Three-dimensional analysis of peri-bone–implant contact of rough-surface miniscrew implants

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Abstract

Introduction

In this study, we evaluated the effects of surface modifications of miniscrew implants (MSIs) and force application on bone surrounding MSIs.

Methods

Seven skeletally mature male foxhound dogs were followed for 9 weeks: a randomized split-mouth design was used to compare 21 MSIs with sandblasted, large-grit, and acid-etched (SLA) surfaces and 21 identical machine-surfaced MSIs. MSIs immediately loaded with 200-g nickel-titanium coil springs were compared with unloaded MSIs. Bone volume to total volume ratios of cortical and cancellous bone regions were measured at 6 to 24 μm and 24 to 42 μm from the entire MSI surface using microcomputed tomography with an isotropic resolution of 6 μm.

Results

Clinical success of SLA-surfaced MSIs was 100%, compared with 85.7% for machine-surfaced MSIs. There was significantly (P < 0.05) more bone at the coronal aspects of the SLA-surfaced than the machine-surfaced MSIs; the SLA-surfaced MSIs also showed significantly greater decreases in bone between their most coronal and apical aspects. MSIs that were loaded demonstrated significantly (P < 0.05) greater decreases in surrounding bone than unloaded MSIs. The amount of bone within 6 to 24 μm of the MSIs was significantly less than that within 24 to 42 μm. Mean placement torque was higher for the SLA-surfaced (42 Ncm) than the machine-surfaced (39 Ncm) MSIs, but the difference was not statistically significant.

Conclusions

SLA surface treatment and loadings have significant effects on bone surrounding the MSIs; this might be related to higher success rates and greater secondary stability.

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