

Evaluation of bone healing after osteotomies prepared with Er:YAG laser and piezosurgery using laser profilometry – an animal study

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Background: The use of manual and drilling instruments has a long history in oral and maxillofacial surgery. Over the past decades, piezosurgery and different types of high-energy lasers have been investigated in bone surgery.

Aim/Hypothesis: The aim of study was to analyse the healing of the bone tissue treated with contact and non-contact mode of Er:YAG laser and piezosurgery in a rat model, using triangular laser profilometry.

Material and methods: Twenty four Winstar rats were included in the study. Three osteotomies on the medial part of tibia were performed on each animal. The piezosurgery was set at maximal power using spherical diamond tip. The laser preparations were performed using Er:YAG laser in contact (7.5 W, 375 mJ, 20 Hz, MSP mode, H-14N handpiece, fiber of 1.0 mm) and non-contact mode (7.5 W, 750 mJ, 10 Hz and QSP mode, digitally controlled handpiece-x-Runner), under continuous irrigation. Bone healing after osteotomy was analyzed immediately after surgeries, 1 week, 2 weeks and 3 weeks after surgery by using 3D laser scanning technique based on the optical triangulation principle. After the cross-sections of all osteotomies were measured, volumes were calculated using computer programme. The results were presented in three-dimensional image form.

Results: Mean values of the volumes were obtained using results of laser profilometry. After first week of healing, contact mode of Er:YAG laser showed the lowest reduction of osteotomy volume. Similar results for piezosurgery group was found. Significant reduction of osteotomy volume for non-contact mode of Er:YAG laser was found. After 3 weeks of bone healing, gradual reduction of volumes for contact Er:YAG laser and piezosurgery was found, but lower for piezosurgery. Non-contact mode of Er:YAG laser showed the greatest reduction of volume and almost complete healing.

Conclusions and clinical implications: Osteotomies prepared with digitally controlled non-contact Er:YAG laser healed the fastest.