

## Common Intra Oral Radiographic Errors Made by Dental Students

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### Abstract

**Background:** Retakes of intra oral radiographs happen frequently in dental practice although radiographic courses train dental students in consecutive semesters. To reduce the patient's exposure as much as possible it is mandatory to reduce the number of retakes both in radiology clinics and educational centers. In order to reduce the patient exposure as much as possible. **Materials and Methods:** 3188 periapical radiographs taken by bisect-angle technique were evaluated in this cross-sectional study to assess the frequent errors necessitating retakes. Views were taken by fourth year dental students using bisect angle method. Errors were tabled according to site and type. **Results:** The four major errors that were found in the study included incorrect film placement (35.4%), cone cutting (18.2%), incorrect horizontal angulation (16.6%), and incorrect vertical angulation (14.4%). The distribution of technical errors by anatomic location was identified. Maxillary molar area was the most occurring site for errors. **Conclusion:** These results suggest that educational programs may be re-evaluated to make the best benefit of educational courses involving both dental and hygiene students. [GMJ. 2013;2(2):44-48]

**Keywords:** Radiography; Dental student; Diagnosis; Errors

### Introduction

Radiographic imaging is a two-sided coin, which supplies the dentists with invaluable information about the anatomy and status of teeth and supporting bone. However, the risks of exposures to ionizing radiation for medical and dental purposes have been a matter of debate. It is now accepted that all exposures should be kept as low as reasonably achievable (ALARA) to minimize these risks. Various scientific and technological improvements are currently available for dose limita-

tion in intraoral radiography, such as the use of fast (E-speed) film and rectangular collimation which offer dose reductions of approximately 50% and 60%, respectively [1]. In addition, constant potential X-Ray units, longer focus-to-skin distances, and rare-earth filtration, are recruited to achieve further dose reductions [1]. Technical errors made by practitioners necessitate radiographic retakes which significantly increase the patient's contact with the radiation. Factors influencing the quality of intra oral radiographs include patient preparation, image receptor placement,

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and targeting the central ray in horizontal and vertical angles [2]. For a single radiographic view, preventing retakes will reduce the patient's radiation exposure to a half. A radiograph is retaken when the view does not meet the criteria of diagnostic quality. These criteria contains: density, contrast, definition, and distortion [3]. Simply, it can be stated that an error occurs if the taken radiograph does not provide the expected information. Technical and processing errors may interfere with diagnostic quality of images. The most common technical errors are: cone cutting, wrong vertical angulation, wrong horizontal angulation, and improper film placement. Some other errors may occur less frequently such as film bending, motion blur, and double exposure. Another error is attributed to processing techniques and solutions, which occurs in the dark room [3]. Two separate studies reported that film placement and cone cutting and improper vertical angulation were the most common errors, in maxillary and mandibular molar areas [4,5].

The present cross-sectional descriptive study was conducted to evaluate intraoral radiographies in regards to the frequency of errors, the types of error necessitating retakes, and the relationship of error frequency to the teeth area examined in bisecting angle intraoral radiographies made by senior dental students. The results may be applied to training protocols to reduce public exposure from the source of dental radiographies.

### Materials And Methods

3188 consecutive periapical radiographs, taken in Oral Radiology Department of Shiraz Dental School, from March 2011 to July 2011, were evaluated in this cross-sectional study.

All views were taken by fourth year dental students, who had already passed two practical training courses in intraoral imaging, using bisecting angle technique. The receptor was conventional size 2 intra oral films (Kodak™, Ultra-speed, Carestream, France) exposed by four intra oral X-Ray machines (Planmeca™, Finland).

Radiographs were checked by an oral and maxillofacial radiologist for diagnostic qual-

ity before delivery. A radiographic critique form was used to evaluate each radiograph. A total of 113 (3.55%) radiographs were decided clinically unacceptable and were repeated.

