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Intraoral Dental MRI Coil (20130110, Dr. Michael Garwood)

IP Status: Issued US Patent; **Application #:** 14/163,447

Optimal Orientation for Orofacial Applications

An intraoral radiofrequency (RF) loop coil placed, between the teeth, efficiently images teeth and associated dental structures. The coil is oriented with its axis parallel (coaxial) with the Zeeman field (coil plane perpendicular to B0) and captures B1 information using the coil's transverse sensitivity volume. This orientation provides one of the most appropriate fields of view (FOV) for orofacial applications (i.e., it "sees" the necessary structures but does not "see" adjacent—and therefore non-relevant—anatomy). This orientation appears the most ideal for obtaining MR images for dental applications, as the sensitivity volume includes the most important dental structures (e.g. teeth, jaw) while mostly excluding cheeks, lips and spinal cord.

Radiological Dental Images

Traditional dental image techniques (e.g. bite-wings, cone beam CT (CBCT), and Panorex) use ionizing radiation and have been linked to brain tumors and cataracts. Moreover, these imaging modalities cannot simultaneously image hard (e.g. dentin, bone) and soft tissues (nerves, inflammation, fat), have limited sensitivity to detect small anomalies in teeth (e.g. early caries/cavities, cracks/root fractures), and cannot be using in continuous fashion to obtain functional imaging (e.g. TMJ movement, blood flow in teeth). Using an extraoral coil for dental MRI is hindered by high signal from the cheek and the larger field of view reduces the resolution that is obtainable. Using an intraoral coil for dental MRI that is place beside the teeth is uncomfortable for the patient, does not image the apices/tips of the teeth, and only obtains images of 3-4 teeth at a time. This new intraoral MRI coil design solves these problems with a coil configuration that maximizes patient comfort, provides full coverage of the complete dental region, and largely excludes signal from unwanted tissues. This new approach uses a highly advantageous configuration that limits the field of view limited to a small region above and below the coil and allows the total scanning time to be reduced while maintaining high resolution.

ADVANTAGES:

- simultaneous visualization of soft and hard tissues
- improvements/differences in contrast, as water is imaged rather than tissue density, making it easier to detect early carious lesions in tissues relatively devoid of water
- three-dimensional imaging
- avoidance of ionizing radiation

BENEFITS AND FEATURES:

Technology ID
20130110

Category
Engineering & Physical Sciences/Instrumentation, Sensors & Controls
Engineering & Physical Sciences/MRI & Spectroscopy
Life Sciences/Diagnostics & Imaging
Life Sciences/Human Health
Life Sciences/Medical Devices
Life Sciences/MRI & Spectroscopy
Software & IT/Algorithms
Agriculture & Veterinary/Veterinary Medicine

Learn more

- Efficiently images teeth and associated structures
- RF loop coil placed between the teeth
- Does not use ionizing radiation
- Ideal for obtaining MR images for dental applications
- May identify caries earlier
- May determine whether cracks and root fractures
- Images pulp, vasculature, and inflammation
- 3D and 4D imaging
- High resolution contrast of low-water tissues (e.g. dentin)
- Coil oriented with its axis parallel (coaxial) with the Zeeman field (coil plane perpendicular to B0)
- Captures B1 information using coil's transverse sensitivity volume
- Dental coil (hardware) for an MR system

APPLICATIONS:

- Dental radiology
- MRI
- Imaging teeth and other associated structures
- Other novel coil placements
- Imaging humans, animals, and objects

Phase of Development - Concept

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Publications

Intraoral approach for imaging teeth using the transverse B1 field components of an occlusally oriented loop coil

Magnetic Resonance in Medicine, Volume 72, Issue 1, July 2014, pp. 160-165

Dental magnetic resonance imaging: making the invisible visible

Journal of Endodontics, Volume 37, Issue 6, June 2011, pp. 745-752

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The University relies on industry partners to scale up technologies to large enough production capacity for commercial purposes. The license is available for this technology and would be for the sale, manufacture or use of products claimed by the issued patents. Please contact us to share your business needs and technical interest in this dental imaging technology and if you are interested in licensing the technology for further research and development.

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