

Publication

A comparative investigation of bone surface after cutting with mechanical tools and Er:YAG laser

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Despite of the long history of medical application, laser ablation of bone tissue became successful only recently. Laser bone cutting is proven to have higher accuracy and to increase bone healing compared to conventional mechanical bone cutting. But the reason of subsequent better healing is not biologically explained yet. In this study we present our experience with an integrated miniaturized laser system mounted on a surgical lightweight robotic arm.; An Erbium-doped Yttrium Aluminium Garnet (Er:YAG) laser and a piezoelectric (PZE) osteotome were used for comparison. In six grown up female Göttingen minipigs, comparative surgical interventions were done on the edentulous mandibular ridge. Our laser system was used to create different shapes of bone defects on the left side of the mandible. On the contralateral side, similar bone defects were created by PZE osteotome. Small bone samples were harvested to compare the immediate post-operative cut surface.; The analysis of the cut surface of the laser osteotomy and conventional mechanical osteotomy revealed an essential difference. The scanning electron microscopy (SEM) analysis showed biologically open cut surfaces from the laser osteotomy. The samples from PZE osteotomy showed a flattened tissue structure over the cut surface, resembling the "smear layer" from tooth preparation.; We concluded that our new finding with the mechanical osteotomy suggests a biological explanation to the expected difference in subsequent bone healing. Our hypothesis is that the difference of surface characteristic yields to different bleeding pattern and subsequently results in different bone healing. The analyses of bone healing will support our hypothesis.

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