

Quantification of Bone Remodeling in the Proximity of Implants

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Problem In histomorphometrical investigations of bone tissue modeling around screw-shaped implants, the manual measurements are time consuming and subjective. In this work we propose an automatic image analysis method for such measurements. We evaluate different discriminant analysis methods and compare the automatic method with the manual one.

What we are looking for The manual measurements are performed directly in the eyepiece of a light microscope, using objective 10x plus a zoom resulting in a magnification such as the mid figure in Fig. 1. The measurements involve percentages of (see Fig. 3):

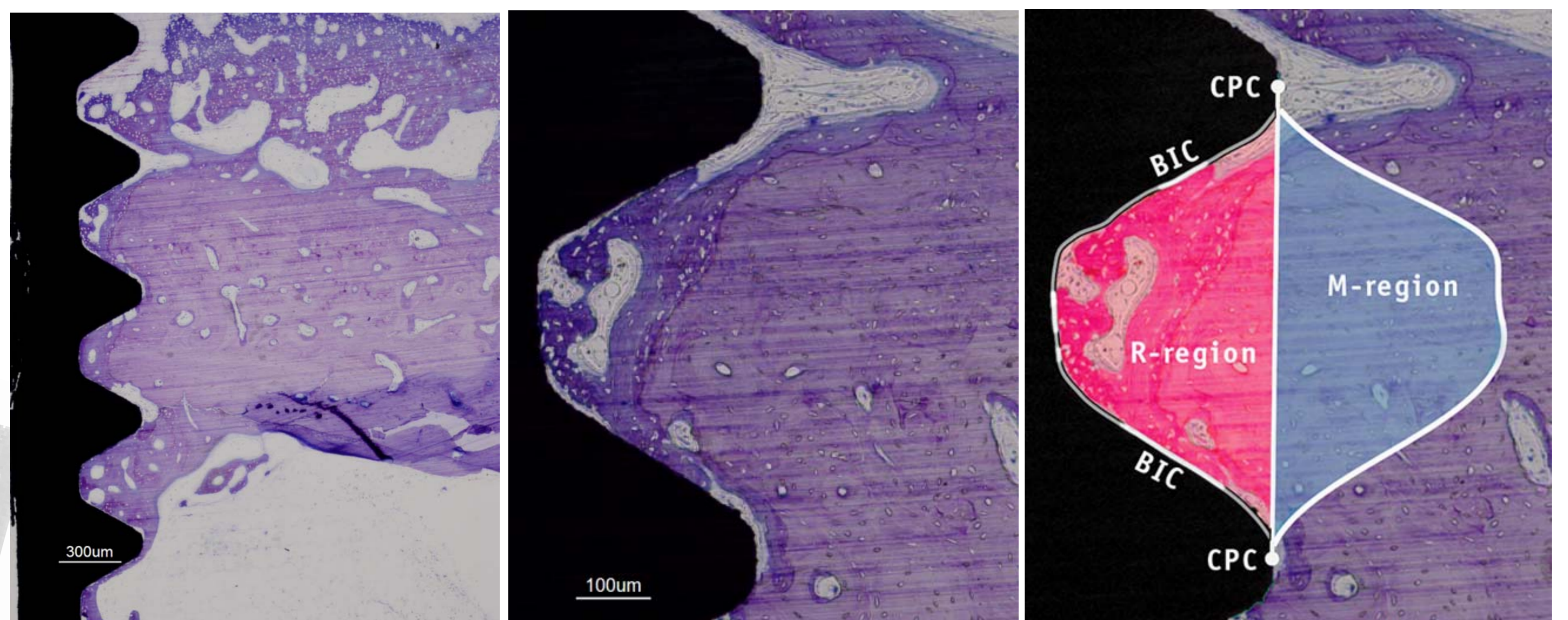


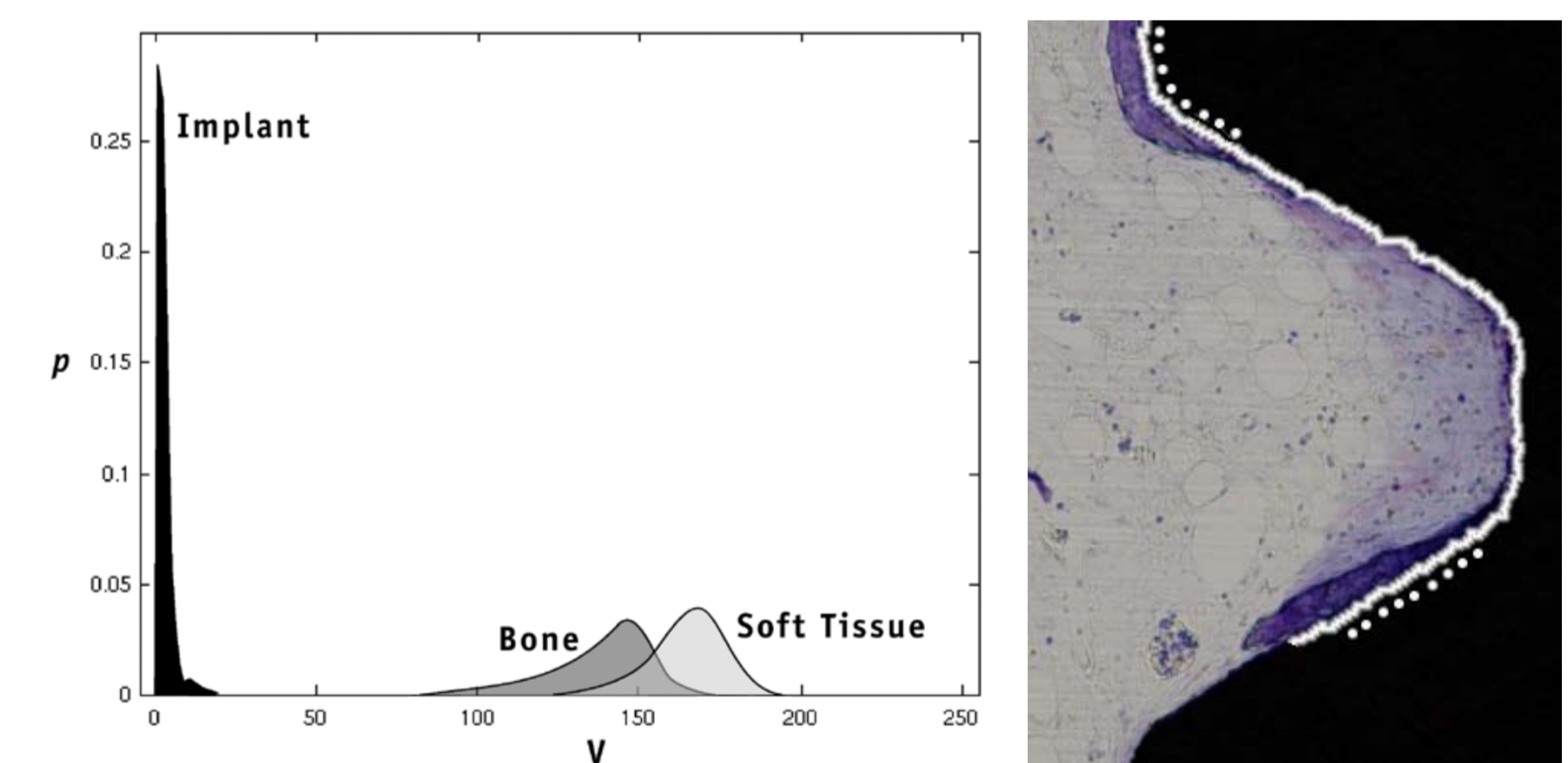
Fig. 1. Objectives of 4x (left) and 10x (middle) were used for capturing the above images. The screw-shaped implant (black), bone (purple with a number of hollow spaces) and soft

Method

- The automatic method is performed on illustrations captures by using either 4x or 10x objectives
- Segmentation into bone, implant and soft tissue using discriminant analysis
- two subsegmentations: implant / non-implant and bone / soft tissue
- Supervised learning: RGB and (H)SV-channels are included

Fig. 2.

Left) Distribution of the pixels in the V-channel for a sample section.



