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Quantitative digital subtraction radiography for the determination of small changes in bone thickness: An in vitro study

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Résumé / Abstract

Objective. The objective of this study was to determine the ability of quantitative digital subtraction radiography to detect small changes in bone thickness adjacent to tooth roots. **Study design.** A series of cortical or cancellous bone slices with a 50 µm-stepwise increasing thickness were attached to 4 porcine mandible sections covering buccal and interproximal defect regions. Standardized radiographs were quantitatively evaluated for radiographic density changes with the use of digital subtraction radiography. Furthermore, all radiographs were conventionally evaluated by 10 clinicians. The Wilcoxon signed-rank test and the Mann-Whitney U test were used for statistical analysis ($\alpha = 0.05$). **Results.** A high linear correlation was found between the actual thickness of bone slices and radiographic density changes (cortical bone: $r^2 = 0.89$ to 0.99 ; cancellous bone $r^2 = 0.61$ to 0.86 , $p \leq 0.001$). A certain increase in bone thickness caused a 3 times higher increase in radiographic density for cortical bone than for cancellous bone ($p < 0.05$). The detection limits of digital subtraction radiography were 200 µm for cortical and 500 µm for cancellous bone, whereas the detection limits of conventional radiography were 600 µm and 2850 µm, respectively. **Conclusions.** This in vitro study demonstrated a very high correlation between the objective, quantitative assessment of subtle changes in alveolar bone by digital subtraction radiography and the true changes in bone thickness.

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