

Inter-university programme on the use of cone beam CT for dentomaxillofacial diagnostics. Day 1

Thursday, June 1, 2017

09:30 Justification of CBCT Imaging. Reinhilde Jacobs (KU Leuven)

In 2009 the European Academy of Dental and Maxillofacial Radiology (EADMFR) published guidelines for the use of cone beam CT in dentistry [Basic principles for use of dental cone beam computed tomography: consensus guidelines of the European Academy of Dental and Maxillofacial radiology - Horner et al, DMFR 2009].

These guidelines imply the following:

- there should be a clear understanding of the justification of CBCT use
- users of CBCT should be trained to use CBCT correctly (cfr. field of view, radiation dose, reporting,...)

There are 2 categories of users:

- 1) Those who use the CBCT images and should be able to interpret them correctly
 - they should follow extra courses on radiation physics, radiation dose and risks, radiation protection and CBCT equipment specifications
- 2) Those who take the CBCT images and provide the referrers of a written report
 - they should follow all of the above and practical sessions (CBCT equipment, imaging techniques, quality assurance, care of patients) and radiological interpretation (incl. radio-anatomy and radio-pathology and interpretation of artifacts)

During this lecture, which is the introduction of this 2 day course, the above will be illustrated with some brief examples.

10:15 CBCT Utopia? Creating and using the perfect CBCT device. Ruben Pauwels (KU Leuven)

CBCT has been widely accepted as an imaging modality for different dental applications. The possibilities of CBCT are evident, providing high-resolution three-dimensional images at a relatively low radiation dose. However, the use of CBCT is still suboptimal in many ways, and the principles of dose limitation and justification are often not adhered.

This lecture provides different optimization strategies for Cone Beam Computed Tomography in dental practice. An overview is given of the different aspects of suboptimal CBCT use due to limitations of the device or inappropriate use by the operator. All factors affecting patient dose and image quality are discussed, leading to a theoretical reflection on the ideal CBCT device and its appropriate use.

11:00 Coffee break

11:30 Fundamental aspects of radiation protection: from X-rays to risk assessment. Klaus Bacher (UGent)

An overview of basic physical aspects of the use of X-rays for dentomaxillofacial Cone Beam CT will be given. The latter comprises the characteristics of X-rays and their interactions with shielding material and tissues. An overview of dose-related quantities, such as absorbed dose, equivalent dose and effective dose will be presented. Special attention will be paid on the influence of the new ICRP recommendations on the quantity effective dose. The biologic effects of ionising radiation will be discussed with special focus on low-dose X-ray exposure. An introduction to risk-assessment methodologies will be given, taking into account the

magnitude and location of the delivered dose and the age-at-exposure. A link between effective dose and radiation-induced cancer risk will be presented.

13:00 Lunch break

14:15 Practical radiation protection aspects of dentomaxillofacial Cone Beam CT. Tom Clarijs (SCK-CEN, Mol)

The lecture will deal with the most recent guidelines from a national and international point of view in relation with the regulation of ionising radiation. An overview of patient doses in dentomaxillofacial imaging techniques will be given. The latter doses will be compared with typical patient doses of other diagnostic X-ray modalities (conventional dental and panoramic X-ray, conventional radiography, CT,...). Furthermore, emphasis will be made on dose optimisation and quality assurance of the CBCT system. Practical issues regarding the installation, authorisation and use of CBCT will be discussed.

15:00 Role of cone-beam CT in head and neck radiology. Robert Hermans (KU Leuven)

Cone-beam CT (CBCT) is being used in various clinical domains to provide diagnostic information or imaging guidance. Its utility has been well illustrated for dental and maxillofacial indications. More recently, this technique has also been introduced for evaluation of head structures, where a high contrast between different structures is present. CBCT can be used as an alternative to low-dose Multi Detector Computer Tomography (MDCT) of the nose and paranasal sinuses. Initial experience also suggests that CBCT could be used as an alternative to MDCT in the investigation of certain temporal bone pathology.

CBCT does not provide sufficient contrast resolution in the soft tissue structures. Therefore, care must be taken not to use CBCT in situations where evaluation of these soft tissue structures is critical to determine patient management, such as complicated sinusitis or neoplastic diseases. Therefore, a good understanding of the possibilities and limitations of CBCT versus MDCT and MRI in the evaluation of head and neck pathology is needed.

