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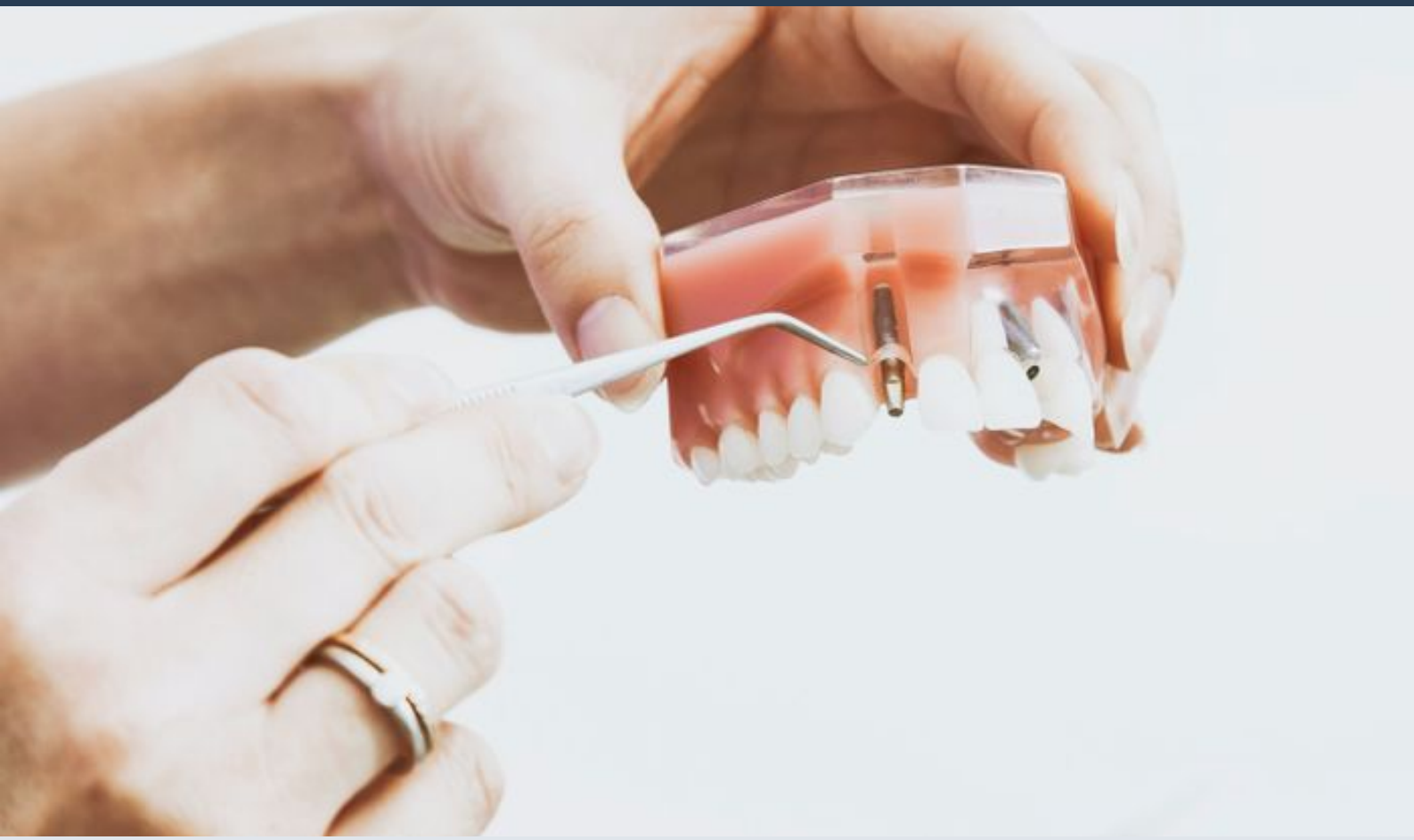
MRI-based Dental Implantolgy

Magnetic resonance imaging based computer-guided dental implant surgery

Reference: Dental Implantology



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IP Status

Patent application submitted

Seeking

Commercial partner, University spin out, Licensing, Seeking investment

About **LMU Munich**

Ludwig-Maximilians-Universität München is the University in the heart of Munich. LMU is recognized as one of Europe's premier academic and research institutions. The LMU Munich community is engaged in generating new knowledge for the benefit of society at large.

