Automated Noninvasive Periodontal Depth Measurement Using Photoacoustic Imaging

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Technology description

Researchers from UC San Diego havedemonstrated for the first time that probing depths could be measured with photoacoustic imaging, suggesting that photoacoustic imaging could become a complementary tool for the dental community to image pockets and measure probe depth noninvasively. Their technology employs photoacoustic imaging in tandem with a food-grade oral rinse containing a contrast agent (strong optical absorber) that increases the amount of photoacoustic signal in the pocket depth. The measurements achieved with this technology have been shown to be more precise, offered higher resolution images, and covered all areas of the tooth, as compared to the standard periodontal approach that uses a Williams probe.

Many people are familiar with the pocket depth measurements that occur in the dentist’ s office. The dental technician pokes her periodontal probe into a patient’ s gum line to measure how deep the probe will go. This is repeated tooth by tooth until the entire mouth is covered. Although inexpensive,probing depth measurements are error prone and suffer from poor reproducibility, largely due to variation in probing force. Indeed, a recent meta-analysis showed that a range of a variation of 20-fold. Other error sources include variation in the insertion point, probe angulation, the patient’ s overall gingival health, and the presence of calculus. Thus, the examination is subject to large errors with inter-operator variation as high as 40%. These error sources can result in poor patient treatment and, hence, poor patient outcomes. This variation also compromises epidemiologic studies and makes it difficult to compare outcomes among dentists or among populations. Given these limitations, new tools are urgently needed to improve this procedure.

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Application area

Use photoacoustic imaging for probing depth measurements with potential implications to the dental field, including tools for automated dental examinations or noninvasive examinations.

Advantages

This novel imaging approach can measure the probing depths at all points along the tooth. This can markedly minimize sampling error, and it might be able to detect isolated deeper pockets that may be indicative of vertical root fractures. This imaging approach also eliminates variation in the probe insertion point and angle and could eliminate the error results from the presence of calculus.

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