

Adam M, Ganz C, Xu W, Sarajian H R, Frerich B, Gerber T

How to Enhance Osseointegration – Roughness, Hydrophilicity or Bioactive Coating?

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Abstract. The apposition of bone at early stages is critical for rapid loading and therefore there is much effort in improving the implant surfaces for a rapid osseointegration. The aim of this study is to investigate the effect of roughness, hydrophilicity and coating on osseointegration. Machined (smooth), sand-blasted (rough), hydrophilic and coated implants were tested *in vivo* for 2, 4 and 6 weeks. The hydrophilic surfaces were obtained by atmospheric oxygen plasma treatment of machined and sand-blasted implants. The coating is obtained by a spin-spray-process using sol-geltechnique.

SEM and TEM investigations revealed that the coating consists of a nanoporous silica matrix with embedded synthetic, nanocrystalline hydroxyapatite. Histological polished sections were manufactured and the bone-to-implant-contact was calculated. The difference between smooth and rough implants was marginal and not significant. There were no statistical differences between hydrophilic and control implants, whereas the BIC of the hydrophilic surfaces was lower by trend. All coated implants offered an increased bone to implant-contact. However, the BIC was decreasing at 6 weeks due to the missing of mechanical stress and a faster bone metabolism in rabbits. The coating offers a new opportunity to enhance the osseointegration and therefore an earlier implant loading.