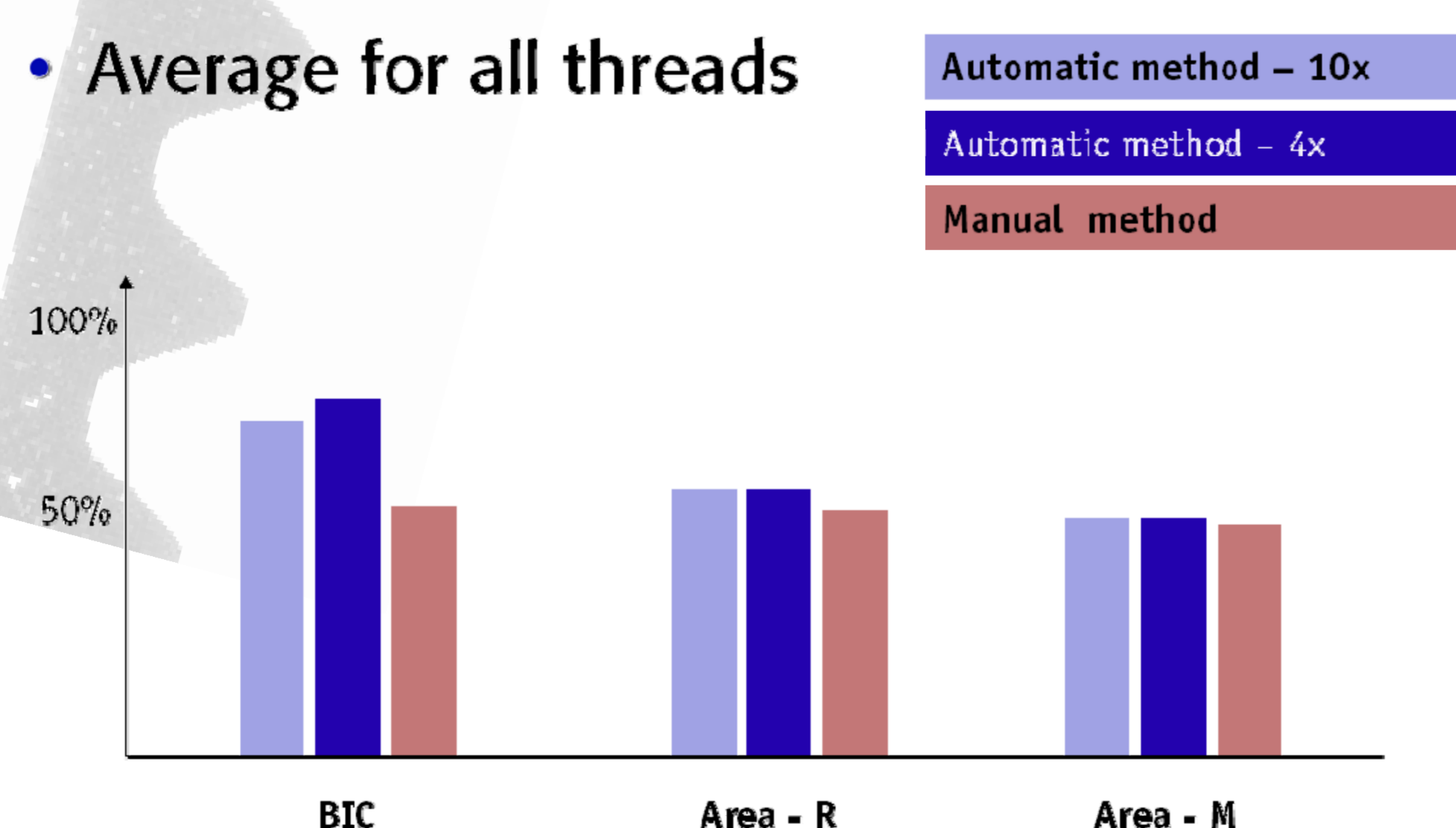
Right)

Problematic case: identified BIC by the manual

Results The results show that the principal difference between the two methods occurs in length estimation, whereas the area measurement does not differ significantly. A major factor behind the dissimilarities in the

