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## Dental radiography – importance of selection criteria

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### Scenario

After explaining the treatment plan to a new patient I was requested by her to provide clarity, regarding the various types and numbers of the radiographs that I had suggested. She said that she was very concerned about exposure to X-rays and could I not limit the number of radiographs I needed to make a diagnosis and carry out her treatment? While it is important to discuss the diagnostic requirements with my patients, I feel I may be ethically comprised by making a less than optimal diagnosis of oral health conditions, by limiting the diagnostic investigations I perform.

### Commentary

The respect for patient autonomy is critical to obtaining valid informed consent. Autonomy refers to the right of every individual to make decisions for him/herself and this would entail allowing the patient to make the final decision, regarding his/her treatment options, after having been provided with all the necessary and relevant information. Before subjecting a patient to any investigations, we need to obtain their agreement and consent. This is both an ethical and a legal requirement. The patient should be able to make a choice, based on an understanding of the information given to him/her regarding the diagnosis, and/or investigative procedures and their consequences, enabling a reasoned assessment of the proposed treatment options. Consent must be voluntary and it is essential for the patient to be given all the relevant information related to the procedure or treatment, and in language that is easily understandable.<sup>1</sup>

According to the National Health Act of No 61 of 2003, Chapter 2 Section 6, the following information must be given to the patient (User of Health Care Services):<sup>2</sup>

- Range of diagnostic procedures and treatment options available;
- Benefits, risks, costs and consequences associated with each option;
- The right of the user to refuse care and explain implications, risks and obligations of such refusal and
- Furthermore, this information must be provided in a language the patient understands and in a manner taking into account the patient's literacy level.

Dental practice is firmly rooted in the principle of "*primum non nocere*" – first do no harm, but there is also the imperative to balance benefits and potential harm.

Radiographic examination plays an indispensable role in the clinical management of patients and remains one of the most important diagnostic tools in dentistry. It is used, not only to diagnose and assess dental diseases, but also to evaluate growth and development. However, it is accepted that radiographic examinations involves risk to X-ray exposure and it is essential for any exposure to have a potential net benefit to the patient, against any possible detrimental effects.<sup>3</sup>

The risks, benefits and effectiveness of alternative techniques must be considered and this decision-making process is called 'justification'. It is both an ethical and legal requirement.<sup>3</sup> Dentistry presents unique challenges to the justification process in radiation protection. The patient's history and risk of disease will determine the numbers and types of radiographs which may be required. Radiographs should not be taken routinely, or for screening purposes and should only be taken following a history and clinical examination.<sup>4</sup> Only patient-specific radiographs must be taken and previous radiographs should be used wherever possible. Extensive intra-oral radiographs may be required only if there is clinical evidence of generalised dental disease. Other radiographs such as the panoramic radiograph may only be indicated if there are specific clinical signs and symptoms.

It is not an easy task to weigh the benefits against the risks, but it is important to have radiographic selection criteria in place in any practice using ionising radiation for medical or dental purposes. Radiographic selection criteria are not rules, but are one form of clinical guideline, designed to help in clinical decision-making.<sup>5</sup> "Selection" criteria are descriptions of clinical conditions, derived from the patient's history, as well as signs and symptoms identifying patients who are likely to benefit from a specific radiographic investigation. The Faculty of General Dental Practice (UK) pioneered the development of radiographic selection criteria for dentistry in the UK in 1998, followed by a second edition in 2004.<sup>4</sup> A third edition, expected in 2013, will include new research evidence and developments in X-ray imaging for dentistry, including cone-beam computerised tomography (CBCT)<sup>3</sup> where imaging is accomplished by using a rotating gantry to which an x-ray source and detector are fixed. In this single rotation, CBCT provides precise, essentially immediate and accurate three-dimensional (3D) radiographic images. Only one rotational sequence of the gantry is necessary to acquire enough data for image reconstruction.<sup>6</sup> It has advantages in such clinical situations as the planning of dental implant placement and extraction of impacted mandibular third molars, to prevent damage to the contents of the mandibular canal. In addition, it has also proven useful in determining the causes of failed endodontic treatment. However, there is still not good enough evidence on the use of CBCT for planning and tracking regular orthodontic procedures, nor for detection of dental caries in most instances.<sup>7</sup>

CBCT systems are very expensive and concern has been raised that depending on the number and price charged for each CBCT imaging procedures performed, a rush to achieve a return on investment could well lead to unethical over-prescription of procedures. Such over-prescription could impact, not only on healthcare cost, but also on the radiation exposure load to the patient.<sup>6</sup> Furthermore, a high level of competency is required to evaluate images in order to maximise the diagnostic yield potential, relative to

the exposure given. Specialist referral might be necessary, adding to the costs. Patients would need to be informed of any added costs.