Background

Computer-guided implant surgery is currently based on radiographic techniques exposing patients to ionizing radiation. X-ray-based three-dimensional (3D) imaging, in particular cone beam computed tomography (CBCT), has become established for presurgical planning in implant dentistry. However, CBCT exposes patients to a relevant amount of ionizing radiation with associated cancer risk. This should be viewed particularly critically in the context of otherwise healthy patients and elective surgery. Even assuming that the risk to individuals is low, radiation exposure from CBCT is certainly relevant seen from a public health perspective. Another drawback of CBCT with regard to planning in implant dentistry is that tracing of the inferior alveolar nerve can be difficult in the absence of a well corticated mandibular canal. Scientists from LMU and TUM (participating partners see Figure 1) jointly showed that magnetic resonance imaging (MRI) may serve as an alternative imaging modality in implant dentistry.

Tech Overview

The clinical workflow for MRI-based computer-guided implant surgery requires both MRI-based volume data and tooth surface data obtained ether by dental model scans or intraoral scans. Because the surface data of the teeth are usually not visible in the MRI image an apparatus and a method have been developed which make it possible to display the tooth surfaces in the MRI three-dimensionally. As a result of this joint invention from LMU and TUM, it is very easy to exactly superimpose the volume data from the MRI with the surface scans of the tooth areas (Figure 2).

Further Details

- *Probst, Schweiger, Stumbaum:* https://doi.org/10.1111/cid.12939
- *Hilgenfeld et. al:* https://doi.org/10.1007/s00330-020-07262-1

Stage of Development

Clinical pilot study. Patent application submitted. Contact TTO for further information.

Benefits

The great benefit of the technology described is that it is possible to precisely plan the implant positions (Figure 3) and then by producing a drilling-guide to enable the exact positioning of the implants (Figure 4) in the bone without exposing the patient to ionizing radiaton.

Applications

Guided implant surgery, digital backward planning.

