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Standardization of Intaroral Radiography

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Abstract: ***Radiographic methods are used to assess periodontal bone changes in clinical trials. Radiographs allow us to have permanent visual record of the bone support and allow for linear, area, and volume measurements of periodontal lesions. However, geometric distortion and radiographic processing errors are major limiting factors of radiographic method outcomes. The use of standardized methods and computer algorithms has minimized the effect of these errors on data from radiographs.***

Keywords: Radiograph, Dental

1. Introduction

Dental Radiographs or x-rays are utilized to find hidden dental structures, cavities, malignant or benign masses and bone loss.A radiographic image is formed by a controlled burst of X-ray radiation which penetrates oral structures at different levels, depending on varying anatomical densities, before striking the film or sensor. Teeth appear lighter because less radiation penetrates them to reach the film. Infections, dental caries and other changes in the bone density and the periodontal ligament, appear darker because X-rays readily penetrate these less dense structures. Besides, dental restorations (fillings, crowns) may appear lighter or darker, based on the density of the substance. Placing the radiographic film sensor inside the mouth produces an intraoral radiographic view. There are few types such as periapical view (view of both anterior and posterior teeth), the bitewing view (to visualize the crowns of the posterior teeth and the height of the alveolar bone in relation to the), the occlusal view (to reveal the skeletal or pathologic anatomy of either the floor of the mouth or the palate) and a full mouth series (a complete set of intraoral X-rays taken of a patients' teeth and adjacent hard tissues).

2. Types of Intraoral Radiographs

Periapical

Periapical radiography describes intraoral techniques designed to show individual teeth and the tissues around the apices. Each film usually shows two to four teeth and provides detailed information about the teeth and the surrounding alveolar bone. The indications are detection of apical infection/inflammation, assessment of the periodontal status, after trauma to the teeth and associated alveolar bone, assessment of the presence and position of unerupted teeth, assessment of root morphology before extraction, during endodontics, pre-operative assessment and post operative appraisal of apical surgery.

Bitewing

The bitewing radiograph shows the crown of both upper and lower teeth on the same film, is the radiograph of choice for evaluation of dental caries.In order for a bite wing radiograph to be considered diagnostic for the evaluation of dental caries, criteria like proper film exposure and processing techniques must be used, interproximal areas should demonstrate open contacts;a thin radiolucent line should be seen between the contacts of adjacent teeth, the occlusal plane should be positioned horizontally along the midline of the long axis of the film, the premolar bite-wing should demonstrate the distal contact areas of both the maxillary and mandibular canines and the molar bite-wing should be centered over the second molar.

Occlusal

Occlusal radiography is a supplementary radiographic examination designed to provide a more extensive view of the maxilla and mandible. The occlusal radiograph is very useful in determining the buccolingual extension of pathologic conditions, and provides additional information as to the extent and displacement of fractures of the mandible and maxilla. Occlusal films also aid in localizing unerupted teeth, retained roots, foreign bodies, and calculi in the submandibular and sublingual salivary glands and ducts. It should be noted that when imaging soft tissues exposure time needs to be appropriately reduced.

3. Improving Intraoral Radiography

There are so many researches and methods done to reduce the radiation dose, minimize the errors and simultaneously improve the information obtained with radiographs. Computer technology has the potential to significantly impact radiography in dentistry. The introduction of video-based computer-assisted image analysis systems for the evaluation of standardized dental radiographs will help in diagnostic accuracy in the detection of subtle density changes over interpretation of conventional radiographs. Digital subtraction images were interpreted qualitatively on a video monitor or quantitatively by applying programs which measure the density differences stored in digital format. The application of digital image analysis methods offers objective, quantitative and non-invasive ways to obtain additional diagnostic information from standardized radiographs in clinical trials.

The comparative analysis of radiographic images of for the periapical lesions taken at monthly or yearly intervals provides an efficient tool for monitoring the progress of chronic apical periodontitis. Such radiographs can be acquired by conventional radiographic techniques or direct digital dental radiography. However, in both cases, there will be so many technical and judgment errors. The main

problem is the radiographic geometrical distortion, which depends on the reproducibility of the relative position and orientation of the X-ray beam, the tooth, and the receptor. Reversible geometrical distortions are caused by misalignment of the image receptor with respect to the tooth. These distortions can be reduced by using digital image processing methods.

Irreversible geometrical distortions are caused by misalignment of the X-ray source with respect to the tooth. Such distortions cannot be corrected because of the large variation of X-ray source positions with respect to the tooth. Therefore, the application of the parallel technique for radiographic acquisition by using an appropriate intraoral receptor alignment tool is obligatory and provides a high degree of reproducibility. The proper use of cephalometric head stabilization methods, as well as the commercially available alignment instruments, customized by occlusal stent or impression material on the bite block, were used for alignment standardization. However, all these are all these methods are too cumbersome to be used in routine clinical practice or require extensive fabrication and exhibit limited precision.

Therefore, the digital radiograph registration and subtraction can be used as an important tool for the evaluation of the progress of chronic apical periodontitis. Another example is, the interpretation of the set of radiographs taken during the follow-up period after tooth replantation might pose several difficulties, especially the inability to adequately reproduce the projection geometry of the exposures. Based on a study conducted, a method for the geometric standardization of intraoral radiographs using a custom-made apparatus comprising a film-holder attached to an occlusal splint for the long-term follow up of dentoalveolar trauma was done. The method was applied in a patient who suffered an avulsion of the maxillary central incisors and had the teeth replanted after 4 h in saline storage. The method of the geometric standardization of intraoral radiographs provided a consistent reproduction of the geometric exposure parameters, being indicated for use in the radiographic follow up of cases of dentoalveolar trauma.

The standardization of the intraoral radiography is very important to provide accurate diagnosis in dental health and many researches have to be done to further improve the radiographic methods.

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