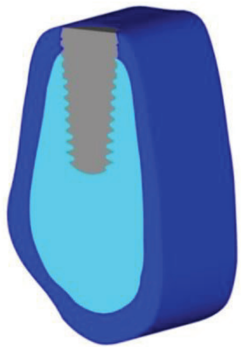
Stress distribution around TRI-Vent* dental implants

**TRI Dental Implants Int. Ag - Switzerland*

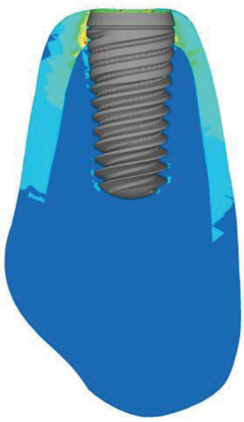
The biomechanical behaviour of a dental implant plays an important role in its functional longevity inside the bone. Occlusal forces affect the bone surrounding an oral implant. To avoid fracture and bone resorption – by achieving the most even stress distribution in the bone – those implants should be used which transfer occlusal forces to the bone within physiologic limits and have a geometry capable of enhancing bone formation. The application of computer simulations is an indispensable method for estimating the mechanical behaviour of the bone surrounding dental implants, because it is non-destructive. The importance of these numerical experiments is in making the implantation the most secure possible, reliable and efficient, and the lifetime of the implant the longest conceivable, by finding the most favourable formation.

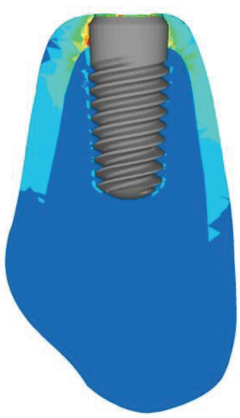
The behaviour of the trabecular and cortical bone around a TRI-Vent dental implant under everyday occlusal load, after the complete healing was examined by means of computer simulations. The model of the screw type dental implant was combined with the model of an idealized bone segment from the mandible. The stress distribution in the bone was examined under occlusal forces – horizontal and vertical simultaneously – acting on the implant. The magnitude and the distribution of the stresses were examined in the trabecular and cortical bone tissue under various circumstances.

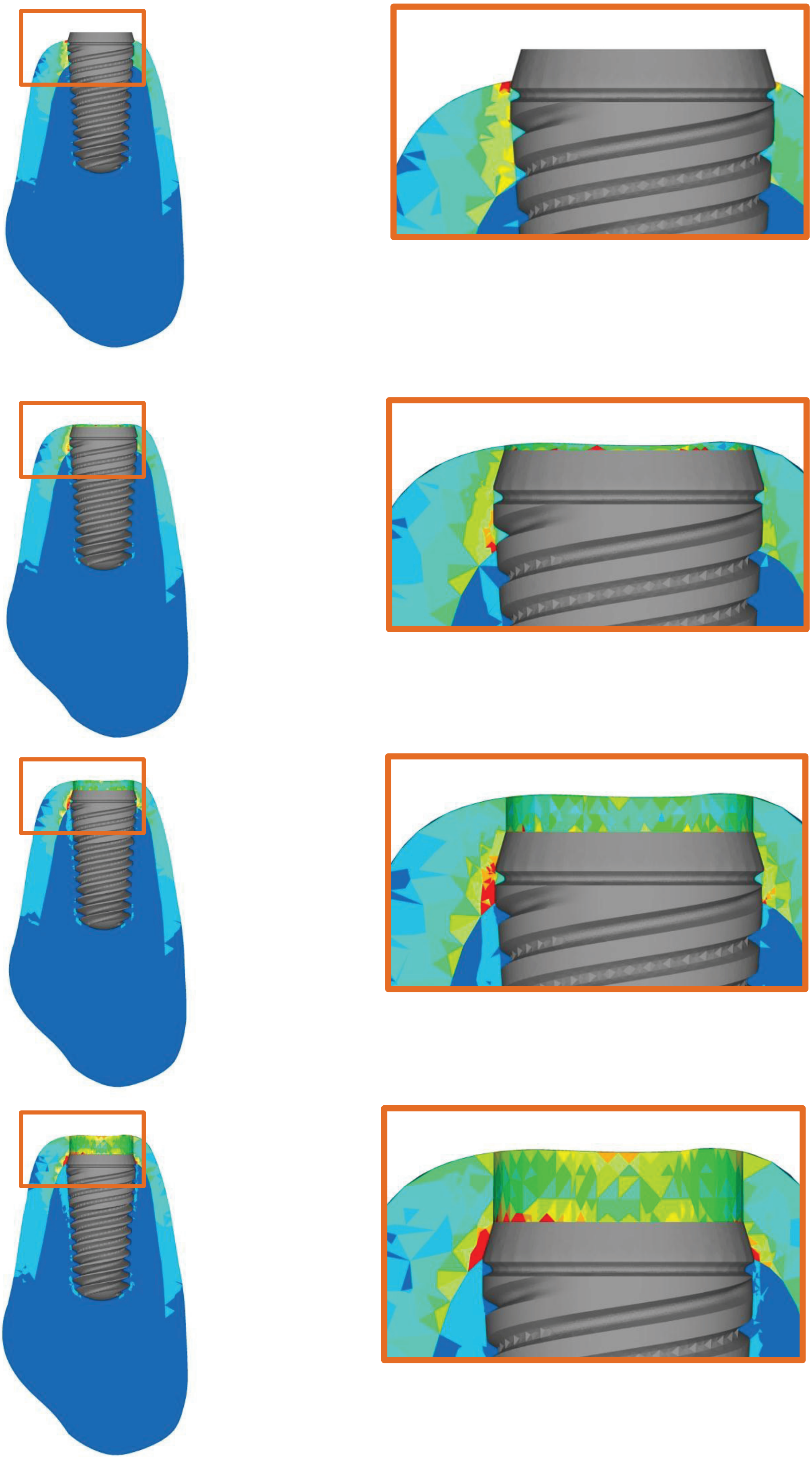


The effect of micro-grooves in the upper region of the implant, where it is connected to the cortical bone, was examined by comparing the behaviour of the bone around two implants, modelled with the same geometry (one with micro-grooves and one with a smooth surface at the cortical bone region). Similarly, the ideal depth of screwing was determined depending on the cortical bone thickness by modelling the same implant screwed to four different depths using various cortical thicknesses. The magnitude of the maximum stresses in the bone was the lowest, the stresses were the most evenly distributed and the heavily loaded area was the least extended, when a micro-grooved implant was fastened, levelling the cortical bone surface.

The following example shows the stress distribution around an implant placed in a mandible segment with an extremely thick cortical bone layer. The regions, where the lowest stresses arise are indicated in blue, while the heavily loaded areas are orange and red (through green and yellow). The first two figures show the effect of the micro-groove, the last four the effect of the depth of screwing.







From the simulation results, it can be concluded, that – because of the relatively low and evenly distributed stresses in the cortical bone – the examined thread formation is advantageous in respect of the normal function of the healed implant, compared to those conventional screw implants, which possess smooth surface in the cortical bone region.

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