespread evidence that many general dental practitioners fail to achieve these ^[5, 6, 7, 8, 9]. Film rejection analysis is an important tool for identification of factors associated with sub optimal radiographic images and subsequent rectification ^[10].

The faculty members play a key role inculcating knowledge to students and produce highly skilled, trained and efficient personalities. Although faulty radiographs are unavoidable, errors during the practice hour of students better practical approaches can prevent faulty radiographs and avoid unnecessary exposure to the patient. Thus a retrospective study was conducted to assess faulty radiographs during the period of 2015-2017 in the department of oral medicine and radiology.

Materials and Method

The aim of this study was to assess the ability of undergraduate dental students in taking and processing of intra oral periapical radiographs (IOPA), which include the following criteria:

- 1) Types of error : Technical error
 Processing error

Anatomical region of faulty radiograph- maxillary region, mandibular region. This study would help us to identify the lacunae and change our educational ability to enhance the

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student’s knowledge in order to improve their practical skills. Faulty radiographic data were collected from the department of oral medicine and radiology during the period between September 2016 to September 2017. These radiographs were taken by the under graduate students using bisecting angle technique in size 2 film for adult and size 1 film for pediatric patients using E speed (Kodak, NY, USA) film satelac x mind (Acteon Company , Uk) IOPA machine was used. The faulty radiographs were assessed retrospectively and the results were determined statistically using spss software.

Result

A total no of 2013 faulty periapical radiographs were evaluated out of which 1008 were maxillary periapical radiographs and 1005 were mandibular radiographs. The radiographic faults were catogorised into cone cut, elongation, overlap, brown stains, light, dark, light exposed, foreshortening, reverse film, artifacts, dark spots and light spots. The results of the present study infer that the radiographic faults among the maxillary radiographs had cone cut in 35.4%, elongation 32.5%, foreshortening 1.7%, overlap 5.7%, reverse film 0.4%, incorrect film placement 21%, light 6.9%, dark 3.7%, finger print 0.1%, light exposed 1.8%, light spots 0.2%, dark spots 0.3%, brown stains 3.2%, artifacts 0.9%. (Table 1, Graph 1)

Radiographic faults among the mandibular radiographs had cone cut in 46%, elongation 11.4%, foreshortening 0.6%, overlap 4.2%, reverse film 0.6%, incorrect film placement 36.9%, light 3.2%, dark 2.9%, light exposed 1.2%, light spots 0.2%, dark spots 0.3%, brown stains 3.6%, artifacts 0.6%.(Table 2, Graph 2).

