

8 Summary

Influence of loading and coating of Schanz´ screws on the osseous integration (a histological, histochemical and histomorphometrical study in a sheep model)

Pintrack infections are a major complication in external fixation, therefore the goal of this study was to analyze the influence of a Poly(D,L-lactide) coating for implants and mechanical loading on osseous integration of Schanz´ screws during fracture treatment.

Standardized osteotomies (3 mm fracture gap) of the right tibia were performed on 16 sheep and stabilized by an AO mono-lateral fixator. Additional Schanz´ screws were mounted that were mechanically unloaded. The screws were randomly coated by a biodegradable Poly(D,L-lactide). The sheep were sacrificed after nine weeks and all screws were removed. The screws were then rolled on blood agar plates for microbiological analyses. Histological sections of the pin tracks were investigated using histochemical and histomorphometrical analyses. A histological grading score graded the extent of osseous integration.

Clinically, no signs of severe infections were visible. Microbiological analyses showed that coated screws amounted to 14,8 % of severe infections by *Staphylococcus aureus*, whereas uncoated screws amounted to 29 %. Histological scoring of the residual samples demonstrated that significantly ($p = 0.0006$) more osseous integration had occurred on Poly(D,L-lactide) coated screws. In the uncoated coated screw group histomorphometrical analyses of the bone surrounding the Schanz´ screws revealed significantly ($p = 0.006$) more bone remodeling and a higher ($p = 0.019$) osteoclastic activity seen near the screw-bone interface. Two to three times more extensive new bone formation occurred around the screw entry and more severe remodeling was detected. Thereby loaded screws showed significantly ($p = 0.048$) more callus around the exit sites.

In the present study, Poly(D,L-lactide) coating of Schanz´ screws was found to enhance their osseous integration in sheep by causing less cortical remodeling and less osteoclastic activity in the cortices compared to uncoated screws. Additionally, it appears to reduce the instances of pintrack infections. Highly mechanical conditions showed an adverse consequence on the bony structure. It has been shown that both biological and mechanical factors play an important role in the maintenance of osseous quality of pintracks. Independently from the mechanical conditions the Poly(D,L-lactide) coating of Schanz´ screws was seen to be beneficial to external fixation in terms of a superior bone quality of pin tracks.