In Vitro Detection of Proximal Caries with High Resolution Ultrasound (Us) in Comparison to Bitewing Radiography in Deciduous Teeth

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Abstract:

Objective: To evaluate the performance of high resolution Ultrasound imaging in detecting proximal caries in primary posterior teeth, compared to bitewing (BW) radiography.

Methods: A total of 64 deciduous molar teeth with proximal dentin caries (32 primary caries and 32 secondary caries under restorations) and 64 primary molar teeth without caries were used. All teeth were randomly placed in the alveolar sockets in groups of 8 ensuring an equal number of maxillary and mandibular deciduous teeth. Digital intraoral bitewing radiographs were exposed by using an X-ray unit with a size 2 photostimulable phosphor plate (PSP) detector. US examinations were performed by using an ACUSON S 2000 (Siemens, Munich, Germany) high-resolution ultrasonography. A total of 2 image sets were obtained as follows: 1) PSP bitewing radiography, and 2) HD US images. A specific calibration session by using 5 images was conducted prior to image reading. Image sets were viewed separately by 2 blinded and calibrated observers by using 5-point rating scale. Histological gold standard status of teeth was performed under a stereomicroscope. Intraclass correlation coefficients were calculated to assess the intra- and inter-observer agreement. The areas under the ROC curves (AUC - Area Under Curve - values) were calculated and the tests for the equality of AUCs for each image type and caries type were compared using chi-square tests. Significance level was set at $\alpha = 0.05$.

Results: Higher intra-and inter-observer coefficients were found for primary caries compared to secondary caries and bitewing radiography when compared to Ultrasound images. In general, excellent ICC values were calculated for all diagnostic image type and caries type assessments. Highest AUC values were found for bitewing radiography images for primary caries detection and lowest for Ultrasound images for secondary caries detection. Dual Diagnostic Performance Comparison between Ultrasound and bitewing radiography showed no statistically significant difference (P=0,329). Again, no statistically significant difference was found for diagnostic performance between primary and secondary caries detection (P=0,545).

Conclusion: High resolution ultrasound imaging has the potential to be utilized in the detection of proximal dental caries in deciduous teeth.