Common Errors in Digital Panoramic Radiographs Taken in Rasht Dental School

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Abstract

Introduction: The use of panoramic radiography has shown a remarkable expansion over the past 20 years. Accurate positioning and preparation of patients is needed to avoid image distortion. The aim of this study was to evaluate the common errors on panoramic radiographs taken in the radiology department of Rasht dental school.

Materials and Methods: The study sample included 390 digital panoramic radiographs taken in Rasht faculty of dentistry by a direct digital panoramic unit. Frequency of common errors including errors related to patient positioning and patient preparation in male and females were evaluated.

Results: There were 314 panoramic radiographs (81.5%) with errors. Errors related to the improper patient positioning were observed in 306 cases (78.5%). The most common error was palatoglossal air space (56.2%). There was no significant difference between males and females.

Conclusion: The errors seen in panoramic radiographs were relatively high, thus training the operators is essential to maximize the quality of panoramic radiographs.

Key words: •Panoramic radiography •Patient positioning •Training

Introduction

Panoramic imaging is a technique for producing a single tomographic image of the facial structures that includes both the maxillary and mandibular dental arches, and their supporting structures.[1] Panoramic image is a useful tool for diagnosis and treatment planning of disease[2] and represents one of the kinds of the image complementary dental imaging in recent years[3].

The quality of any radiograph depends on an accurate technique and careful processing of the image. Correct positioning of the patient is essential for a sharp, accurate and undistorted image.[4] The operator must pay careful attention to the patient positioning and film processing. But there is no film processing in digital imaging.

Some of the technical errors may cause radiographs to be of minimal or inadequate diagnostic quality. In cases without enough diagnostic quality, radiographs have to be retaken which results in receiving unnecessary radiation absorbed dose of the patient.

A number of studies evaluated the frequency rate of errors seen on panoramic radiographs. Schiff et al. reported that out of 1000 panoramic radiographs, 79.7% had errors[5] and Brezden et al.[6] examined 500 radiographs and found only one error-free radiograph. Kaviani et al.[2] reported that out of 250 panoramic radiographs, 92.4% had errors. Glass et al. examined 75 panoramic radiographs of edentulous patients and found that 89.3% of radiographs had errors.[7] Granlund et al.[8] evaluated the frequency of errors in panoramic radiographs of young orthodontic patients and reported that 96%

had errors. A close look at frequency of panoramic errors in the above studies reveals that preparation of error-free panoramic radiographs is complicated. Thus, the aim of this study was to evaluate the frequency of common errors on panoramic radiographs taken in the radiology department of Guilan dental school by trained assistants, in order to prevent further occurrence of them.

Materials and Methods

A total of 390 digital panoramic radiographs of patients above 18 years old taken from November to February 2012 with a DR panoramic unit (Cranex D, Sordex, Helsinki, Finland) in the radiology department of Rasht faculty of dentistry were considered in this study. The radiographs were taken by only two trained technicians with the same amount of experience. Radiographs related to patients with mental or physical disorders were not included in this study. All radiographs were printed by Kodak (5700, Germany) printer. The radiographs were viewed under identical condition, using a standard viewing box in a room with subdued lighting.

Radiographs were evaluated by one oral and maxillofacial radiologist, and frequency of errors was recorded according to the criteria described by Langland et al[9].

Patient positioning errors:

Antero-posterior positioning error (Patient is positioned too forward or backward)

The patient's head is twisted.

The chin is tipped too low or high.

The patient is slumped.

The chin is not positioned on the chin-rest.

The tongue is not on the palate.

The patients' movements.

Technical errors:

The patients' wearing prostheses,orthodontic appliances or jewelry.

Apron/thyroid shield artifact.

Error related to film radiographs, such as static electricity or exposure and darkroom problems were not evaluated in our study. Because our study focused on digital panoramic radiographs, and exposure problems can easily be dealt with by changing brightness. The frequencies of individual errors on all radiographs were evaluated. Chi-Square analysis was carried out to test for the differences between genders. The level of significance was less than 0.05.

Results

Panoramic radiographs of 390 patients (female: 199 and male: 191) were evaluated. There were 76 radiographs (19.5%) which were error free and 314 radiographs (80.5%) with errors. The most common positioning error was found to be palatoglossal air space over the roots of the maxillary teeth (56.2%). Frequency distribution of common errors observed in this study is shown in tables 1&2. Some radiographs had more than one error, so the percentages of technical and positioning errors add up to more than 100 percent. There was no significant differences between male and females by using chi-square statistical analysis (P-value=0.824). In this study, 202 (51.7%) radiographs had one error, 83 radiographs(21.3%) had two errors, 28 (7.2%) radiographs had three errors, and only one (0.3%) radiograph had four errors.

