Developing an Intraoral Digital Tomosynthesis System

Using CNT X-ray Technology: Preliminary Images

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Background

- Tomosynthesis reduces tissue superimposition and improves tissue contrast as 3D information is acquired from 2D radiographs (Fig 1)
- Research on intraoral dental tomosynthesis has shown promising results for the visualization of caries, alveolar defects, root fractures and dental anatomy1-4

Objectives

- Demonstrate the feasibility of dental imaging with a digital CNT based tomosynthesis system
- Produce initial high-quality images of teeth, caries lesions, and intraoral dental phantoms

Materials and Methods

- A digital tomosynthesis unit employing a CNT x-ray multi-source array was adapted for intraoral dental imaging
- Conventional size 2 intraoral digital sensors were used for image acquisition
- An anthropomorphic dental phantom with simulated defects plus extracted teeth with caries lesions were imaged
- Total image dose was equal to a single D speed film bitewing exposure
- Basis projections were reconstructed into DICOM stacks scrollable in the bucco-lingual direction

Preliminary Results

- Reconstructed images of the phantom demonstrate increased visualization of dental anatomy, simulated lesions, and tooth fractures compared to standard 2D images (Fig 3)
- Reconstructed images of the extracted teeth demonstrate subjectively better lesion contrast and definition compared to standard 2D images (Fig 4)

Potential Benefits

- Improved detection of dental pathology such as caries, root fractures, and alveolar defects
- Fewer image angulation errors compared to standard intraoral imaging
- High-detail 3D information of dental and alveolar anatomy with patient dose equal to a standard intraoral bitewing
- Less metal streak artifact compared to CBCT
- A quick, easy, and clinically practical imaging unit

Future Directions

- Develop a low dose 3D system optimized for dental use
- Evaluate efficacy with robust observer and clinical studies
- The authors disclose that this dental imaging technology is patent pending

References