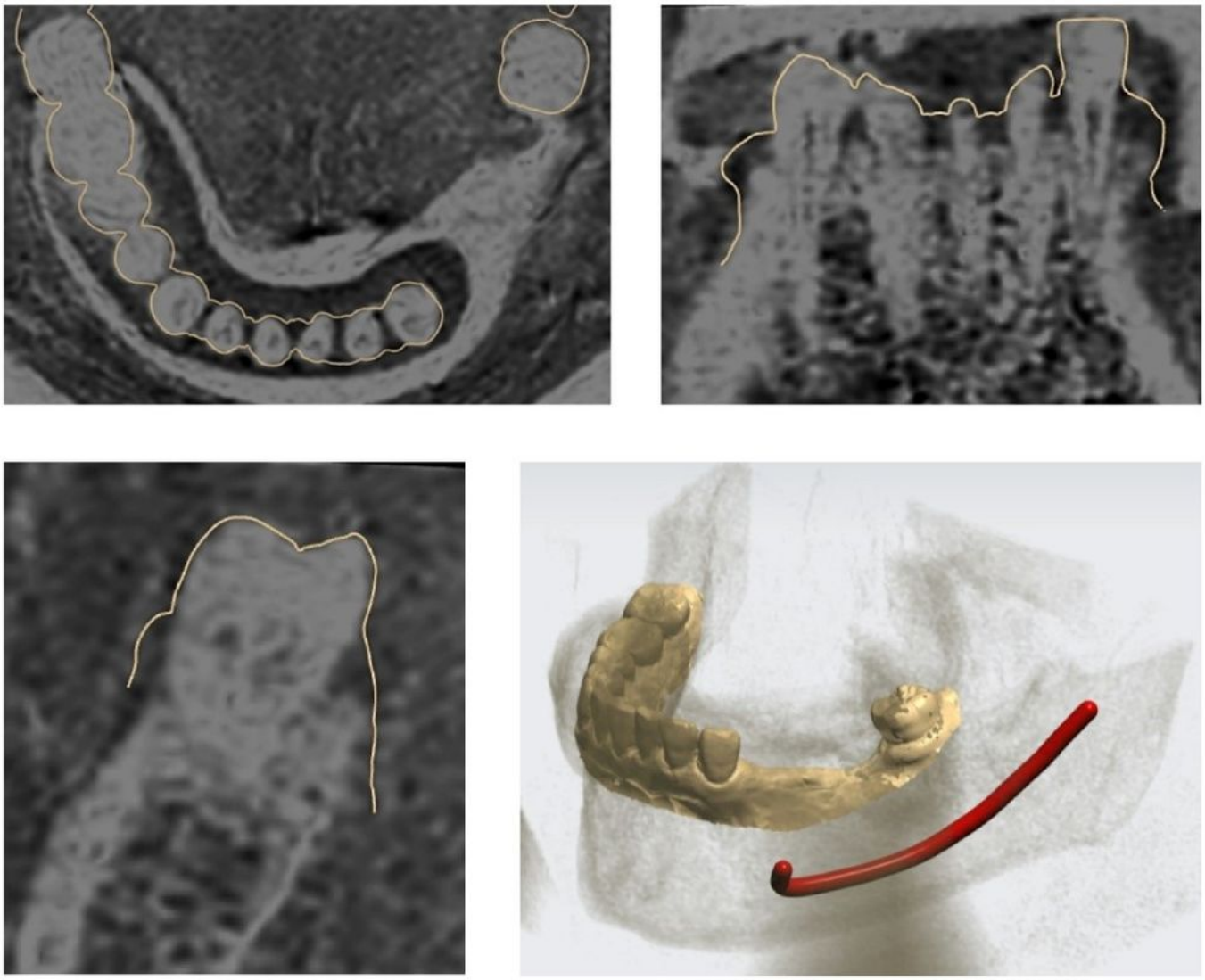
Appendix 1

Figure 1

Appendix 2

Figure 2

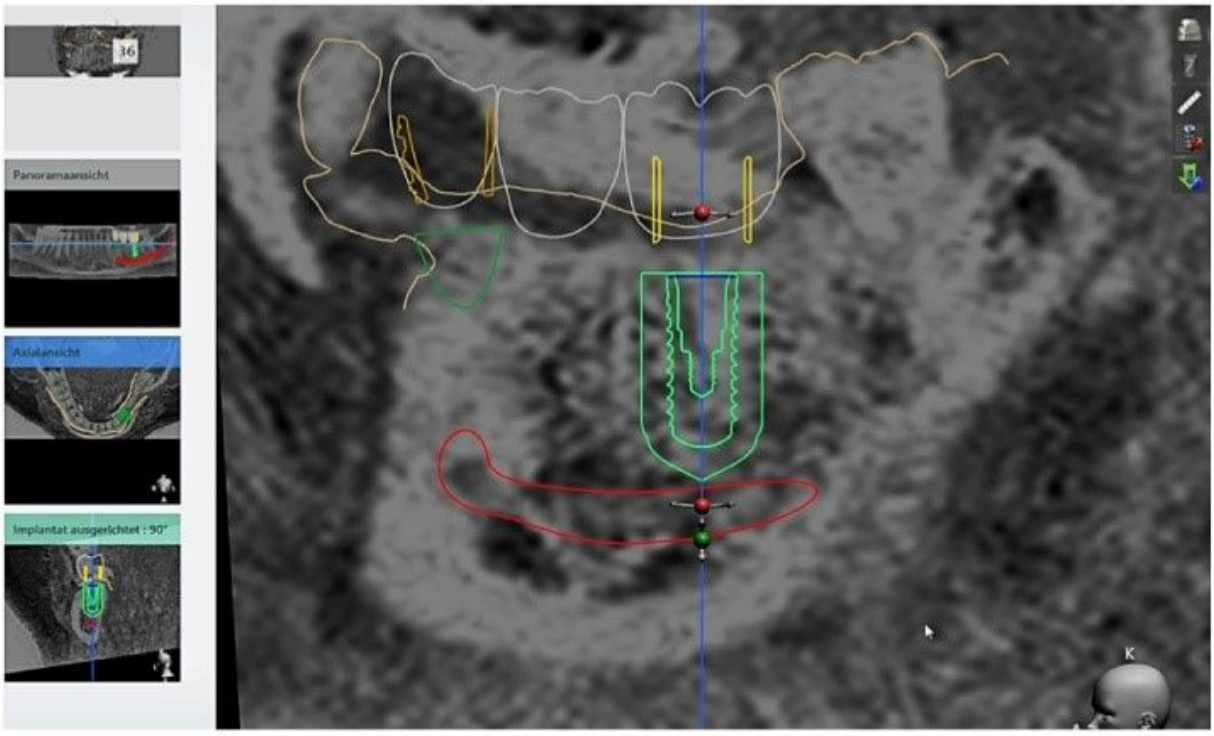
Top and Bottom left: Digitalized occlusal surfaces derived from a model scan (beige lines) are superimposed with MRI DICOM data in the planning software. The alignment is fine-tuned in the coronal, axial and sagittal planes using translation and rotation tools to achieve an exact matching. Please note: In this case, the signal values of the T1-weighted images were previously inverted (black to white) to provide a CBCT-like appearance. Bottom right: Resulting 3D “Hybrid Model” with the traced inferior alveolar nerve (displayed in red)

