QUALITY OF PERIAPICAL RADIOGRAPHS TAKEN BY

UNDERGRADUATE DENTAL STUDENTS AT QASSIM UNIVERSITY

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"No conflict of interest"

Abstract:

Purpose: The periapical radiographs are the most common type of dental radiograph used. The purpose of this study was to evaluate the quality of periapical radiographs (the bisecting angle technique) taken by undergraduate dental students at Qassim University (QU) and the types of errors in different anatomical location.

Methods: A total of 272 periapical radiographs were collected from dental clinic at QU. The radiographs were taken by undergraduate dental student at QU. The radiographs were evaluated by two radiologists.

Results: The most frequent errors were processing errors (23.5%), cone cut (20.2%), and incorrect vertical angulation (15.1%).

Conclusion: Dental clinicians must be fully aware about a variety of technical skills and the basic knowledge of radiology..

KEYWORDS: x-ray, errors, undergraduate dental students.

Introduction

The use of x-rays is an integral part of clinical dentistry, and radiographic examination is necessary on the majority of patients. As a result, radiographs are often referred to as the clinician's main diagnostic aid (1). Periapical radiographs become extremely important in diagnosing the majority of pathologic condition as well as assisting in endodontic treatment.

However, the correct radiographic interpretation relies on the availability of basic knowledge, quality images, and absence of technical and processing errors. Studies have reported the types and frequency of errors incurred when radiographs are taken and processed by dental students (2-4) and professionals (5, 6). Regardless of the technique employed (bisecting or paralleling), the most commonly found errors are: film and/or radiation beam positioning, image contrast (light or dark), vertical and horizontal angulations, processing, inadequate fixation, and presence of stains and streaks (2-4).

Previous studies have shown that many factors, such as radiographic technique, use of film holder and anatomical location of the teeth, affected radiographic errors (7-9). A recent study revealed that incorrect film placement, incorrect angulation and cone cutting were the most frequently types of errors (10). In addition, the most frequent regions for errors were the maxillary molar, maxillary premolar and mandibular molar regions, respectively (10). The purpose of this study was to evaluate the quality of periapical radiographs (the bisecting angle technique) taken by undergraduate dental students at Qassim University (QU) and the types of errors in different anatomical location.

Materials and Methods

A total of 272 periapical radiographs were collected from dental clinic at Qassim University (QU). An informed consent from the director of the clinic was given. The radiographs were taken by undergraduate fourth (males N =104 radiographs, females N = 49) and fifth year (males N = 119 radiographs) dental student at QU. This study was based on evaluation of a randomly gathered periapical radiographs taken using the bisecting angle technique and processed with manual film processor. The evaluation was done by two radiologists (Assistant professor at College of Dentistry QU, Radiology Department) relied on the following errors:

Blurred and reverse image, dot artifact, apices cut off , crown not shown , area of interest not shown , distortion , incorrect vertical and horizontal angulations, cone cut, low and high density, processing errors and film positioning.

The anatomical distribution of the samples was divided into eight segments and each segment has particular code number (Table 1).

The study results were expressed by mean values and standard deviations (SD). P-values less than 0.05 were considered statistically significant. The data were analyzed using an SPSS (version17) statistical program package.

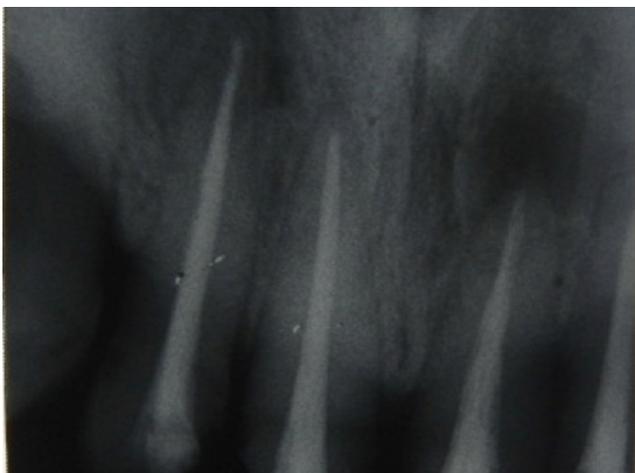
Figure 1 - High density image

Figure 2 - Cone Cut Image

Figure 3 - High density image

Figure 4 - Cut Image (Apices not shown)