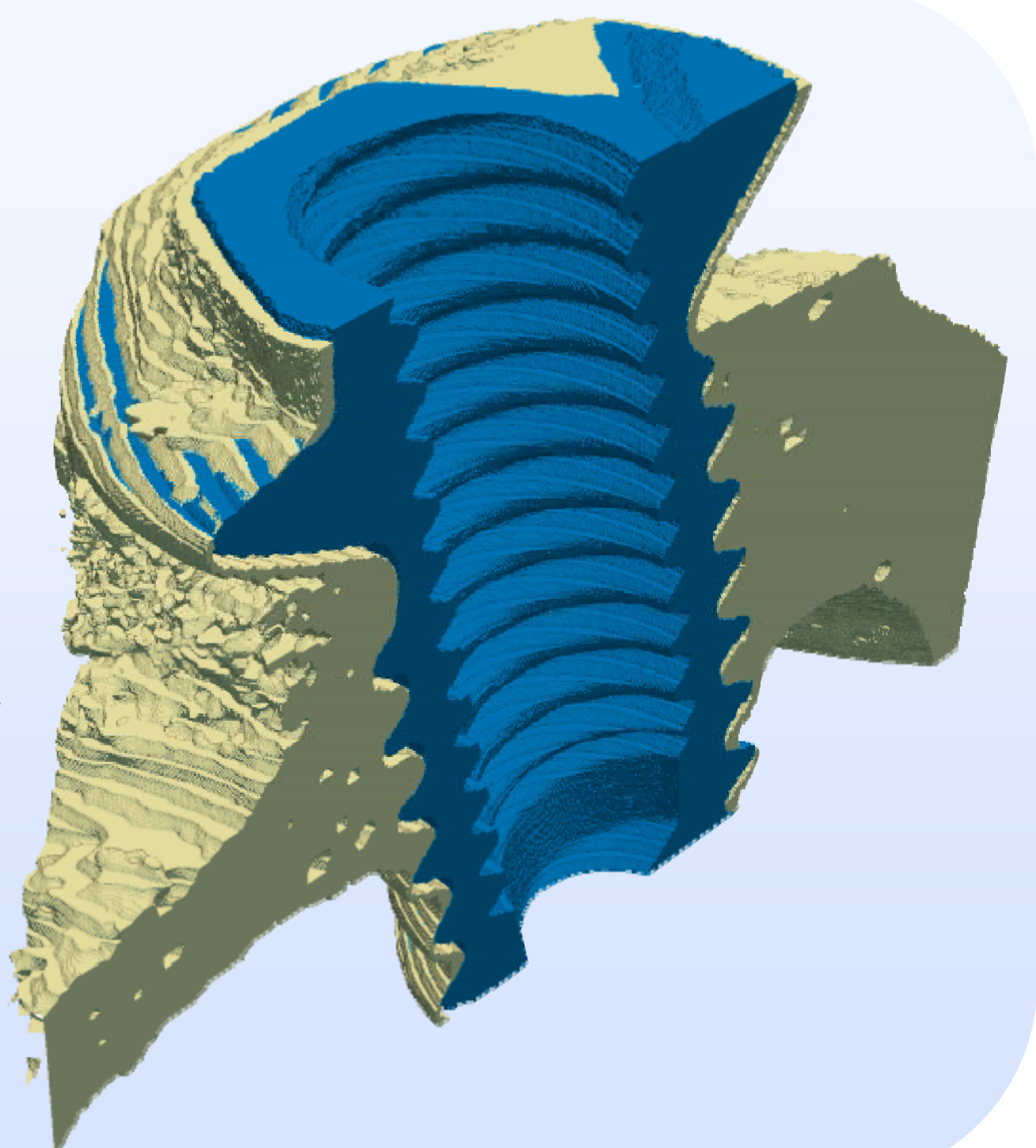
• Average for all threads

Fig. 3. The results of the two methods (measurements from one section) when using two



Going to 3D

Implants were imaged with an SRμCT-device. A combined investigation of the 2D and 3D data, allowing a more extensive



Conclusion An automatic (after an initial training step), fast and effective method for measurement of bone area and estimation of bone-implant contact length in images of screw-shaped implants was developed. The method was compared with a manual method.

The difference in the area measurement is, according to our experience, lower than the variation in the material and hence within acceptable error limits. The BIC-estimation of the automatic method, however, requires further development to match the manual method.



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