



## **ASSESSMENT OF TYPES OF COMMON ERRORS IN THE PANORAMIC RADIOGRAPHS**

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### **ABSTRACT**

The objective of this study was to examine all the panoramic radiographs taken in the period of 3 months and to find out the faulty radiographs. The common errors and their percentages were calculated. A list of measures to prevent the errors was made. The number of faulty radiographs in each category of error was calculated. The faulty radiographs were classified in the descending order of occurrence along with the percentage. Out of 300 panoramic radiographs assessed, 188 were categorized into the errors caused by processing faults. The percentage was 62.66%. Out of the fifteen types of errors assessed, the most common were the errors related to the processing problems. They include streaking on the films, surface marks, film discolorations etc.

**Keywords:** Panoramic radiographs, Processing errors.

### **INTRODUCTION**

Radiography is a useful tool in various disciplines of medicine and dentistry for diagnosis and treatment planning of diseases. Panoramic radiographs are very commonly used now days in day to day dental practice as a routine mode of radiographic investigation. This is possible due to their widespread indications, advantages over other procedures and simplicity of the technique etc. They continue to offer today's dentist a unique patient view; covering the entire dentition and surrounding structures, the facial bones and condyles, and parts of the maxillary sinus and nasal complexes. The equipment used to obtain panoramic radiographs has continued to improve with recent advances including automatic exposure and multiple image programs.

As they are widely used, high chances of errors are also present which may be related to the technique, processing or other factors. Changes in the quality of radiographs may lead to misinterpretation, resulting in incorrect diagnosis and treatment planning. This also leads to increased need for retakes of radiographs, increased amount of time, radiation exposure and the cost factor. For these reasons, common errors, artifacts and

faults in panoramic radiography need to be understood so that we can avoid them thereby preventing further inconvenience. High quality radiographs are of vital importance to the practicing dentist as an aid in the proper diagnosis of patients' dental needs.

The aim of this study is to evaluate the common errors on panoramic radiographs of the department in order to prevent further occurrence of them. This will allow the practitioner to determine from the radiograph the point at which the error occurred in the image creation process. Elimination of errors results in panoramic radiographs with the maximum diagnostic details and information that the equipment and technique allows.

### **MATERIALS AND METHODS**

All the panoramic radiographs taken in the department of Radiology of Dr. D. Y Patil Dental College were examined daily for a period of 3 months. 300 oral pantomographs were studied for the mentioned objectives. An informed consent and ethical approval was obtained from all the patients. 2 researchers were involved in this study. A variable intensity radiographic viewer was used for the assessment of the errors.

**Panoramic machine specifications-**

Product / Model- PM 2002 EC Proline with total filtration of 2.5mm Aluminium. It complies with DHHS radiation performance standards, 21 CFR subchapter J.

Manufacturer- Planmeca OY, ASENTAJANKATU 6, 00810 HELSINKI FINLAND.

KvP- 74, mA- 12, Exposure time- 18sec

All the pantomographs were processed by manual visual method of processing in the dark room. The radiographs were categorized into the following major classes of radiographic errors.

**COMMON ERRORS WITH CAUSES**

1. Low density radiographs – Low kvp / mA Weak developer inadequate developing time etc
2. High density radiographs – High kvp / mA Developer too strong Developing time too long etc
3. Fogged radiographs – Improper film storage Outdated films Faulty processing solution selection Accidental light exposure etc
4. Only a portion of film exposed – not positioning film cassette drum from starting
  - Exposure of the film to the light or unexposed films or films developed without exposure
  - Vertical white lines on radiograph – exposure switch accidentally released and pressed back
  - Alternating black and white vertical lines – irregular cassette holder movement
5. Random artifacts on film – contaminants like dust, clips, paper on screens

6. Processing problems – Streaking Surface marks Discoloration and stains
7. Static electricity – rapid movement while handling the films
  - Glove smudge markings – use of gloves in film handling
  - Fingerprints and fluoride artifacts – fingers contaminated with fluoride preparations
  - Crimp marks – bending of film into sharp crease before development
8. Shadows of eyeglasses, earrings, metallic items, dentures etc. – patient not instructed to remove them
9. Narrowing of anterior teeth – patients head positioned too far forwards wide, unsharp image of anterior teeth – patients head positioned too far backwards
10. Severe curvature in Occlusal plane, tmj outside the upper limit of film – downward angulation of head Flattening of Occlusal plane, superimposition of hard palate on maxillary tooth apices – excessive upwards angulation
11. Magnification of image on one side, superimposition in premolar region – patient’s head twisted or turned in machine Uneven lower border of mandible, magnification of image on one side – patient’s head tilted in machine
12. Low density area around lower center of film – slumped position of the patient
13. Dark band on the radiograph – patient’s shoulder touching the cassette holder during its movement
14. Distortion of the image – patient movement
15. Double exposure – two exposures taken on the single film

