MRI Diagnosis of Periodontal Inflammation

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Magnetic resonance imaging and spectroscopy provide valuable information on pathophysiological state of soft tissues. As such, they can be used in periodontology to access information on the progress of periodontal inflammation. In this study we used contrast enhanced T1-weighted MRI for monitoring the success of a periodontal inflammation therapy. Ten volunteers were involved in the study. Success of the treatment was quantified by the image signal intensity analysis in the region of inflammation before and after the treatment. Significant differences between signal intensities before and after the treatment were observed in patients with severe periodontal inflammation.

Introduction

It is well known from the literature that relaxation times of tissues strongly depend on the state of tissues, i.e., wether they are normal or pathological. Inflamed tissues have longer T1 and T2 relaxation times and therefore appear bright on T2 weighted MR images and dark on T1 weighted MR images. However, quite different is the situation after administration of the contrast agent. The dynamics of a contrast agent accumulation and its highest concentration is different in the pathological tissue compared to a normal tissue. Concentration of the contrast agent is higher in the inflamed region compared to a normal tissue and the peak concentration is reached faster. This has as a consequence a decrease of relaxation times T1 and T2 in the inflamed tissue region, which reflects in a signal increase from that region [1,2].

Materials and Methods

Ten volunteers with different stages of periodontal inflammation were selected for the study. Periodontal parameters including PI, bleeding on probing and plaque index were taken. After the clinical examination and X-ray analysis, T1 weighted and contrast enhanced T1 weighted MR images were acquired.

All studies were performed on a 1.5 T Siemens Magnetom imaging system with the use of a head coil. In each exam twelve T1 weighted images in consecutive 3 mm thick transversal slices at the filed of view 28 cm were acquired before and after the administration of the contrast agent (Gd-DTPA). Imaging parameters were: TE/TR =15/500 ms. Each patient was examined by MRI before and after the periodontal therapy.

The periodontal therapy includes root planning and scaling with curettage under local anesthesia. Therapy was performed on each tooth and was repeated after a period of three and six months. Patients were motivated and instructed for good oral hygiene including appropriate tooth cleaning and interdental flossing.

Results

Signal intensity (SI) on MR images was evaluated for normal (n) and inflamed (i) tissues. Signal intensities were normalized to a reference signal from the fat tissue. T1 weighted images show the ratio between inflamed and normal tissues as SIi/SIn = 1.3 ± 0.2. After the administration of the contrast agent the SI ratio increased to SIi/SIn = 2.1 ± 0.25. After the periodontal therapy the amount of plaque as measured by PI decreased as well as bleeding on probing and probing depth. That indicated the reduction of inflammation. The success of the therapy was observed also by MRI signal intensity measurements. T1 weighted images showed the ratio SIi/SIn = 0.9 ± 0.23 and SIi/SIn = 1.5 ± 0.31 in contrast enhanced T1 weighted images.

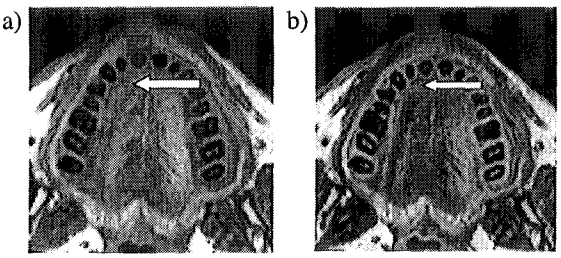

Fig. 1: Pre (a) and post (b) contrast T1 weighted image of the maxilla. Arrow indicates the inflamed periodontal tissue.

Conclusions

The results of the study indicate significant signal decrease in contrast enhanced T1 weighted images in the treated periodontal tissues which is in consent with the clinical examination. MR imaging can, therefore, be used also for the diagnosis of periodontal inflammation and for monitoring the course of the periodontal therapy.

References

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