The Use of Radiographs in Dentistry

Core Subject

Aims:

- To give an overview of the different uses of radiographs in clinical dentistry
- To give an overview on the justification of taking radiographs
- To list the contents required for the practice radiation protection file

Objectives: On completion of this verifiable CPD article the participant will be able to demonstrate, through completion of a questionnaire, the ability to:

- Identify the uses of different types of radiographs in clinical dentistry
- Identify the current UK legislation relating to radiography
- List the contents of a radiation protection file

Introduction

The use of radiographs within clinical dentistry is controlled by the Ionising Radiation Regulations 1999 (IRR99) which are primarily concerned with the radiographic equipment, the workers and the public\(^1\), and the Ionising Radiation (Medical Exposure) Regulations 2000 (IRMER) which are primarily concerned with the protection of the patient\(^2\).

The amount of radiation received from dental radiography is comparatively small when compared with medical radiographs. However, despite this, no dosage of radiation, no matter how small, is without risk. This highlights the importance of ensuring that every radiograph taken is justified.

Various types of radiographic images of the teeth, jaws and skull are used as a diagnostic aid in clinical dentistry. Radiographic examinations can be performed using digital imaging or conventional film. The various images can be divided into two main groups:

1) Intraoral radiographs where the image receptor is placed inside the patient's mouth. This includes:

- Periapical radiographs
- Bitewing radiographs
- Occlusal radiographs
2) Extraoral radiographs where the image receptor is placed outside the patient's mouth. This includes:

- Oblique lateral radiographs
- Lateral Cephalometric skull radiographs
- Panoramic radiographs

1) Intraoral Radiographs

Dental clinicians in the UK can refer to the 2013 FGDP Selection Criteria for Dental Radiography which makes suggestions for the justification of dental radiography.

Periapical Radiography

The main clinical indications for periapical radiography (fig.1) include:

- Detection of apical infection/inflammation
- Assessment of periodontal status
- After trauma to the teeth and alveolar bone
- Assessment of root morphology before extractions
- During endodontics
- Preoperative assessment and postoperative appraisal of apical surgery
- Detailed evaluation of apical cysts and other lesions within the alveolar bone
- Evaluation of implants post operatively.

![Fig1. A periapical xray is used to view the whole tooth, including the root, periodontal ligament width and alveolar bone](image)

Bitewing Radiography

Bitewing radiographs (fig.2) originally take their name from when the patient had to close the teeth together and bite on a wing projecting from the tube side of the film packet. Each bitewing shows the crown of the premolar and molar teeth on one side of the jaw. The main clinical indications for bitewing radiography are as follows:
- Detection of dental caries
- Monitoring progression of dental caries
- Assessment of existing restorations
- Assessment of the periodontal status

Fig 2. A Bitewing radiograph, showing a cavity in the UL5

**Occlusal Radiography**

Occlusal radiography is defined as "those intraoral radiographic techniques taken using a dental x-ray set where the image receptor is placed in the occlusal plane." These X-rays are taken with the X-ray machine either pointing straight down from near the nose (to take pictures of the upper jaw and teeth), or straight up from under the chin (to take pictures of the lower jaw and teeth).

Clinical indications of maxillary occlusal projections (fig 3):

- Periapical assessment of the upper teeth
- Detecting the presence of unerupted canines, supernumeries and odontomes
- Evaluation of cysts or tumours
- Assessment of fractures of the upper teeth and alveolar bone
- Assessment of the condition of the antral floor
- As an aid to determining the position of roots displaced into the antrum during extraction of the upper posterior teeth
Clinical indications of lower occlusal projections (fig.4) :

- Detection of the presence and position of radiopaque calculi in the submandibular salivary ducts
- Assessment unerupted mandibular teeth
- Evaluation of the buccolingual expansion of the body of the mandible by cysts/tumours
- Assessment of fracture displacement
- Assessment of mandible width prior to implant placement

Fig. 4 Taking a lateral mandibular occlusal radiograph

2) Extraoral Radiographs

Oblique Lateral Radiographs

Oblique lateral radiographs are extraoral views of the jaws (Fig. 5).

The main clinical indications for oblique lateral radiographs include:

- Assessment of the presence and position of unerupted teeth
- Detecting fractures of the mandible
- Evaluation of lesions or conditions affecting the jaws including cysts, tumours, giant cell lesions, and osteodystrophies
- As an alternative when intraoral views are unobtainable because of severe gagging or if a patient is unable to open their mouth.
- A specific view of the salivary glands or temporomandibular joint
Lateral Cephalometric Skull Radiographs

Cephalometric radiographs (Fig. 6) have two main clinical indications:

- **Orthodontics** - Used for initial diagnosis, treatment planning and appraisal of orthodontic treatment.
- **Orthognathic surgery** - Preoperative evaluation of skeletal and soft tissue patterns, treatment planning and postoperative follow up of surgery.

