

Assessment of spatial resolution in dental CBCT using the circular edge method: Impact of zoom reconstruction

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Aims: Dental CBCT is widely utilized in dentistry, where high spatial resolution is essential for evaluating anatomical structures. Although zoom reconstruction is used to improve spatial resolution, its impact has not been fully quantified. This study evaluates dental CBCT spatial resolution using the circular edge method and examines the effect of zoom reconstruction.

Materials & Methods: A dental CBCT system (3D Accuitomo F17, J. Morita) was operated in standard mode, with tube voltage of 90 kV, current of 1 mA, and reconstruction filter G001. A contrast phantom (X001-99530-404, J. Morita. Co.) was used to assess spatial resolution using the circular edge method [1]. $MTF_{reference}$ was obtained from images acquired at the center of a 40 mm field of view (FOV) (voxel size: 0.08 mm). For MTF_{large} , images were acquired at the center and the off-center (at 30 mm from the center) in a 100 × 50 mm FOV (voxel size: 0.125 mm). Zoom reconstruction was applied to the large FOV images to generate a 40 mm FOV (voxel size: 0.08 mm) to obtain MTF_{zoom} . All images were analyzed using iQMetrix-CT software (v1.2, SFPM), and MTFs were calculated [2].

Results: At the center, MTF_{large} decreased by approximately 20% at 2.0 cycles compared to $MTF_{reference}$. After zoom reconstruction, MTF_{zoom} was comparable to $MTF_{reference}$ (Fig. 1 (a)). At the off-center, MTF_{large} decreased by approximately 70%, and MTF_{zoom} improved to approximately 50% of $MTF_{reference}$ (Fig. 1 (b)).

Conclusion: Dental CBCT spatial resolution was quantitatively evaluated using the circular edge method. Zoom reconstruction restored spatial resolution at the center but only partially recovered resolution at the periphery.

References:

[1] Richard S, et al. Med Phys 2012.

[2] Greffier J, et al. Diagn Interv Imaging 2022.

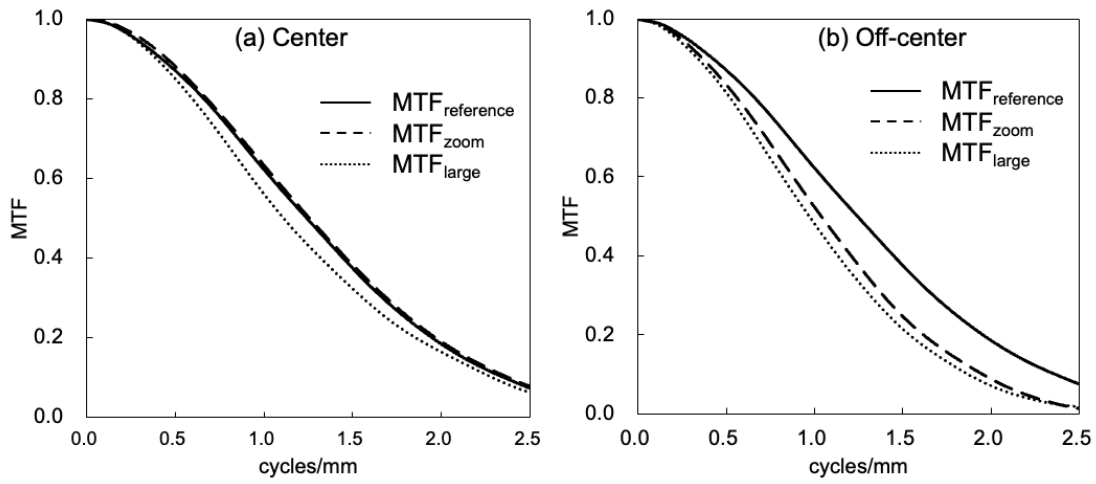


Fig. 1. MTF at different positions within the FOV. (a) center of the FOV; (b) off-center of the FOV