

Technical Report

Digital Cone-Beam Computed Tomography in Implant Dentistry

Morita's three-dimensional imaging systems help dentists plan and carry out implant procedures

Imaging systems play a very important role in progressive dentistry. They provide invaluable information for making accurate diagnoses, and this ensures successful treatments. In the past years, it has become evident that Digital Cone-Beam Computed Tomography (CBCT) offers new diagnostic possibilities in dental procedures. Although it can be used in numerous dental specialties, it has proven its relevance in dental implant therapy. The report would like to discuss the concrete benefits offered by this three-dimensional imaging method to implant dentists and, in particular, the advantages of Morita's CBCT system solutions.

Before an implant is inserted, it must be determined whether this is actually possible, i.e. the following question needs to be asked: Is there sufficient bone structure and bone quality to ensure that the implant can be anchored securely? In order to be able to answer this question, imaging methods have been used for some time now because they provide three-dimensional representations of the implant site. This was made possible by computer tomography; however, patients had to be referred to radiologists. In the meantime, implant dentists can use CBCT as an option for 3D imaging in their own offices. In fact, it involves an even lower effective radiation dose for patients than computer tomography.

For what tasks can CBCT devices be used in implant dentistry and what advantages do they have? One decisive point already was mentioned: the assessment of the bone material within the scope of pre-implantation diagnostics. In the two-dimensional images provided by conventional panorama X-ray scans, the alveolar ridge may appear to be sufficient for an implant although this might

actually not be the case due to insufficient width. A CBCT scan provides the needed certainty: it helps assess the height of the alveolar ridge and provides information about its width and, accordingly, whether horizontal augmentation is necessary. Such devices as 3D Accutomo 170 made by Morita have proven their worth based on high resolution (voxel sizes up to 80 μm), low radiation dose and short exposure times, which minimizes movement artifacts. In addition, the capacity of this CBCT device allows dentists to determine the quantity and quality of the bone that is available as well as the bone density. If the latter is insufficient, the stability of the implant cannot be ensured; therefore, being able to evaluate this risk factor prior to implantation is a significant benefit.

Morita supports risk prevention not only with hardware but also with software. So, for example, dentists can generate so-called volume renderings with the image processing software. For this purpose, a 3D image comprising both the bone structure and dental arch is generated. It is scanned in real time and can be sliced and enlarged. This illustrates another special feature of three-dimensional imaging: for example, such important structures as the mandibular canal can be depicted particularly well. This is a substantial advantage with regard to implant planning. Finally, inserting an implant without knowing the exact course of the mandibular canal may damage or, in the worst case, divide the mandibular canal, which would render nerve reconstruction necessary. In order to avoid such scenarios as much as possible from the start, it is advisable to make use of computer-assisted treatment planning using CBCT system solutions. Thus, for example, the course of the mandibular canal can be marked in the CBCT scan with the drawing function of the i-Dixel software; then its position with respect to the implant site as well as its buccal and lingual position can be represented.

Furthermore, CBCT supports implant dentists by providing the basic information necessary for creating a drilling guide. With Morita's system solutions data can be exported in the DICOM format and processed with other software. In this way, a dental practice can be linked directly to a dental laboratory where an appropriate drilling guide can be made based on the digital data.

The advantages of three-dimensional imaging are not limited only to the planning phase, practices and patients will benefit from this technology also after the implant

has been inserted. Thanks to the high resolution and image quality, CBCT can provide valuable information and help identify reasons for complications. As during the planning process, the accurate representation of sensitive anatomical structures is a decisive advantage. For example, implant dentists can determine whether an implant is too close to a nerve canal and whether, accordingly, surrounding tissue is affected by the ensuing compression.

Summary for dental practices

Cone-beam computed tomography provides numerous advantages for general dentistry and, in particular, for implant therapy. A decisive feature is the detailed and accurate three-dimensional depiction of oral structures with a device that is located directly in the dental office and also ensures low patient dosage. Diagnostics, planning, making drilling guides and treating post-implant complications all benefit from this technology. Precisely matched system solutions, such as those offered by the imaging specialist Morita, are an attractive option. They provide high capacity hardware as well as matching software and thereby allow dental offices to benefit from three-dimensional imaging with CBCT.