**RESULTS**

**Table 1. Showing the type of error, number of faulty pantomographs in each category and the percentage**

Type of error	Number of faulty Oral Pantomograms	Percentage (%)
1	26	8.66
2	37	12.33
3	18	6
4	4	1.33
5	51	17
6	188	62.66
7	49	16.33
8	36	13
9	41	13.66
10	69	23
11	76	25.33
12	70	23.33
13	0	0
14	6	2
15	3	1

**DISCUSSION**

Out of the fifteen types of errors assessed, the most common were the errors related to the processing problems. They consist of streaking due to inadequate developer and fixer replenishment, dirty wash water and

improper chemicals or films used. The surface marks are seen due to irregularities on the surface of rollers or dirty workbench and water droplets. Various discolorations are present due fixer and developer solutions, rapid processing or exhausted fixer solutions. The best method

to avoid such errors is proper handling of the films in the dark room, maintenance of the manual and automatic processing solutions and machines. The second most common error was related to the faulty patient positioning. It consisted of the magnification of the image on one side with superimposition in the premolar region caused due to the patient's head twisted or turned in the machine. It also included the image with an uneven inferior border of the mandible and magnification of the image on one side caused due to the patient's head tilted in the machine. To avoid such errors, the patient positioning within the OPG machine should be verified before the exposure is made. The third most common error is where a low density area around the lower centre of the film is seen which is caused again due to the faulty patient positioning. If the patient stands in slumped position, the radiopaque ghost image of the spinal column is superimposed in the mandibular anterior region. So the patient should always stand erect within the OPG machine. If too much downward angulation is given to the patient's head, severe curvature in the occlusal plane is noted along with temporomandibular joints being outside the upper limit of the film. If excessive upward angulation is given, it results in the flattening of occlusal plane with the superimposition of the hard palate on the apices of the roots of the maxillary teeth. Accurate positioning of the patient's head and occlusal plane is must to avoid these errors. The presence of random artifacts on the film is also one of the common errors which consists of contaminants like dust, clips, papers on the screen. The OPG cassettes should be well cleaned before the use. The film storage conditions should be proper. The other errors in the decreasing order of frequency were surface abnormalities like static electricity, glove smudge markings, fingerprints and fluoride artifacts and crimp marks. Next errors include the patient positioning errors causing horizontal minification or magnification of the anterior teeth if the patient's head is positioned too far forward or backward respectively. Next were the radiographs with high density caused due to high kVp or mA, too strong developer or too long developing time etc. If proper patient preparation is not done, shadows of eyeglasses, earrings, metallic items or dentures are seen on the radiographs. Next in the order are the low density radiographs caused due to low kVp or mA, weak developer solution or too short developing time. The radiographs may become fogged because of improper film storage, use of the outdated films, faulty processing solutions or accidental light exposures. Few OPGs showed distorted images due to the patient's movement in the horizontal or vertical plane. The next category included the radiographs in which only a portion of the film was exposed or vertical white lines or alternating white and black lines were noted on the OPGs. The films exposed to the light, unexposed films or the films developed without radiographic exposure were also

included in this category. 3 OPGs were found with double exposure namely two exposures taken on a single film. There was no radiograph classified in the last group which included the radiographs with dark band on it if the patient's shoulder touches the cassette holder during its movement.

250 panoramic radiographs taken at the Department of Oral and Maxillofacial Radiology were evaluated. Radiographs were categorized into five groups according to the type of errors (patient positioning errors, darkroom errors, failure to remove metallic accessories, equipment setup errors and patient movement during exposure) [1].

Results-There were 19 error-free radiographs. The number of radiographs with errors was 231, of which 26 were unacceptable and had to be retaken. Errors of patient were observed in 78% of cases, film development in 69.2%, equipment setup in 3.2%, failure to remove metallic accessories in 3.2% and patient movement during exposure in 2.4% of cases.

Conclusion- The errors seen on panoramic radiographs were relatively high with errors in patient positioning being the most frequent error.

A study was carried out to examine the effect of potentially common patient positioning errors in panoramic radiography on imaged mesiodistal tooth angulations and to compare these results with the imaged mesiodistal tooth angulations present at an idealized head position [2].

## CONCLUSION

1. The majority of maxillary and mandibular image angles (64%) from the various head positions were statistically different from image angles at the idealized head position.
2. Vertical head rotation (5 degree up and 5 degree down) had a much more pronounced effect on the deviation of maxillary angle projection. Conversely, horizontal head rotation (5 degree right and 5 degree left) had a much more pronounced effect on the deviation of mandibular anterior angle projection from truth.

Rushton et al carried out examination of 1,813 panoramic radiographs obtained from 41 general dental practitioners and recording of faults. Only 0.8% of films were excellent, 66.2% were diagnostically acceptable and 33% were unacceptable. The most common faults which directly contributed to failure of the radiographs were antero-posterior positioning errors, low dentistry and low contrast [3].

