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European
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Dental
Implantologists

Guidelines

Three-dimensional Imaging in Dental Implantology

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Participants

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Protocol

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1. Introduction

Three dimensional imaging is applied in dental implantology for more than 20 years. Today dental digital volume tomography (DVT) (also described as cone beam computer tomography (CBCT), cone beam volumetric imaging (CBVI), cone beam volume tomography (CBVT) or cone beam imaging (CBI)) provides three dimensional x-ray imaging at higher resolution and lower radiation dose. Facing a wide variety of different machines available today the scientific community discusses the meaningful application of DVT in the different disciplines of dental medicine.

This consensus paper is based on current scientific publications of different grades of evidence concerning the application of three dimensional imaging in dental Implantology.

2. Definitions

Effective Dose: The effective dose measures the radiation exposure to the humans based on the different biological impact of the different ray qualities (e.g. alpha, beta, gamma x-rays) as well as the sensitivity to x-rays of the different tissues. For example, the human skin is much less sensitive to radiation than different internal organs (as per ICRP standard)

3. Indications

a. Pre-implantological Diagnosis

Prior to implantation a sufficient radiological investigation of the planned implant site is required. This should visualize the available bone as well as the surrounding anatomi-



cal structures and augmented areas. Two dimensional radiographs can be sufficient for pre-implantological diagnosis.

For example, in cases with little remaining bone that requires an augmentation or an implantation close to sensible anatomical structures (like nerves and sinus cavity), additional radiological examinations with measurements aids are required. This can be achieved by recording a second layer (e.g. transversal slices) or by three-dimensional imaging [1]. CBCT should be used when the question for which imaging is required cannot be answered adequately by lower dose conventional (traditional) radiography.

DVT renders the present bone without any superimposition and allows measuring of the available bone in sub-millimetre accuracy [2]. Given a sufficient volume size, DVT can meet all necessary radiological requirements prior to dental implantation [3]. For the 3D-diagnosis the procedure with the lowest effective dose necessary to evaluate the indication is to be preferred.

b. Computer-aided implant planning

Three dimensional image data can be applied for computer-aided implant planning. The procedure assists to consider the prosthetic planning as well as the given patients anatomy when determining the optimal implant position and surgical procedure.

c. Computer-aided static and dynamic navigation

Computer-aided implant plans can be applied clinically to the patient by drill guides or navigation systems. The accuracy assessment of the procedure in use is mandatory.

d. Postoperative evaluation of implants

Three-dimensional imaging permits to determine the exact position of a placed implant relative to the surrounding anatomy and other implants. However, the high absorption of x-rays by titanium and ceramic implants causes imaging artefacts in the close proximity of the implants hampering the evaluation of osseointegration. 3D-imaging is required in case of supposed nerve injury. It may be necessary to exclude lesions of important anatomical structures.

e. Other indications

Most fields in dental medicine can benefit from three-dimensional imaging. An overview of indications can be found in table 1.



Possible Indications for three-dimensional Imaging
Dentoalveolar pathologies
cysts, periodontal and apical lesions
Form and position abnormalities of teeth and their relation to adjacent structures (dental roots, sinus, nerves)
Odontogenic tumors and bone pathologies and abnormalities in structure in particular
ostitis, osteomyelitis and osteoporosis
Pathologies of the maxillary sinus
Saliva stones
TMJ pathologies
Facial and dental trauma
Diagnosis and treatment planning of complex syndromes and abnormalities

Table 1: Indications for three-dimensional imaging in dental medicine [6].

References

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