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P1.15: Triple-energy virtual monochromatic imaging with a photon-counting detector for reducing metal artifacts in half-beam dental CT

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Dental computed tomography (CT) has become an indispensable tool in dental practice for accurate diagnosis and precise treatment planning. However, metal artifacts induced by dental restorations or implants present considerable challenges in obtaining high-quality diagnostic images. Such artifacts can lead to misdiagnosis or suboptimal treatment planning. To address this issue, researchers have developed various techniques aimed at improving image quality and mitigating metal artifacts in dental and endodontic CT. One of these techniques is the triple-energy virtual monochromatic imaging (TEVM) method, which employs a photon-counting detector (PCD) to minimize noise and generate accurate virtual monochromatic images (VMIs). This technique synthesizes three images captured at distinct energy levels to produce a VMI with enhanced contrast and sharpness, particularly in regions affected by metal artifacts. In this study, we assessed the efficacy of the TEVM in mitigating metal artifacts in both half-beam dental CT and endodontic CT (Fig. 1). We conducted a comprehensive evaluation of the technique using dental phantoms containing various types and quantities of metal, comparing its performance to conventional metal artifact reduction approaches. Our findings demonstrated that the proposed TEVM was successful in reducing metal artifacts and enhancing image quality, compared to the conventional method. Utilizing TEVM in conjunction with PCD has the potential to significantly improve the quality and dependability of clinical imaging in patients with metallic restorations or implants. This can equip clinicians with more accurate and detailed information for diagnosis and treatment planning, ultimately leading to improved patient outcomes. Furthermore, the proposed technique can contribute to a reduction in radiation exposure for patients by minimizing the necessity for repeated scans to obtain accurate images (Figs. 2 and 3). In conclusion, TEVM combined with PCD represents a promising solution for mitigating metal artifacts in dental and endodontic CT, thus enhancing patient care and promoting optimal treatment outcomes.

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