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Classification of Conventional Artifacts In Routine Dental Radiography : A Review Of Literature

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Abstract:
Introduction: Conventional and advanced radiography are useful tool in various disciplines of oral medicine and dentistry for diagnosis and treatment planning of diseases. Radiographs with artifacts have poor diagnostic value and cannot be use for diagnostic purpose. Because changes in quality of radiographs may lead to misinterpretation, resulting in incorrect diagnosis and treatment planning. Thus, a proper knowledge of normal anatomy of orofacial region and radiographic artifacts is necessary to reach to a proper diagnosis. In this review article , we have discussed about the classification of different artifacts taken from different database.

Keywords: *Radiographic artifacts, dark and light radiograph, intraoral periapical radiograph*

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I. Introduction

Radiography is a useful tool in various disciplines of medicine and dentistry for diagnosis and treatment planning of diseases. Changes in quality of radiographs may lead to misinterpretation, resulting in incorrect diagnosis and treatment planning.[1] Radiographs with a diagnostic quality aids in accurate diagnosis of the lesions. Dark radiographs are one of the various radiographic faults encountered in daily dental practice resulting in an image with low diagnostic quality which requires a need for an additional exposure to the patient.[2]. Accurate positioning and preparation of patients is needed to ensure the image is not distorted while quality control is critical when screen film is processed.[3] An artifact is a feature in an image that masks or mimics a clinical feature.[4] or An artifact is a structure or an appearance that is not normally present on the radiograph an is produced by artificial means. Radiographic errors may be due to technical errors (errors related to technique of taking the radiographs) or processing errors(related to all aspects of processing), improper handling of film packet, excessive movements of tube, the patient's head and or the film may result in a variety of unusual radiographic flaws.[5]

Panoramic radiographs have been one of the most common means for imaging dental structures among dentists due to their many advantages. However, the panoramic radiographs also bear some disadvantages. It provides less sharp images and less accurate information about dental and oral diseases than regular intraoral periapical or bite wing radiographs.[6] Many types of artifacts and technical errors occur during panoramic radiography. Some of these artifacts are under operator control i.e. proper patient positioning, exposure factors and processing technique. Other artifacts may result from factors beyond operator control i.e. patient movement.[7] The most common positioning error encountered, palatoglosal air space above the apices of root of maxillary teeth 81.8%, followed by slumped position 17.2%.[8] Synthetic hair braid extensions are only type of synthetic hair extensions that might cause a radiopaque artifactual interference on panoramic radiograph. Artifacts appear in many forms of radiography. Ghost images by hair pins and jewelry are often encountered and well documented in panoramic radiography.[9] in order to get around of this problem of ghosting; we need to display the stitched image as if nothing in the scene moved. Another problem in automatic image stitching is exposure differences between images. If the difference is not corrected, the panorama will appear to have seams, even when the images are blended in overlapping regions.[10] However, as in all imaging modalities; there are potential hardware and software artifacts that may lead to wrong radiological diagnosis. Being aware of these artifacts would ensure a correct diagnosis and the appropriate treatment given to the patient.[11]

For being aware of these artifacts, the systematic method to identify the artifacts on X-ray films includes:-

1. One needs to know about the anatomical landmarks to differentiate the undiagnostic object (artifact) present on radiograph.

2. One needs to identify other object other than anatomical landmarks which appears as artifacts on radiograph as hair pins, ornaments (nose pins, necklace, and ear rings), mufflers, spectacles etc.
3. Ghost images are very important to differentiate .They might be resulting from normal anatomical landmarks. Other times they also might be resulting from other objects. They might be single, double and multiple often magnified, located at higher position and even blurred. There are many types of artifacts which include discoloration (dark, light, brown, black, yellow, fogging etc), elongation, foreshortening, cone cut, finger prints on radiographs due to improper handling of x –ray film, ghost images etc. Discoloration of films is mostly resulting from the processing errors and it can be of various types. However a small discoloration may be attributed to expired films and some may be attributed to excessive exposure to safe light, visible light and no exposure.
4. Care full examination and prior knowledge deals proper identification, correlation and differentiation.