15:45 Coffee break

16:15 The sedentexCT files. Reinhilde Jacobs (KU Leuven)

During the last decade, there has been an upward trend in using 3D information as an aid in dentomaxillofacial diagnostics and surgical planning. Initially, this was realized by conventional computed tomography, associated with relatively high radiation dose levels and costs. Nowadays, dental cone beam computed tomography enables volumetric jaw bone imaging at reasonable costs and doses. This offers numerous diagnostic potentials and may change treatment strategies in oral health care, but not without proper optimisation and economic considerations. These topics have been discussed and investigated thoroughly by the sedentexCT FP7 Euratom project, coordinated by Manchester University. The outcome of this project and its guidelines will inspire the European Commission and subsequent national governing bodies.

17:15 Discussion with the audience on the use of 2D and 3D imaging in dental practice

17:45 Closure

Inter-university programme on the use of cone beam CT for dentomaxillofacial diagnostics. Day 2

Friday, June 2, 2017

09:00 Specific radiodiagnostics in orthodontics. Bart Vande Vannet (VU Brussel)

Cone beam computer tomography is a widely used diagnostic tool in maxillofacial surgery and orthodontics. The Belgian law of August 31, 2011 allows as of March 1, 2011 the reimbursement of 3D images in case of lip, jaw and palate cleft. CBCT gives important information for orthodontic treatment and planning. It allows good insights of abnormalities of the teeth and skull. Cephalometric analysis is an important tool for the planning of orthodontic treatments. 3D imaging offers many advantages for the diagnostic, planning and evaluation of all treatments in dental sciences. Indications of CBCT imaging for orthodontic diagnosis and treatment will be presented.

10:30 Coffee break

11:00 Radiodiagnostics in periodontology and implant treatment. R. Jacobs (KU Leuven)

Imaging is the most important diagnostic tool in periodontology and implant dentistry. More than half of all CBCT applications can be related to presurgical imaging particularly for implant placement. Many studies have demonstrated acceptable accuracies for linear and anatomical model measures, yet also indicated the excellent visualization capacities of the host bone bed, the neighboring neurovascular and other vital anatomic structures. This lecture will focus on clinical applications and limitations of CBCT for imaging of periodontal, edentulous and peri-implant bone.

12:30 Lunch break

13:45 CBCT applications in maxillofacial surgery. Raphael Olszewski (UC Louvain)

This lecture will focus on the recognition of the "abnormal or aberrant" anatomy and pathology which should be recognized when viewing CBCT images. We will start with the 2D images of the mandible, the temporomandibular joint, the hyoid bone, the cervical spine (levels C1 to C4), the maxillary sinuses, the orbitae, the sphenoidal and ethmoidal sinuses.

14:30 Radio-anatomy of the jaw bone in 2 and 3 dimensions. R. Jacobs (KU Leuven)

This lecture will focus on the recognition of the "normal" anatomy which should be recognized when viewing CBCT images. First of all we will start with the 2D images of the mandible, the temporomandibular joint, the hyoid bone, the cervical spine (levels C1 to C4), the maxillary sinuses, the orbitae, the sphenoidal and ethmoidal sinuses. This will be done in an interactive fashion, in order to have the attendant's attention at all times.

Secondly, the same anatomical regions will be assessed in a 3D image and again the same interactive way of lecturing will be used.

The aim of this part of the course is to rehearse the attendant's knowledge of the skull's anatomy in order to differentiate the normal from the pathological or aberrant features.

15:15 Coffee break

15:35 Specific radiodiagnostics in endodontics and pediatric dentistry. R. Jacobs

In endodontics, the question often occurs if a tooth has a root fracture or if there is a perforation of a broken endodontic instrument or if there is ankylosis, how extensive is the apical lesion one sees on a peri-apical radiograph and so on. Some of these can sometimes be seen on peri-apical radiographs and sometimes not, because the perforation or external resorption of the root is on the buccal or lingual surface of the root. In those cases, CBCT may offer benefit for the practitioner and the patient. The choice for the best FOV, kV, mA and resolution will be addressed. The interpretation of streaking artifacts, caused by metal and gutta-percha will be discussed in detail. The advantages and disadvantages of CBCT in those cases are also part of the discussion.

In pediatric dentistry, besides the FOV, the issue of radiation dose reduction is of paramount importance. CBCT in children should only be used when no other possibility is going to provide satisfying information for the diagnosis and treatment. The latter is important for all patients, but especially in this significant radiation sensitive population. The applications for CBCT could be root resorption of the lateral incisors by an impacted canine, dento-alveolar trauma with or without root fracture, ankylosis, mesiodens, etc

16:35 Open panel discussion on CBCT - all lecturers in interaction with audience

17:00 Closure