X-RAY MICROCOMPUTED TOMOGRAPHY

X4 POSEIDON – Human molar tooth

Innovation with Integrity

MicroCT is one of the most advanced methods for gaining 3D insights into samples of any material and shape non-destructively, with little to no preparation.

MicroCT enables precise visualization of enamel, dentin, and cementum, allowing assessment of structural integrity, mineral density, and pathological changes. This is particularly relevant in caries detection, where early-stage demineralization can be observed with exceptional clarity. Additionally, microCT facilitates the study of enamel erosion and wear, contributing to preventive and restorative dentistry. Molar Incisor Hypomineralization (MIH) can be effectively studied using microCT by the measurement of mineral density defects and their distribution.

In endodontics, microCT is instrumental in evaluating the internal morphology of root canals. This includes analyzing canal complexity, measuring obturation quality, and identifying voids in fillings. Such insights are critical for refining endodontic techniques and improving long-term treatment outcomes.

MicroCT plays a significant role in orthodontic applications, offering detailed insights into tooth movement and root resorption during treatment. It facilitates the evaluation of micro-leakage at the interface between bone and the root, ensuring a better understanding of treatment outcomes.

Scan parameters

- Detector: 7 MP flat panel
- Voxel size: 12 µm
- Source: Transmission-type
- Source settings: 90 keV, 9 W
- Filter: 1mm Al + 0.1 mm Cu
- Rotation step: 0.4° over 360°
- Scan time: 14 minutes

Cover Image: Human extracted tooth imaged at 12 µm voxel size

MicroCT enables dynamic monitoring of bone quality over time, utilizing 3D registration, enhancing the ability to track changes and adapt treatment strategies effectively.

Additionally, automated segmentation algorithms have streamlined data processing, reduced time and improved accuracy.

The X4 POSEIDON microCT system, equipped with a flat panel detector, enables fast scans of extracted human teeth in under 15 minutes. Enamel, dentin, and root canal are clearly resolved, as shown in Figures 2 and 3. This system allows for quantitative assessment of the structure and properties of dentin, particularly in relation to its permeability and mineral content, while also providing a detailed analysis of enamel's structure to assess caries, fluoride treatments, and remineralization. For cementum, microCT evaluates its integrity, thickness, and bonding interface with dentin, which is crucial for root canal treatments and restorations. Micro-defects and changes inside root canals can also be quantified through 3D analysis of root canal morphology.

The Bruker 3DxSUITE software package includes all the necessary tools for image processing and analysis, allowing the creation of 3D models through volume and surface rendering algorithms (Figure 2).

Figure 2: 3D volume rendering of an extracted human tooth, enabling the segmentation of enamel, dentin, and the root canal (left), and 3D volume rendering of the root canal (right), with a 12 µm isotropic voxel size

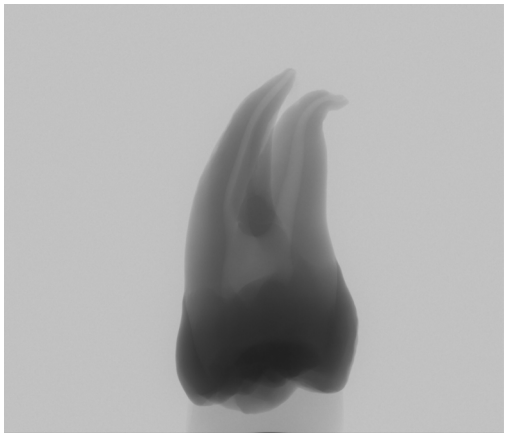

Figure 1: Projection image of an extracted human tooth, single field of view with 12 µm isotropic voxel size

Figure 3: Cross-sectional image of an extracted human tooth with a 12 µm isotropic voxel size

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