Panoramic Radiographs

The main clinical indications for panoramic radiographs are as follows:

- When intraoral radiographs cannot show a bony lesion or unerupted tooth
- In a case of a grossly neglected mouth
- To assess periodontal support (often supplemented with pericapical radiographs)
- For the assessment of wisdom teeth prior to surgical intervention
- As part of an orthodontic assessment if there is clear clinical justification
- Fractures of the mandible
- Antral disease
- Destructive diseases of the articular surfaces of the TMJ
- Verticulalveolar bone height as part of pre-implant planning.

Justification

The international commission on radiological protection cover all aspects of radiological protection. The recommended system of dose limitation is summarised into three basic components. That is that there should be:

- Justification of practice.
- Optimisation of radiation protection.
- Dose limits for individuals at work and for members of the public.

The primary concern is to keep exposures at the lowest practicable level. In English law this is known by the acronym ALARP which is keeping exposures:

As Low As Reasonably Practicable

This requirement is specifically included in the Ionising Radiations Regulations 1999 and employers deemed not to be keeping exposures as low as they reasonably can, could be at risk of prosecution.
Although the exposure to ionising radiation in dental radiography is small compared to medical radiography, any X-ray exposure entails a risk to the patient. Therefore, it is essential that any X-ray examination should show a net benefit to the patient, weighing the total potential diagnostic benefits it produces against the individual detriment that the exposure might cause.

An IRMER practitioner is the person who takes responsibility for an individual's medical exposure. This would be the dentist or DCP that is qualified to take a dental radiograph. “No exposure can take place unless it is justified by the IRMER practitioner.” For an exposure to be justified the benefit to the patient from the diagnostic information should outweigh the detriment of the exposure.

When justifying an exposure the IRMER practitioner should take into account many factors such as:

- “The specific objectives and the characteristics of the individual involved.
- The total potential diagnostic benefit to the patient.
- The individual detriment that the exposure may cause.
- Alternative available techniques.
- The information supplied by the referrer, including information available from previous radiographs.”

Therefore, the efficacy, benefits and risk of available alternative techniques having the same objective but involving no or less exposure to X-rays should be taken into account. The anticipated benefits are that the X-ray examination would add new information to aid the patient’s management. This indicates that dental radiography should not be performed routinely, but should be prescribed according to the individual patient's clinical examination.

Each dental radiograph should be clearly justified in the patient's clinical records and the findings clearly noted.
Every radiation employer should, in respect of any controlled area or, any supervised area, make and set down in writing local rules that are appropriate to the radiation risk and the nature of the operations carried out in that area (this means each surgery that contains x-ray equipment must have its own set of local rules). The radiation employer should ensure that the local rules are brought to the attention of those employees and other persons who may be affected by them and should appoint one or more suitable radiation protection supervisors for the purpose of securing compliance with these rules and the local rules should contain the names of the individuals appointed.

It is important to maintain a radiation file that is comprehensive and contains access to:

- A practice declaration that it complies with the IRR99 Regulations;
- An inventory of all x-ray equipment (including assessment reports/maintenance reports);
- Details of all processing equipment and chemicals;
- Details of risk assessments carried out;
- Local rules for each controlled area;
- Details of how patient safety is maintained;
- Details of quality assurance- This includes evaluation of image quality, processing procedures, handling of chemicals, maintenance of processor equipment, justification and reporting of radiographs;
• X-ray audits carried out. (These should be carried out in a time period not exceeding 12 months. Any part of the quality assurance programme may be audited); and,

• A record of all staff involved in radiography at the practice and details of training each person has taken part in. This does not just refer to the clinician taking the radiograph but also to all staff involved in any aspect of the procedure. This includes the developing and storing of radiographs and related equipment and chemicals used in dental radiography. Every employer should also ensure that employees who are engaged in work with ionising radiation are given appropriate training in the field of radiation protection and receive such information and instruction as is suitable and sufficient for them to know -

✓ the risks to health created by exposure to ionising radiation;

✓ the precautions which should be taken; and

✓ the importance of complying with the medical, technical and administrative requirements of the IRR99 regulations.¹

**Conclusion**

Although the amount of radiation received from dental radiography is comparatively small, no dosage of radiation, no matter how small, is without risk. It is important that the correct type of radiograph is selected and justified so that the information obtained from the radiograph adds new information to aid the patient's management. All staff involved in radiography need to ensure they comply with the Ionising Radiation Regulations 1999 and the Ionising Regulation (Medical Exposure) Regulations 2000 (IRMER).

**Non-Verifiable CPD Tips**

The Ionising Radiation Regulations 1999 and the Ionising Regulation (Medical Exposure) Regulations 2000 (IRMER) can be accessed from the non verifiable CPD section of the website. Please remember to update your non verifiable CPD log with the time you spend reading.
References


4. FGDP UK (2013) Selection criteria for dental radiography 3rd edn. Faculty of General Dental Practice
