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Comparison of intraoral radiography and cone-beam computed tomography for the detection of horizontal root fractures: an in vitro study.

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Abstract

OBJECTIVES: This study aimed to compare the diagnostic accuracy of two different cone-beam computed tomography (CBCT) units with several intraoral radiography techniques for detecting horizontal root fractures.

METHODS: The study material comprised 82 extracted human maxillary incisors without root fractures that had not undergone any root canal treatment. Root fractures were created in the horizontal plane in 31 teeth by a mechanical force using a hammer with the tooth placed on a soft foundation as described in a previous study. The teeth were divided into two groups: a control group with no fractures and a test group with fractures. These were randomized to the empty maxillary anterior sockets of a dry human maxilla. Each tooth was imaged at various vertical angles using each of the following modalities: a 3D Accuitomo 170 CBCT, a NewTom 3G CBCT, a VistaScan PSP, a CCD sensor, and conventional film. Specificity and sensitivity for assessing horizontal root fracture by each radiographic technique were calculated. Chi-square statistics were used to evaluate differences between modalities. Kappa statistics assessed the agreement between observers. Results were considered significant at $P < 0.05$.

RESULTS: The kappa values for inter-observer agreement between observers ranged between 0.88 and 0.98 for the 3D Accuitomo 170, 0.82 and 0.91 for the NewTom 3G, and 0.61 and 0.72 for the different types of intraoral images. The diagnostic accuracy for detecting fracture lines in 3D Accuitomo 170 (0.93) was significantly higher than NewTom 3G (0.87), VistaScan (0.71), CCD (0.70), and CF (0.68).

CONCLUSIONS: 3D Accuitomo 170 has the highest sensitivity and diagnostic accuracy for detecting horizontal root fracture among the 5 radiographic modalities examined. CBCT should be considered as the most reliable imaging modality of choice for the diagnosis of horizontal root fracture.

CLINICAL RELEVANCE: CBCT imaging offers the clear advantage over conventional imaging that traumatized teeth can be visualized in all three dimensions--especially the oro-facial dimension.

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