New imaging technique for faster and more accurate detection of cavities

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Q Your work has generated a significant technological advance in detecting cavities. Please tell us about this new technology.

A: The method we employ is called swept-source optical coherence tomography (SS-OCT), which uses high-speed frequency swept-laser light from a near-infrared laser. The light is projected at the occlusal surface of the tooth and scanned across its proximal surface. Two-dimensional images from below the tooth surface are generated by detecting the back-scattered laser beam signal, which is digitized over a time scale.

Q What methods are currently used to detect cavities, and how is the new method superior?

A: These days, oral health professionals typically use radiographs to detect cavities that are not visible to the naked eye. However, cavitated enamel lesions and dentin caries that comprise cavities can be difficult to detect on radiographic images, especially at the early stages. Our study has shown that images generated using SS-OCT are better than radiographic images for detecting cavities

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in several ways. First, cavities were detected at an earlier stage with SS-OCT than with radiographs. Also, SS-OCT detected cavities in areas that may be difficult to reach using radiographs. Finally, SS-OCT appears to provide more reliable and accurate images than bite-wing radiographs. In addition to these differences, SS-OCT images can be collected in real-time, enabling on-site diagnosis in a dental clinic.

Q How will the new method help patients with cavities?

A: Earlier detection of cavities using SS-OCT would allow the cavity to be treated when it is smaller, rather than detecting it later when the cavity could be larger and require more extensive and invasive treatment. This could reduce the pain experienced by the patient, which is associated with more complex dental

procedures. Moreover, SS-OCT imaging does not require any radiation, so it can be used safely for dental diagnosis on patients such as pregnant woman and young children.

Q Tell us about any further improvements to the SS-OCT technique.

A: We already saw an improvement in cavity detection using two-dimensional imaging. Obtaining three-dimensional images in real time will further improve detection of early-stage cavities and cavities in areas that may be difficult to reach using X-rays. Our goal is to improve technology that can be used in dental offices, and this research is important in improving overall oral care.

Occlusal view (left) and SS-OCT image (right) of lower first and second molars

The SS-OCT image was obtained by scanning along the dotted yellow line shown in the left-hand image. SS-OCT reveals slight demineralization at the first molar (red arrow) and enamel caries at the second molar (blue arrow).