The errors were classified and tabled according to type, region of occurrence, and number. Errors of processing were not included. The interpretation of results was done based on frequency of type and region of occurrence. Pearson Chi square test was used to compare differences.  $P \leq 0.05$  was considered significant.

### Results

A total of 181 errors were found in 113 unacceptable views with the average of 1.6 errors for each view. The most frequent error was the incorrect film placement, by 35.4%, followed by cone cutting by 18.2% (Table-1). Elongation were detected nearly twice more than the foreshortening.

In this study errors were mostly prevailed in maxillary molar area by 39.4 % (Table2). There was a statistically significant difference between errors occurred in maxillary molar area and other regions ( $P=0.003$ ). Film placement and cone cutting were most frequent errors in mandibular canine area. However minimally frequent and processing errors were excluded from this analysis. Film placement, was the most common error and understandably the most prevalent error in the first two areas, but improper horizontal angulation was seen most in maxillary premolar area. Errors were least frequent in maxillary incisor area (3%). Cone cutting and bending were most detected in maxillary molar area.

### Discussion

Errors in taking radiographs increase patient's radiation exposure, and also waste time and money. Inspecting the frequency and mechanism of producing errors will result in less retakes; however, a few studies have been performed to evaluate radiographic errors in dental field.

Patel et al evaluated the frequency of errors necessitating retakes in paralleling intraoral radiographic technique. Out of 6763 expo-

**Table-1.** Frequency of Errors Based on Types

Type of Error	Frequency (%)
Film Misplacement	64(35.4)
Cone Cutting	33(18.2)
Improper Horizontal Angulation	30(16.6)
Improper Elongation	17 (9.4)
Vertical Angulation	26(14.4)
Forshortening	9 (5)
Bending	12(6.6)
Exposure Errors	4(2.2)
Processing Faults	4(2.2)
Backward Positioning	4(2.2)
Motion Blur	2(1.1)
Thyroid Shield Cut	2(1.1)
Total	181(100)

sure, 13.1% were retaken. The results showed that mandibular molar area was the most common site for errors to occur, followed by maxillary molar, mandibular premolar and maxillary premolar area. Incorrect film placement and cone cutting were the most frequent errors, respectively [4]. In another research in 1986, Patel et al concluded that incorrect film placement followed by incorrect vertical angulation and cone cutting were the most common errors in paralleling technique. This time maxillary molar followed by mandibular molar region were the most common sites for occurrence of errors [5]; however, rankings were slightly different in the two studies. These studies evaluated many parameters including different X-Ray machines and paralleling devices, and dental students in different levels of education. Although it may be interpreted as completion of the study, results may encounter bias due to complexity of method and material employed. Additionally, bisecting-angle technique was not appreciated in previous studies except the study conducted by Mourshed et al in which 47% technical errors was reported in 5578 periapical radiographs made by dental students using the bisecting-angle technique [6].

**Table-2.** Error analysis based on site of occurrence

Error Area	Film Misplacement	Cone Cut	Improper Hz	Elong	Forshort	Bending	Total	%
Maxillary Incisors	1	3	—	1	—	—	5	3
Maxillary Canines	2	4	3	2	1	1	13	7.9
Maxillary Premolars	6	5	10	3	4	—	28	17
Maxillary Molars	26	12	10	8	4	5	65	39.4
Mandibular Incisors	—	1	1	1	—	3	6	3.6
Mandibular Canines	4	4	1	1	—	1	11	6.6
Mandibular Premolars	7	1	2	1	—	1	12	7.3
Mandibular Molars	18	3	3	—	—	1	25	15.2
Total	64	33	30	17	9	12	165	100