Results

A total of 272 periapical radiographs were evaluated. Table 2 shows proportion of error types. The most frequent error was processing errors (23.5%), cone cut (20.2%) and, incorrect vertical angulation (15.1%), respectively. However, no the blurred or reversed image was observed.

Table 3 shows a comparison between 4th and 5th year male students regarding the periapical radiographic errors. The comparison between 4th and 5th year male students showed no statistically significant difference except in processing errors and crown not shown. The processing errors were found 9.6% in 4th year and 43.7% in 5th year (p < 0.001), and the crown not shown was found 0.8% in 5th year while 14.4% in 4th year (p <0.001).

Table 4 presents a comparison between periapical radiographic errors of 4th year male and female students. The only statistically significant difference between 4th year males and females was in incorrect vertical angulations which was 6.1% in 4th year females and 20.2% in 4th year males (p = 0.026).

Table 5 presents the distribution of errors according to the anatomical location. The most frequent anatomical locations where the samples have been taken were maxillary molars, mandibular molars, maxillary premolars, and maxillary canine, respectively. The less frequent anatomical locations were mandibular canine and mandibular anterior, respectively.

In the processing errors, the most errors were found in mandibular premolars (31.5%), maxillary premolars (27.3%), and maxillary anterior (25.0%) with no statistically significant difference (p = 0.248). The cone cuts were mostly found in maxillary molars (32.4%) and mandibular molars (27.4%), while none were found in the maxillary anterior, mandibular anterior and canine area (p = 0.001). Incorrect vertical angulations were mostly detected in maxillary anterior (35.7 %) followed by mandibular premolar (27.8%) and maxillary canine (25.8%) (p = 0.003). A statistically significant difference was found for apices cut off error (p = 0.033. Apices cut off error had not found in maxillary and mandibular anterior and canines, but it was found mostly in mandibular molars (17.8%) and mandibular premolars (16.7%). No statistically significant differences were found for the other errors.

1	Maxillary anterior area (central and lateral incisors)
2	Maxillary canine areas
3	Maxillary premolar areas
4	Maxillary molar areas
5	Madibular anterior area (central and lateral incisors)
6	Madibular canine areas
7	Madibular premolar areas
8	Madibular molar areas

Table 1. The anatomical distribution of the samples

The Errors	N %
Blurred Image	.0%
Reversed Image	.0%
Dot Artifact	1.5%
Apices cut Off	9.6%
Crown Not shown	6.6%
Area of interest not shown	1.1%
Distortion	6.3%
Incorrect vertical Angulations	15.1%
Incorrect horizontal Angulations	9.2%
Cone cut	20.2%
Low Density	4.4%
High Density	12.5%
Processing errors	23.5%
Film Placement	4.4%

Table 2. Distribution of error types
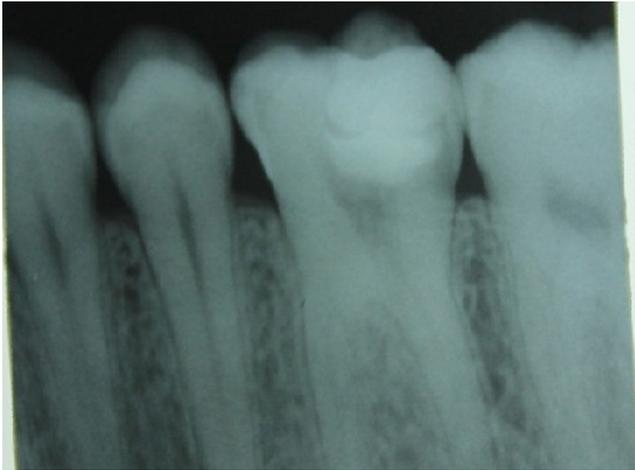
Picture 5 - Apices cut off and incorrect vertical angulation