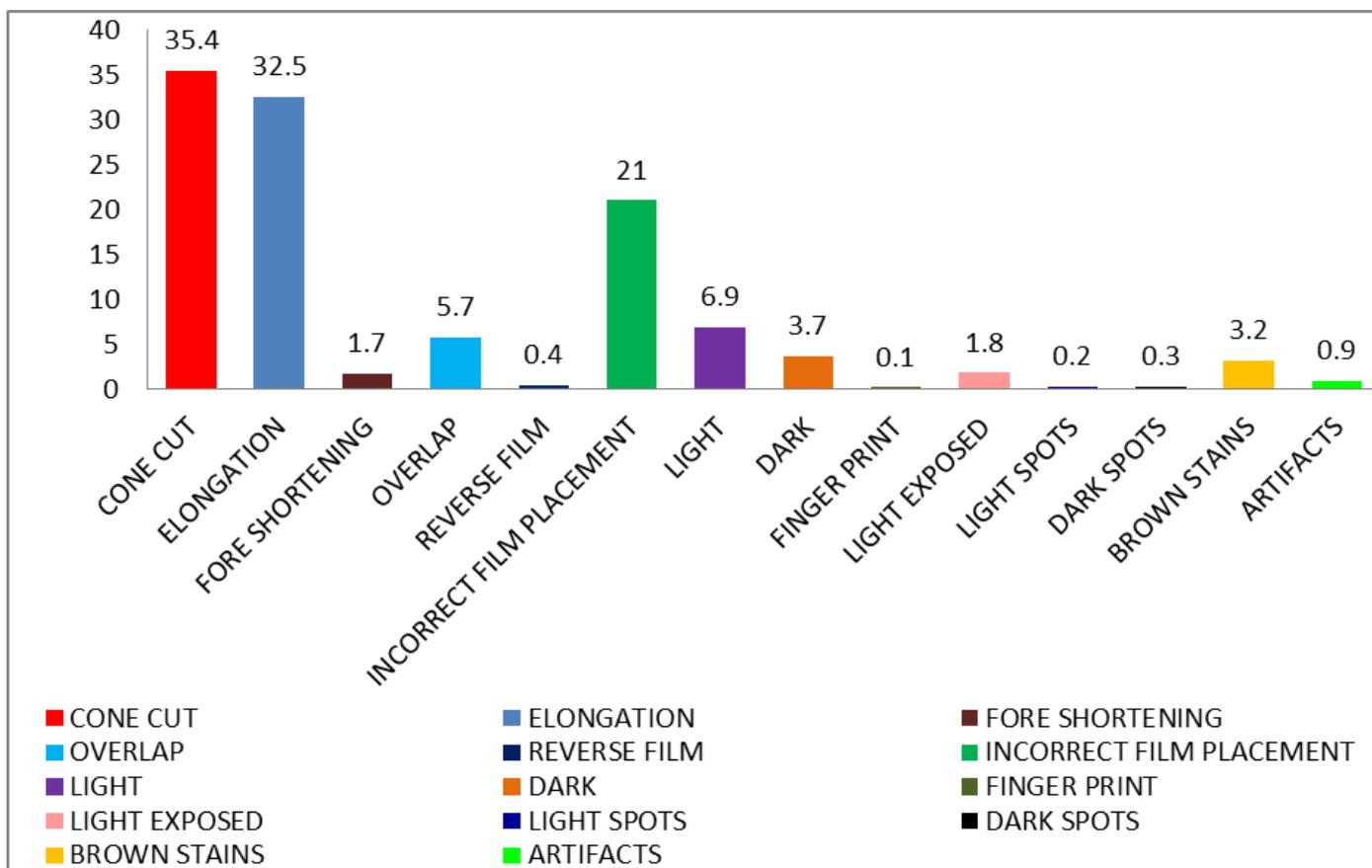
Foreshortening, overlap, light, dark, artefact were observed more in maxilla than mandible, In mandible more of conecut, elongation, reverse film, incorrect film, brown stains were observed. We obtained equal distribution of light spots and dark spots in both maxilla and mandible (Graph 3)

When comparing cone cut, elongation, foreshortening, overlap, incorrect film placement, light radiographic values with maxilla and mandible all the above mentioned were statistically significant, were as the other parameters such as reverse film, dark, fingerprint, light exposed, light spot, dark spot, brown stain, artefact are non significant when compared the values between maxilla and mandible. (Table 3)

**Maxilla
Total: 1008**

Table 1

Cone cut - 357	35.4%
Elongation -328	32.5%
Foreshortening -17	1.7%
Overlap -57	5.7%
reversefilm -4	0.4%
Incorrect film placement-212	21%
Light -70	6.9%
Dark -37	3.7%
Fingerprint -1	0.1%
Light exposed -18	1.8%
Lightspts -2	0.2%
Darkspots -3	0.3%
Brown stains -32	3.2%
Artefacts -9	0.9%