Hz:Horizontal angulation

However, the present study reported a significantly lower rate of retakes compared to Mourshed and colleagues' study; the high range of technical errors reported by them may be the result of different educational level of students with different experience that entered the study [6]. To overcome bias resulting from students' experiences and machine differences, our study employed bisecting-angle technique with one common type of X-Ray machine and students of the same level of education. Our results showed that film misplacement was the most common type of error that is in accordance with the study conducted by Mourshed et al in which improper film placement was reported to be the most frequent error [6]. This may be attributed to the pressure inserted unintentionally finger of the patient onto the film after placement by operator that may displace the film. After placement by operator. This may have displaced the film. Direct and exact vision on the area may also play a role. This error is more prevalent in maxillary molar area which is the most complicated area to check for operators. The frequency of this error in mandibular molar area is also high in spite of direct vision on this area. Gag reflex and unintended resistance of the patient may attribute to misplacement of films in this area and also in maxillary molar area. Cone cutting is also prevalent in maxillary canine area. The curvature of the arch in canine region that affects film placement may be ignored by the operator which results in cone cutting [7]. To reduce this error, using indicator devices or light guided exposures were highly recommended. Improper horizontal angulation is much more prevalent in maxillary molar and premolar areas. The limitation of vision, especially in cases of fatty cheeks is probably a considerable cause. Improper vertical angulation (elongation and foreshortening) also presents the same situation. Bending of film was encountered most commonly in maxillary molar area followed by mandibular incisor area. Restricted space and patient's finger pressure on film are the most probable causes. Our study showed that the most common errors in different parts of arch were as follows: 1) Maxillary incisor: cone cutting, 2) Maxillary canine: cone cutting, 3) Maxillary premolar: improper horizontal angulation, 4) Maxillary molar: film misplacement and cone cutting, 5)

Mandibular incisor: film bending, 6) Mandibular canine: cone cutting and film misplacement, 7) Mandibular premolar: film misplacement, 8) Mandibular molar: film misplacement. The distribution of errors that our study showed may be considered during the educational courses of dental students to concentrate their attentions on desired points. Since cone cutting accounted for the majority of errors in all studies (20% in our study), it can be suggested that using a device to simplify the alignment of tube over the image receptor will reduce the number of retakes significantly. This may be done by a laser light localizing the periphery of x-ray beam over the skin of the patient, a method that can be evaluated in further studies. In our study any view which had not provided necessary information was repeated. In this manner, some views with minor faults might have been delivered and not retaken. Minor cone cutting which did not interfere with diagnostic quality were ignored. This may be interpreted as a cause of bias in the study, but it was done to reduce patient's exposure. Finally, it is the operator who judges if a certain view absolutely needs to be retaken, as we all are following the ALARA rule strictly.

## Conclusion

Based on our results, errors were more prevalent in maxillary molar and premolar area followed by mandibular molar area. In bisecting angle technique film misplacement and cone cutting were the most common errors followed by improper horizontal angulation. It appears that most of students have some difficulties dealing with taking radiographs from mentioned areas, so teaching plans may be revised emphasizing more on the problem arising areas.

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## Conflicts of Interest

None declared

## References

1. Horner K, Hirschmann PN. Dose reduction in dental radiography. *Journal of Dentistry*. 1990;18(4):171-84.
2. Pasler FA, Visser H. *Pocket Atlas of Dental Radiology*. 1st ed. Thieme. Germany, 2007. p.3-5.
3. White SC, Pharoah MJ. *Oral Radiology: Principles and Interpretation*. 6th ed. Elsevier. China, 2009. p.58-61.
4. Patel JR. Intraoral radiographic errors. *Oral Surgery, Oral Medicine, Oral Pathology*. 1979; 48(5):479-83.
5. Patel JR, Greer DF. Evaluating student progress through error reduction in intraoral radiographic technique. *Oral Surgery, Oral Medicine, Oral Pathology*. 1986;62(4):471-4.
6. Mourshed F. A study of intraoral radiographic errors made by dental students. *Oral Surgery, Oral Medicine, Oral Pathology*. 1971;32(5):824-8.
7. Iannucci JM, Howerton LJ. *Dental Radiography: Principles and Techniques*. 3rd edition. Elsevier Saunders. 2011:217-248.

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