Dentists must also guard against quoting figures on how much less exposure to radiation patients can expect with digital radiography, especially for those who are particularly concerned about radiation exposure. Current literature reports reductions of 0-50 percent per digital radiograph, when compared with the radiation dose from F-speed film.<sup>8</sup> There are other ways of significantly limiting exposure including techniques, film speed and by using rectangular collimation, rather than circular collimation.<sup>9</sup> Practitioners must balance the diagnostic needs and evidence-based science with the desires of the patient, must use tested selection criteria and should maximise the efficiency of radiography.

In South Africa, a Code of Conduct is issued by the Department of Health<sup>10</sup> (Appendix 1) but Herbst and Fick (2012)<sup>11</sup> have recommended that the use of medical X-ray equipment be restricted by regulation, (not licensing conditions), to professionals registered with the HPCSA and appropriately trained in those aspects of imaging or therapy and safety relevant to their clinical role, so as to limit overexposures caused by human error. They anticipate that such regulations will bring South Africa in line with other countries,<sup>12-15</sup> acknowledging the importance of human competency in radiation protection and where each user of a machine must be certified to operate and utilise the unit.

### **Concluding Remarks**

The "best interest" of patients means that professional decisions of proposed investigations and any reasonable alternatives proposed by the dentist, must consider patients' values and personal preferences. This must be done in a manner allowing the patient to become involved. It requires careful communication with patients and listening is of paramount importance. In some instances, patient desires conflict with professional recommendations. Patients must be informed of alternative treatments, advantages and disadvantages of each, costs of each, expected outcomes and possible complications. Together, the risks, benefits and burdens can be balanced. It is only after such consideration that the "best interests" of patients can be assured. Clinical and non-clinical factors influence the use of radiography in dental practice. Evidence-based radiographic selection criteria can assist in reinforcing good practice, but requires a multi-pronged implementation strategy incorporating a clinical audit, easy availability to users and education.<sup>3</sup>

## References

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**Appendix 1: Extract from Code of practice for users of medical x-ray equipment. Directorate Radiation Control (DOH, 2010).<sup>7</sup>**

**4. Responsibilities of licence holders / responsible persons**

**4.1 The licence holder of a diagnostic x-ray facility is ultimately responsible for:**

- (a) The entire scope of radiation safety, for the equipment and premises for which he/she holds a licence;
- (b) Fulfilment of all related statutory requirements, and
- (c) Compliance to conditions specified in the licence.

**4.2 The licence holder / responsible person must ensure that:**

- The equipment and the facilities, in which such equipment is installed and used, meet all applicable radiation safety standards;
- The equipment is maintained and functions properly;
- The equipment is used and maintained only by competent and appropriately trained persons / personnel;
- Applicable Quality Control (QC) tests are performed at the prescribed frequencies as stipulated in "Diagnost QC" document on DOH website;
- The required QC equipment is provided;
- Ensure that radiation surveys to monitor safe performance of equipment and to monitor radiation levels in work areas are undertaken;
- Radiation workers (occupationally exposed persons) are identified and issued with personal radiation monitoring devices (PRMD's);
- The appropriate protective clothing, devices and equipment is provided to personnel and properly used;
- Radiation safety rules are communicated to and followed by all personnel;
- Operational procedures are established and maintained to ensure that the radiation exposure to workers, patients and public is kept as low as reasonable achievable (ALARA) without compromising the diagnostic efficiency of the result, and
- Workers are educated in the hazards and risks of ionising radiation.

**Keeping of patient records**

**4.3 Records must be kept and available for inspection purposes by DOH.**

**4.4 A record / register must be kept of all patients undergoing x-ray examinations. The record / register must be preserved for 5 years and contain the following information:**

- surname, name, date of birth or ID number / age and gender;
- date of examination;
- brief clinical indication of the examination;
- type of examination;
- number of exposures (repeat exposures included) and
- fluoroscopy time, dose results (if available) and the name of the person performing the fluoroscopy procedure
- total dose read-out or Dose Area Product (DAP) reading (if applicable)
- brief statement of the diagnostic information obtained from the examination.