

Assessment of Bone Degradation and Acute Inflammation in Apical Parodontitis

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Background

The apical Parodontitis is a bacterial inflammation. The bacteria arrive over an ignited root channel (pulpitis) or over a deep gingival sulcus to the root point. The chronic inflammation in the vicinity of the root canal may cause osteonecrosis, often combined with an acute inflammation near the tip of the canal. In pain patients, however, the identification of the acute inflammation is paramount for identification of the culprit lesion. The current X-ray (XR) based imaging techniques (panoramic tomography (PT) and Cone Beam CT (CBCT)) are limited in delineating chronic and acute periapical lesions. The objective of this feasibility study was to investigate the applicability of MRI for the assessment of the 3D structure of the bone degeneration and for the identification of the area of the acute inflammation in pain patients.

	T1W spin echo	T2W spin echo
Echo time [ms]	7.2	60
Repetition time [ms]	625	2092
Pixel BW [Hz]	272	157
Acquired res. [mm ³]	0.5x0.5x1.5	0.5x0.5x1.5
Slices	10	10
TSE factor	8	11
Field of view [mm ³]	230x230x15	230x230x15
Scan time	9:06	5:43

Table I: MRI Acquisition Protocol

Methods and Materials

Eleven patients were enrolled in this feasibility study. XR imaging showed minor up to severe periapical lesions. All patients had multiple dental fillings (including amalgam, gold, ceramic and composite fillings), crowns and bridges. The patients underwent a CBCT scan and an MRI investigation within 2 weeks prior or 4 weeks after the CBCT. The MRI imaging protocol comprised a high resolution multi-slice T1-weighted (T1W) and T2-weighted (T2W) multi-spin echo acquisition. Acquisition parameters are listed in Table I. MRI scans were planned in parasagittal orientation aligned

with central line of the tooth of either side of the jaw. All MRI data was acquired at a 3-Tesla whole body system (Achieva, Philips Medical, Best, Netherlands) with a 16-element neurovascular coil. Location and size of the lesions were compared between MRI and CBCT. For identification of acute inflammation (related edema), the appearance of the lesions in T1W and T2W was compared. In patients who underwent surgery, histology was performed for identification of inflammation.

Results

All lesions identified in CBCT were clearly visible in T1W as well as in T2W MRI. The lesion size in the different MR images corresponded well with the lesion size in the CBCT (fig. 1 a,b). In contrast to CBCT, in T2W MRI, many lesions showed a non homogeneous contrast. Especially in the vicinity of the foramen apicale, in many cases, a well circumscribed hyper-intense signal was observed in the T2W images (fig 1 a (circle), d (arrow)). The histological findings of the resections of five cases confirmed the presence of acute inflammation in those lesions.

Discussion

MRI can be applied for the identification of apical parodontitis with similar sensitivity as XR based techniques. The versatile contrast of MRI facilitates the delineation of acute and chronic inflammation, which may support the identification of the culprit lesion in pain patients.

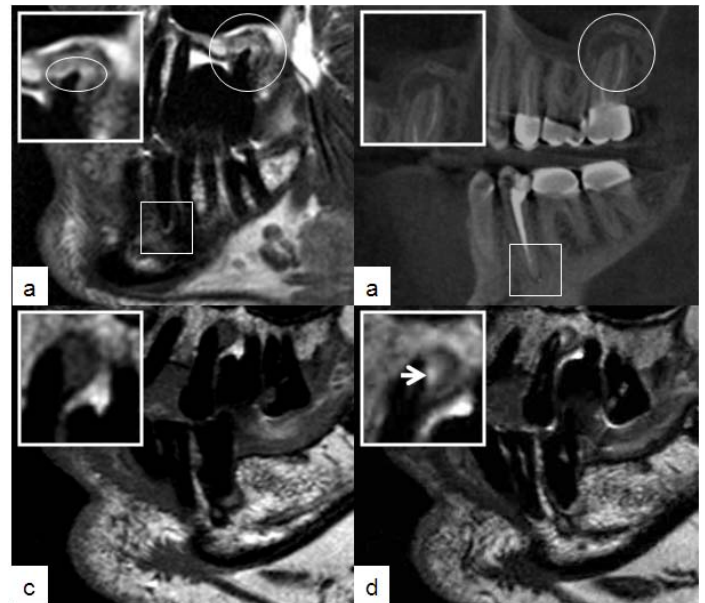


Figure 1: T2W-MRI (a) and CBCT (b) of a progressed (circle) and initial (square) lesion; T1W (c) and T2W (d) MRI of a progressed lesions. Insets show close-ups of the lesions.