Discussion

The errors in periapical radiographs can be categorized into to the followings: the x-ray equipment, the image receptor (film or film/screen combination), processing, the patient, the operator, and the radiographic technique (11). Errors related to the x-ray equipment and the image receptor has been minimized as the result of developments in the film industry (10).

The present study focused primarily on the periapical radiographic technique errors, including blurred and reverse image, dot artifact, apices cut off, crown not shown, area of interest not shown, distortion, incorrect vertical and horizontal angulations, cone cut, low and high density, processing errors, and film positioning.

In this study, the most frequent errors were processing errors (23.5%), cone cut (20.2%) and incorrect vertical angulation (15.1%). However, the incorrect angulation was the most frequent error reported in other conducted study (10). Those findings can be in agreement with the present study if the incorrect angulation would be considered as one error (horizontal and vertical)(24.3%).

In a previous study, the rates of error types were 32.74%, 32.33%, 19.86% for incorrect angulation, incorrect film placement and cone cutting, respectively (10). The present findings corroborate their result regarding to the incorrect angulation and cone cut error. In contrast, the incorrect film placement (4.4%) and processing errors (23.5%) were observed in this study distinct to several studies (10,16,17). This could be attributed to the fact that a manual film processor was used in the present study unlike the other studies which used an automatic film processor.

Although there was no statistically significant difference between 4th and 5th year male students in most of the radiographic errors, processing errors and crown not shown demonstrated a statistically significant difference. Contrary to expectations, the processing errors revealed 9.6% in 4th year and 43.7% in 5th year. A possible explanation for this might be a lack of adequate knowledge about the basic of processing. In addition, the 5th year students have a lot of clinical requirements to be finished. Therefore, they might attempt to finish the processing in hurry. On the other hand, crown not shown was found 0.8% in 5th year while 14.4% in 4th year. Therefore, it seems possible that these results are due to the 4th year students have less experience in radiographic practice.

Male 4th and 5th year			
Errors	4th year No. = 104	5th year No. = 119	Total No. =223
Dot Artifact	1.9%	0 %	.9%
Apices cut Off	13.5%	6.7%	9.9%
Crown Not shown	14.4%	.8%	7.2%
Area of interest not shown	1.0%	.8%	.9%
Distortion	5.8%	5.9%	5.8%
Incorrect vertical Angulations	20.2%	14.3%	17.0%
Incorrect horizontal Angulations	9.6%	10.1%	9.9%
Cone cut	22.1%	15.1%	18.4%
Low Density	4.8%	4.2%	4.5%
High Density	10.6%	16.0%	13.5%
Processing errors	9.6%	43.7%	27.8%
Film Placement	2.9%	7.6%	5.4%

Table 3- Distribution of errors for male 4th and 5th year students

The results of this study showed the only statistically significant difference between 4th year males and females was in incorrect vertical angulations which was 6.1% in 4th year females and 20.2% in 4th year males. This might be because the fact that patients' flow at female clinics is lesser than male clinics. Therefore, the samples that have been collected from the female were smaller in number.

The cone cuts were mostly found in maxillary molars (32.4%), mandibular molars (27.4%), and maxillary premolars (21.2%). This result was similar to that of previous studies (2,3,10).. Previous study suggested that the maxillary molar region may be a particular problem area because of tongue movements and gag reflex for some patients and vertical angulation may seem to be relatively indistinct for clinicians.10

Aydin et al reveled incorrect angulation was most frequent in the maxillary molar region followed by the maxillary premolar, maxillary anterior and maxillary canine regions (15). However, in current study the Incorrect vertical angulations were mostly detected in maxillary anterior (35.7 %) followed by mandibular premolar (27.8%) and maxillary canine (25.8%). The possible explanation for the high percentage at maxillary anterior is the anatomical angulation of the jaw.