Natalia et al examined 500 radiographs. Of the 500 radiographs evaluated, 467 had positioning errors, 441 had processing errors and 424 had miscellaneous errors. The severity of error was of more importance than the number of errors in type determination of diagnostic adequacy. Even slight variations in the placement of head

would produce considerable distortion, especially in the ramus region, coronoid processes and condyles [4].

According to a study done by Samavi et al, a distorted image of the angular relationships of the long axes of the teeth can occur following alterations in anterior tilt of the head. The canine and premolar teeth of both arches are expressed as the largest amount of distortion and the molar teeth the smallest [5].

Glass BJ evaluated numerous panoramic radiographs. Panoramic films were randomly selected from the inactive files of 75 edentulous patients seen at the dental school for complete denture construction. The radiographs were numbered and reviewed by a board-certified oral and maxillofacial radiologist trained to identify errors in panoramic radiography [6].

Results and conclusions: Of the 75 panoramic radiographs examined, only 6 films (8.0%) were free of errors, and 67 films (89.3%) had one or more errors in patient positioning and 33 films (44.0%) had one or more technical errors. The most common positioning errors were positioning the chin too high (32 films, 41.3%) and positioning the patient too far forward (26 films, 34.7%). Without modification, manufacturer's instructions for positioning dentate patients during panoramic radiography may result in positioning errors on the panoramic radiographs of edentulous patients. Proper training and appropriate attention to detail while exposing and developing panoramic films are required to ensure maximum diagnostic benefits for edentulous patients.

According to the study carried out in College of Dentistry, King Saud University, there are several errors encountered during patient preparation and positioning. This study focussed on six of these errors, including palatoglossal air space above the apices of the root of maxillary teeth, slumped position, chin tipped up, or down, as well as the patient placed either too far backward or forward [7]. The presence of any of these errors alone or in combination with each other will affect the diagnostic usefulness of the panoramic radiograph. 500 panoramic radiographs were randomly selected from inactive files of adult dentate patients seen at the dental school taken by trained technicians. The radiographs were numbered and reviewed by the author under standard viewing conditions to identify the presence of these six errors. Out of 500 panoramic radiographs examined, 468 (93.6 %) showed one or more than one errors. The most common positioning error encountered was palatoglossal air space above the apices of the root of maxillary teeth - 81.8 %, followed by slumped position- 17.2 %. The percentage dropped in other errors between 10 –11.6 %. The high rate of errors occurred in this study can be attributed to the lack of verbal communication between the patients and the technicians. This dictates a need of continuing education program for the operators in the panoramic dental radiography.

V. E. Rushton et al in one proved that out of 1,813 panoramic radiographs examined, only 0.8% of films were 'excellent', 66.2% were 'diagnostically acceptable' and 33% were 'unacceptable' [8]. The most common faults which directly contributed to failure of the radiographs were antero-posterior positioning errors, low density and low contrast.

Conclusions - The quality of panoramic radiographs was considerably lower than standards recently set for primary dental care. The quality of panoramic radiography could be improved by careful attention to radiographic technique and processing.

According to a study conducted in 2003, the most common errors were found to be the palatoglossal airspace shadow of air above the tongue due to the patient not raising the tongue against the palate (46.30%) and the superimposition of hyoid bone with the mandible (26.30%) respectively. The least common error was found to be dirty or bent films (0.21%). The quality of panoramic radiographs could be enhanced by improving radiographic technique [9].

In conclusion, according to our study, the most common errors which take place in the hospital are the one related to the processing errors. The common types and their causes are as follows:

**A.Streaking (uneven density) may be caused by:**

1. Developer and fixer replenishment low
2. Rollers and crossovers encrusted with chemical deposits
3. Dirty wash water improper chemicals and/or films used  
Failure to rinse films prior to fixation
4. Failure to stir processing solutions thoroughly after replenishment
5. Failure to agitate films in developer and fixer
6. Unclean film hangers

**B.Surface marks on the radiograph may be caused by:**

1. Irregularities on the surface of the rollers
2. Contamination of the film by dirty work-bench or water droplets (black spots and lines)

**C.Film discoloration may be caused by:**

1. Fixer in the developer
2. Processing too fast
3. Exhausted fixer

**D.Stains**

1. Yellow or brown: exhausted developer, oxidized developer, insufficient rinsing, exhausted fixer, prolonged fixing
2. Variegated (different colors in streaks or spots): careless rinsing, causing fixer to act unevenly on emulsion, exhausted developer or fixer, contaminated developer or rinse water
3. Green: insufficient washing
4. Grayish white scum: incomplete rinsing (excess developer carried into fixer precipitates hardening agent, resulting in white sludge in solution and white scum on film, can be prevented by proper rinsing)

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