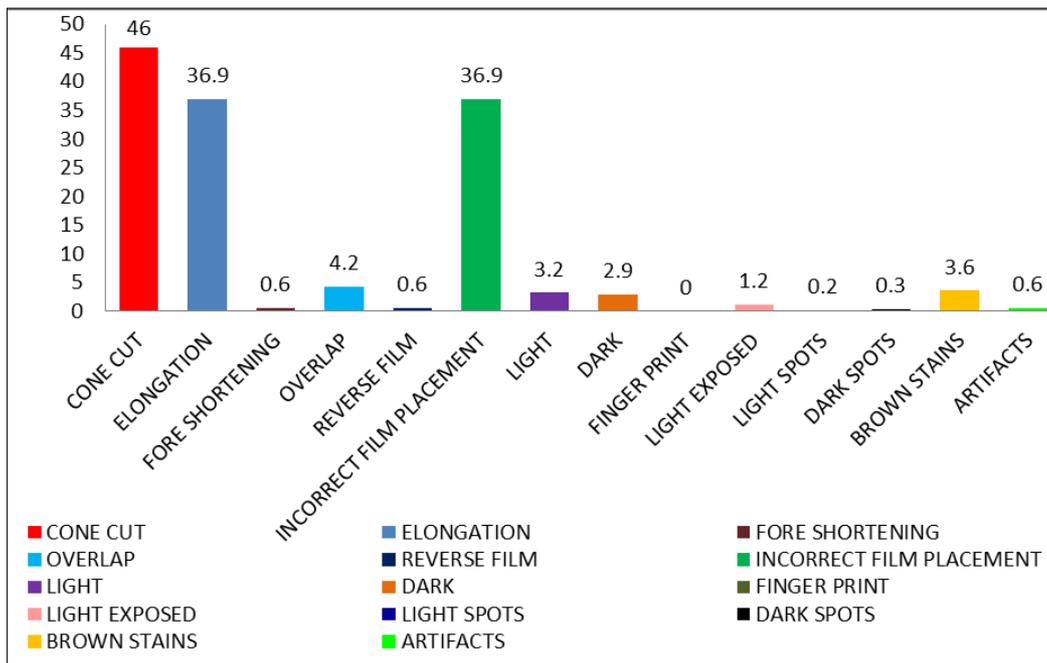


Graph 1: Percentage of various faults in maxillary radiographs

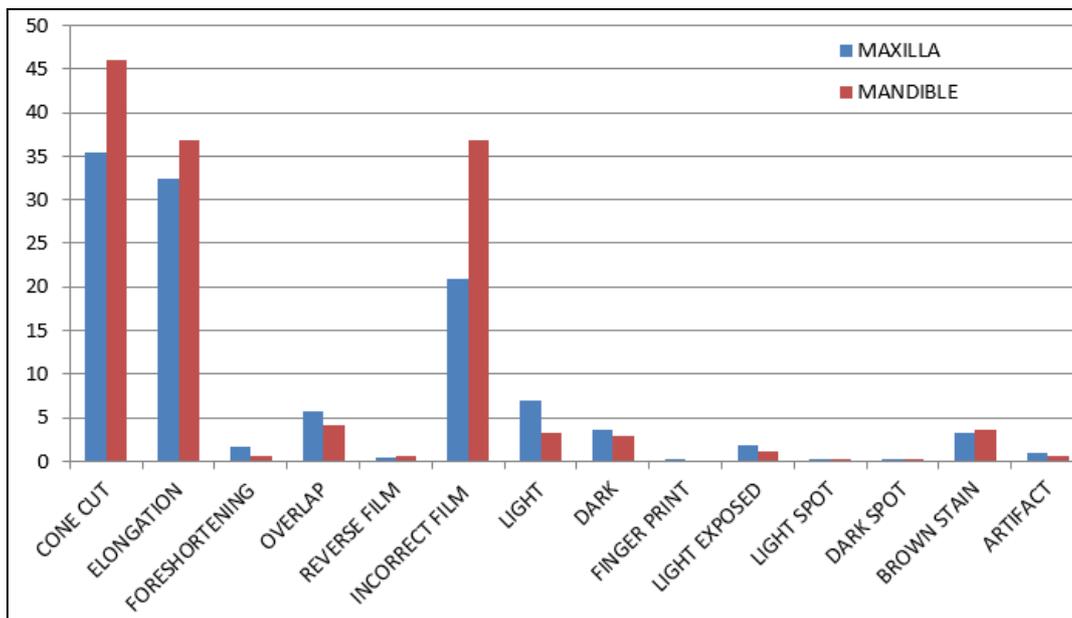
Mandible
Total: 1005

Table 2

Cone cut - 462	46%
Elongation -371	36.9%
Foreshortening -6	0.6%
Overlap -42	4.2%
reversefilm -6	0.6%
Incorrect film placement-371	36.9%
Light -32	3.2%
Dark -29	2.9%
Fingerprint -0	0%
Light exposed -12	1.2%
Lightspots -2	0.2%
Darkspots -3	0.3%
Brown stains -36	3.6%
Artefacts -6	0.6%



Graph 2: Percentage of various faults in mandibular radiographs



Graph 3

This study was analysed with spss software version 17 which shows statistically significant variation between maxilla and mandible.