Discussion

Panoramic radiographs have long been one of the most common means for imaging the dental structures.[5] The focal through of the panoramic machines is a three dimensional curved zone and it is important for obtaining high quality images.[1] The limited dimension of the focal trough, carelessness of operators and the age of the panoramic unit affect the occurrence of some errors[3].

Table1. Frequency distribution of technical errors in panaromic radiographies

Technical Error	Female (N%)	Male (N%)	Total (N%)
Jewelry	5(1.3)	3(0.08)	8 (2.1)
Prostheses	0 (0.0)	0 (0.0)	0 (0.0)
Orthodontic Appliances	0 (0.0)	0 (0.0)	0 (0.0)
Eye glasses	0 (0.0)	0 (0.0)	0 (0.0)
Leaded apron artifact	0 (0.0)	0 (0.0)	0 (0.0)

Table2. Frequency distribution of positioning errors reported in panaromic radiographies.

Positioning Error	Female N (%)	Male N (%)	Total N (%)
Patient too far forward or too far back	25(6.4)	28(7.2)	53(13.6)
Head twisted	20(5.1)	17(4.4)	37(9.5)
Chin tipped too low or too high	47(12.1)	48(12.3)	95(24.4)
Slumped position	7(1.8)	8(2.1)	15(3.9)
Chin not on the chin rest	12(3.1)	17(4.4)	29(7.5)
Tongue not on palate	113(28.7)	107(27.4)	220(56.2)
Patient movement	0(0.0)	0(0.0)	0(0.0)

In our dental school, training in panoramic radiography is only given to radiology assistants and technicians, but not the dental students. The radiographs in this study were taken by two trained dental assistants with about 5 years of experiences. The rate of error free radiographs was found to be 19.5%. Kaviani et al.[2] reported that 7.6% of radiographs were error free. Schiff et al.[10]

and Akarslan et al.[3] found that 20.3% and 37.61% were error free, respectively. Dhillon and coworkers reported Out of 1,782 panoramic radiographs, 196 (11%) were error free.[11]

On the other hand, Brezden et al.[6] and Rushton et al.[8] reported that only 0.5% and 0.8% of radiographs had no errors, respectively.

In all above mentioned studies, conventional panoramic machines were only used in our study and Peretz et al.[4] study digital panoramic radiographs were used. Thus there were no errors related to chemical film processing.

The most common error was found to be the presence of palatoglossal air space. This result is similar to other studies.[3,5,8,10,11] This error happens when the patient does not raise the tongue against the palate. The resulting air in the mouth is visible on the radiograph as a band of radiolucency over the maxillary teeth. This can reduce the diagnostic quality of the roots and its surrounding structures. According to our experiences, patients find it difficult, or become a little confused, when asked to raise their tongue against the palate. This might suggest the reason for such a high rate of error. Taking radiographs with older machines tends to increase error rates because with extended use, the location of the focal trough could change.

In this study, radiographs were taken with a only a couple of months old machine. This may be reason for presence of more error free radiographs than the other studies. [2,4,5,7,8] But generally the error rates seem to be high when the biological effects of ionizing radiation is considered. Sometimes errors could occur beyond the operator's control in patients having facial asymmetry, short and heavy neck, very over weight, unusually tall and the inability of following the instructions[3].These situations make it difficult to position the patient properly in the X-ray machine. The operator must be careful in positioning these patients. Although errors beyond the operator's control may occur, most errors are within the control of the operator and could be reduced by paying more attention to taking the radiographs. Thus, the errors seen on panoramic radiographs were relatively high and the errors in patient positioning were the most frequent errors. In most cases, we accept radiographs to reduce absorbed patient dose. But it's ideal to take standard radiographs. It seems that the operator skill can decrease the frequency of errors and help produce high quality radiographs. It is important to monitor the panoramic images regularly and identify errors and suggest methods to avoid these errors.

Conclusion

From the results of the study, the frequency of errors seen on panoramic radiographs are relatively high, thus training the operators discussing the technical errors in case of occurrence are highly essential to maximize the quality of panoramic radiographs.

Acknowledgement

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