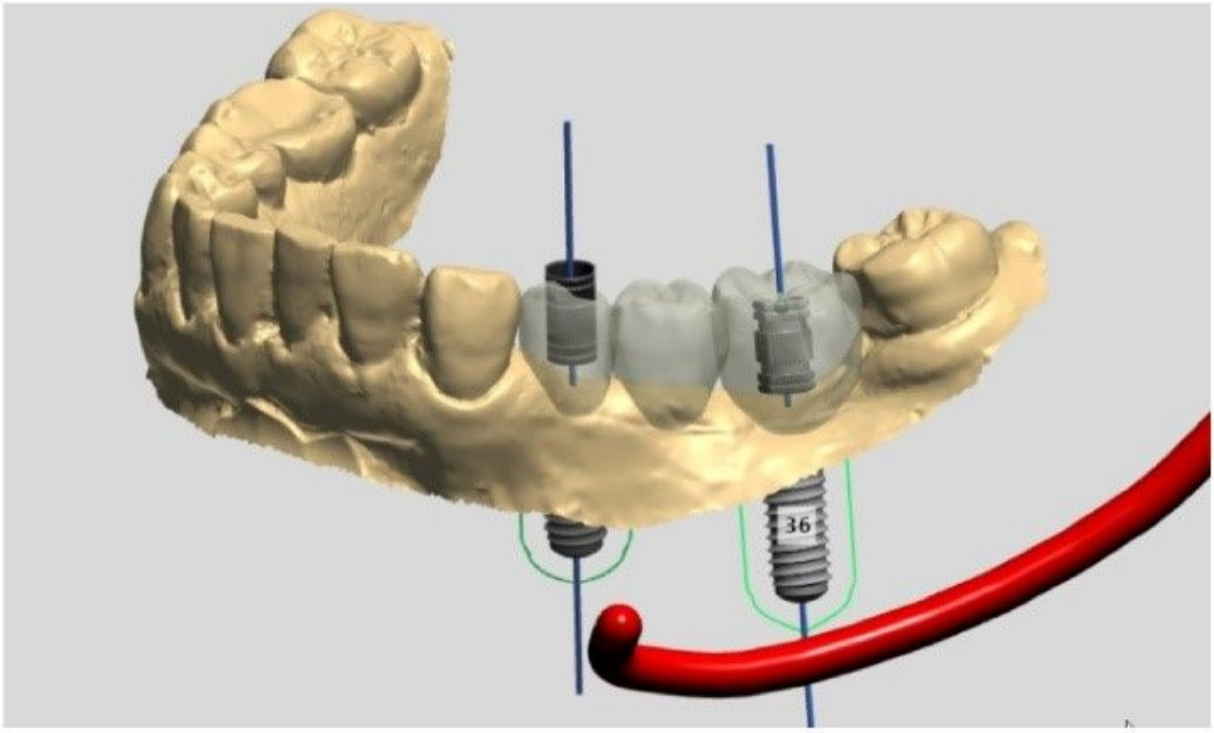


Appendix 3

Figure 3

Top: Virtual positioning of an implant in region 36 in parasagittal section according to prosthetic requirements. Bottom: 3D view of the virtually positioned implants in region 34 and 36 in relation to the digital set-up of the planned dental restoration and to the traced inferior alveolar nerve