II. DIFFERENT CLASSIFICATIONS OF RADIOGRAPHIC ARTIFACTS

1. According to **Freny R Karjodkar** Textbook of Dental and Maxillofacial Radiology, 2nd edition (93-110,240-247)[12].

Causes of faulty radiographs can be broadly classified into:

a) Projection errors
b) Exposure and processing errors
c) Technique errors
d) Automatic processing errors

2. According to **Farzaneh Kaviani et al in 2007[13]** classified panoramic errors into –

a) Errors due to positioning of the patient
b) Failure to remove metallic accessories
c) Equipment setup errors
d) Error of patient moving during exposure and
e) Dark room errors.

3. According to **V.E. Rushton et al in 1997[14]** classified panoramic errors into-

a) Technical faults-

1. Poor film/ intensifying screen contract
2. Image of foreign objects(and / their ghost shadows) on films
3. Antero- posterior patient positioning errors
4. Angulation of Occlusal plane errors
5. Incorrect sagital plane position
6. Slumped position with spinal column shadow
7. Tongue not in contact with palate
8. Patient movement
9. Absence of orientation
10. Other technical faults

b) Processing faults-

1. Faults in dentistry
2. Faults in contrast
3. Developer / fixer splashes
4. Localized film fogging artifact (leak in cassette)
5. Generalized film fogging
6. Chemical streaks
7. Inadequate fixation or washing

4. According to **Charles E. Willis et al in 2004** classified artifacts according to

a) Causative agents -

1. Hardware , software or operator

b) Mechanism of interferences with image acquisition , processing or display

5. According to **Neil Serman in 2000** classified radiographic errors and artifacts into –

1. Distorted image
2. Finger marks
3. Blurred image

4. Dark and light films
5. Clear films
6. Cone cut
7. Herring bone pattern/ tire track
8. Double exposure
9. Static electricity
10. Crescent shape black lines
11. Crescent shape white line
12. Reticulation
13. Undeveloped
14. Scratch films
15. Black borders
16. Black spots
17. Streaks
18. Radiolucent spots
19. Clear spots
20. Brown film
21. Black films
22. Ghost images
23. Gray films

6. **Benjamin Pretez et al in 2011** classified panoramic artifacts into-
1. Technical errors and
2. Patient positioning errors

7. **Dr. Wafa's AL –Faleh 2002** classified common panoramic errors as-
a) Patient positioning errors
1) Palatoglosal air space above the apices of rootr of maxillary teeth
2) Slumped position
3) Chin tipped up or down
4) Patient placed too far backward or forward

8. **Ronald S. Brown et al in 1998** classified one panoramic artifact as- Radiopaque artifact- synthetic hair braid extension artifacts.

9. **LTH Tan and KL Ong in 2000** classified artifacts in computed radiography as-
a. Double exposure
b. Hardware artifacts
1. Dust particles and scratches
c. Software artifacts
1. Excessive edge enhance cement
2. Inappropriate display protocol selection
3. Light bulb effect
d. Foreign body artifacts
1. Clothing
2. Adhesive tape

10. **A.S.Carmo et al in 1998** [15]classified artifacts into-
a. Processing errors (locked film inside the machine, burned film, chemical products)
b. Manipulation errors(damaged cassette, dirty screen, bad positioned screen)
c. Radiographic factors(superexposition, under exposition)
d. Double exposition(the machine shot off once more , the film already exposed)
e. Positioning objects(string, necklaces, ring)

III. Conclusion

For a radiograph to be diagnostic it is important that it should be free from all artifacts. This is possible only if proper technique is used under adequate parameters. Without proper knowledge of technique aad otjer exposing parameters it is impossible to have diagnostic radiographs.

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