The apices cut off error was not found in maxillary and mandibular anterior and canines, but it was mostly present for mandibular molars (17.8%). This higher prevalence could be due to the fact that the floor of the tongue pushes the periapical radiographic film upward. Therefore, for some patients, it is not comfortable to place the film in the correct position because they tend to elevate the film from the intended area.

Conclusion

Dental radiography has an essential role in dentistry which allows dentists to diagnose cavities, lesions and other conditions that they otherwise would not be able to detect during a regular clinical examination. This study was set out to see the quality of taking radiographs of undergraduate dental students in QU. The result has shown that most frequent error was processing errors cone cut and incorrect vertical angulation. In addition, maxillary molars, mandibular molars, maxillary premolars, and maxillary canine were found as the most frequent locations where the radiographs were taken from.

The dental clinician must master a variety of technical skills in addition to understanding background scientific knowledge related to the radiology to minimize the needs for radiographic retake during training periods for undergraduate dental students, and consequently decrease the exposure to patient, clinician, radiology staff and environment.

Male and Female 4th year			
Errors	Male N= 104	Female N= 49	Total N=153
Dot Artifact	1.9%	4.1%	2.6%
Apices cut Off	13.5%	8.2%	11.8%
Crown Not shown	14.4%	4.1%	11.1%
Area of interest not shown	1.0%	2.0%	1.3%
Distortion	5.8%	8.2%	6.5%
Incorrect vertical Angulations	20.2%	6.1%	15.7%
Incorrect horizontal Angulations	9.6%	6.1%	8.5%
Cone cut	22.1%	28.6%	24.2%
Low Density	4.8%	4.1%	4.6%
High Density	10.6%	8.2%	9.8%
Processing errors	9.6%	4.1%	7.8%
Film Placement	2.9%	0%	2.0%

Table 4- Distribution of errors for male and female 4th year students

Acknowledgment

Table 5 - Anatomical Distribution of Errors

	Max. Anterior	Max. Canine	Max. Premolars	Max. Molars	Mand. Anterior	Mand. Canine	Mand. Premolars	Mand. Molar
Dot Artifact	.0%	.0%	.0%	2.7%	.0%	.0%	.0%	2.7%
Apices cut Off	.0%	.0%	6.1%	10.8%	.0%	.0%	16.7%	17.8%
Crown Not shown	10.7%	3.2%	.0%	6.8%	25.0%	.0%	11.1%	5.5%
Area of interest not shown	.0%	.0%	3.0%	.0%	.0%	.0%	5.6%	1.4%
Distortion	3.6%	16.1%	12.1%	2.7%	12.5%	14.3%	11.1%	1.4%
Incorrect vertical Angulations	35.7%	25.8%	6.1%	9.5%	25.0%	14.3%	27.8%	8.2%

Continue Table 5

	Max. Anterior	Max. Canine	Max. Premolars	Max. Molars	Mand. Anterior	Mand. Canine	Mand. Premolars	Mand. Molar
Incorrect horizontal Angulations	7.1%	9.7%	12.1%	14.9%	.0%	.0%	16.7%	2.7%
Cone cut	.0%	6.5%	21.2%	32.4%	.0%	.0%	11.1%	27.4%
Low Density	3.6%	3.2%	3.0%	4.1%	12.5%	28.6%	.0%	4.1%
High Density	7.1%	16.1%	15.2%	8.1%	.0%	14.3%	16.7%	16.4%
Processing errors	25.0%	22.6%	27.3%	21.6%	.0%	14.3%	5.6%	31.5%
Film Placement	.0%	6.5%	9.1%	5.4%	.0%	.0%	.0%	4.1%

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