Table 3: Statistically Significant Parameters

	Pvalue
Conecut	0.001
Elongation	0.001
Foreshortening	0.021
Overlap	0.012
Incorrect film placement	0.001
Light	0.001

Discussion

As a dental surgeon one should be aware of taking and processing radiographs [2]. The institution trains their students to develop technical application skills as well. Although standard for subjective quality rating of dental radiographs have defined [3, 4], there is nonetheless, widespread evidence that many general dental practitioners fail to achieve these [5, 6, 7, 8, 9]. Film rejection analysis is an important tool for identification of factors associated with sub optimal radiographic images and subsequent rectification [10].

Radiography serves as a key diagnostic tool in dentistry which renders good and quality radiographs a prime requisite to attain an appropriate diagnosis. Radiographs with poor diagnostic value not only hinder the process of diagnosis and disease management but also creates hazardous scenarios where the patient/subject and the operator are exposed to unwanted radiation and many other such discomforts. Hence, the X-ray unit, the exposure parameters, the technique chosen, skill of the operating personal, patient education on the technique and its importance, developing manoeuvre etc. play an important role in quality assurance of a radiograph and aids in enhancement of its diagnostic value.

In the present study, which included 2013 total radiographs (of which 1008 were of maxillary and 1005 were mandibular) radiographic faults like cone cut, elongation, foreshortening, overlapped, reverse film placement, incorrect film placement, light, dark, finger prints, light exposed, light spots, dark spots, brown stains and artefacts were detected.

Cone cut was the most commonly encountered radiographic fault which accounted for about 35.4% in a total of 1008 maxillary radiographs and 46 % in a total of 1003 mandibular radiographs. This prevalence in the cone cut is in accordance with the previous studies conducted by Patel *et al.* (1986) [11] and Mourshed *et al.* (1972) [12], Elangovan *et al.* (2016) [14] which can be attributed to factors such as the cone not covering the area of interest which can be due to the minimal expertise of the operating personal, displacement of the film when a film holder is used or patient movement. This can also occur as a processing error where the film is not immersed in the developing solution completely.

32.7% of the maxillary radiographs showed elongation, which is due to decreased angulation which could possibly due to limited skill of the personals, constituting undergraduate students.

Incorrect film placement was found to be 21%. Proficiency of the personals play an important role. These results and disquisition are in accordance with previous studies by Patel *et al.* (1986) [11] and Mourshed *et al.* (1972) [12], Elangovan *et al.* (2016) [14]

Radiographic faults like light radiographs, overlapped, dark radiographs were accounted to be 6.9%, 5.7%, and 3.7% respectively. The probable causes being errors during

exposure, cone positioning and during processing.

Other radiographic faults like brown stains, light exposed radiographs, foreshortening, artifacts, dark spots and light spots were found to be of minimal incidence which were computed to be 3.2%, 1.8%, 1.7%, 0.9%, 0.3, 0.2% correspondingly.

Auxiliary radiographic faults due to errors in exposure parameters and during the processes of exposure, film handling and processing of film like phalangioma, blurring, under or over developed films, film fogging, peeling of emulsion and nail artefacts were not identified in the present study.

Other radiographic faults in the mandibular radiographs included elongation in 11.4%, foreshortening 0.6%, overlap 4.2%, reverse film 0.6%, incorrect film placement 36.9%, light 3.2%, dark 2.9%, light exposed 1.2%, light spots 0.2%, dark spots 0.3%, brown stains 3.6%, artefacts 0.6%.

Unlike maxillary radiographs the finger print pattern was not noticed in mandible and a significantly higher incidence of cone cuts were noticed in mandible which could probably due to the placement of film in the lingual sulcus and patient discomfort.

In a study conducted by S. Elangovan [14] in the year 2017 he reported statistically significant value when compared between the radiographs taken by a final year students and interns, in our study we have compared the values obtained from each parameters with maxilla and mandible and found cone cut, elongation, foreshortening, overlap, incorrect film placement, light was statistically significant.

Conclusion

Dental radiography plays an important role in the field of dentistry which allows the practitioner to diagnose dental caries, assess bone loss, other bony lesions and conditions that are otherwise impossible to detect during routine clinical examinations, this present study aims to identify the prevalence of faults which are encountered during routine radiography by dental students and to minimise these faults by understanding technical knowledge related to radiation and to overcome these faults to minimise repeating radiographs.

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