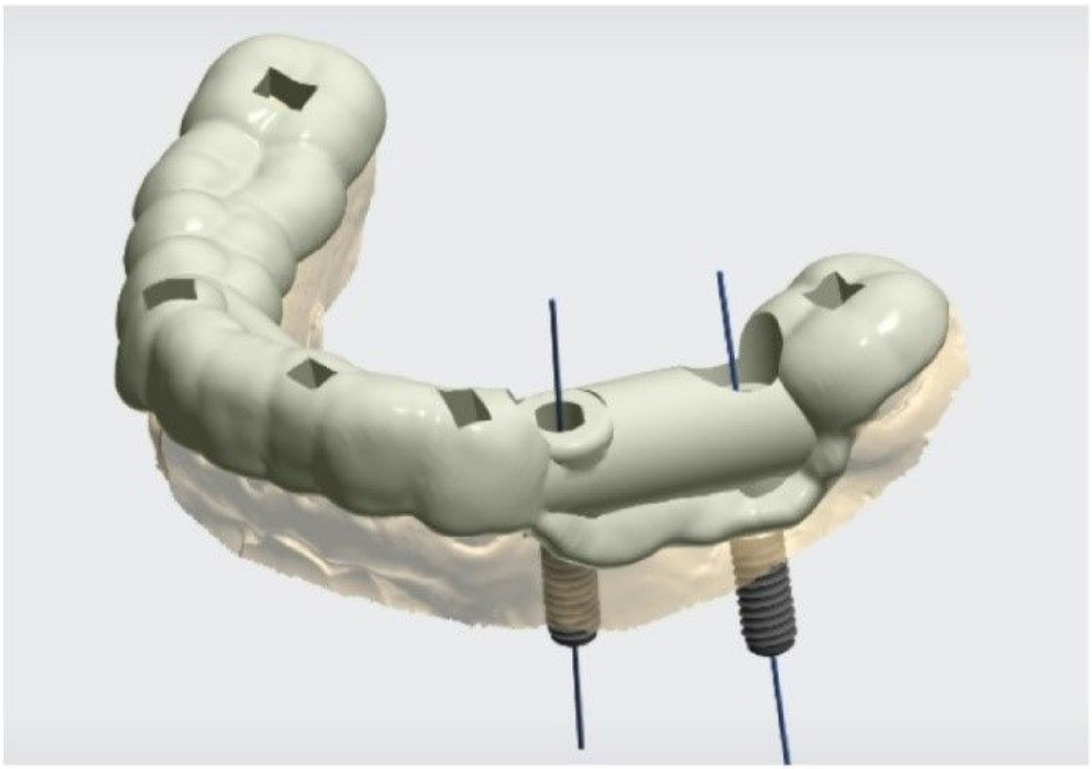


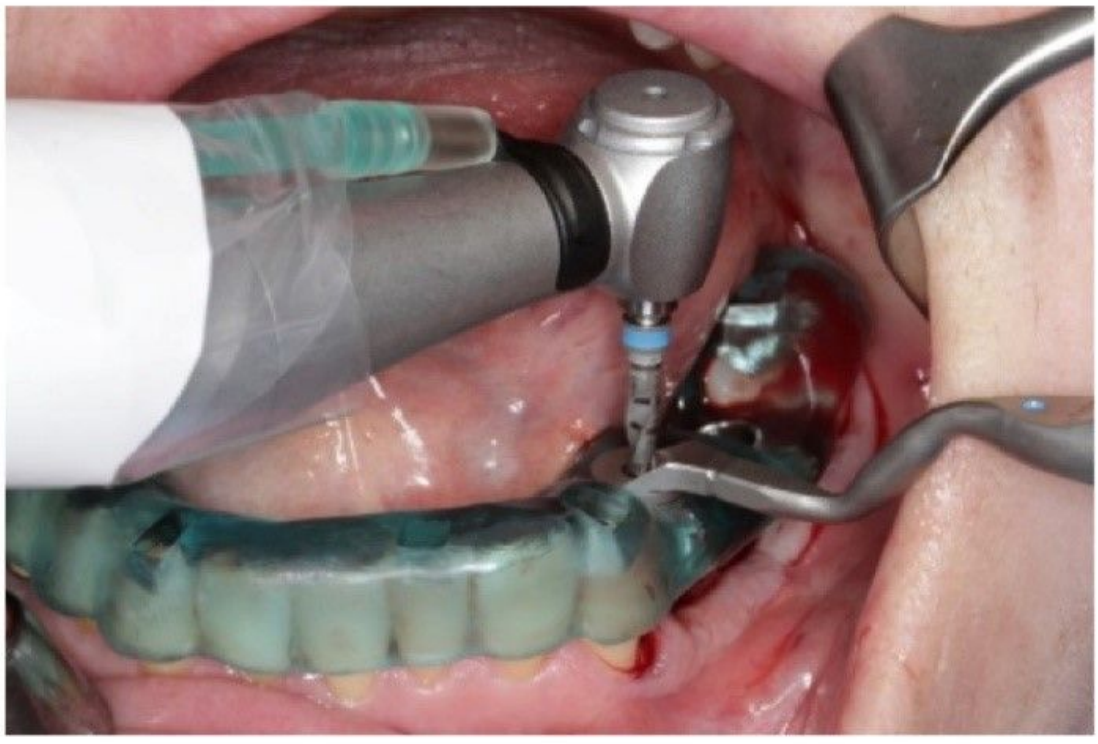


Appendix 4

Figure 4

Top: CAD construction of a rigid drilling guide. Bottom: Surgery with fully guided implant drilling sequence in the left mandible.





For further information, please contact us.

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