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Author

Schenkel, M, Hoediono, C, Reher, Vanessa, Xiao, Y, Reher, Peter

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Bone healing stimulated by low-intensity pulsed ultrasound (LIPUS) in critical-sized bone defects in rats.

Researcher: Michael Schenkel (MSc. BSc.)

Supervisor: Prof. Peter Reher

Griffith University, School of Dentistry and Oral Health. Gold Coast, Queensland, Australia.

Background: The potential for clinicians to accelerate bone healing through low-intensity pulsed ultrasound (LIPUS) has a wide range of opportunities in the medical health field. However, further studies, including the effects of the ultrasound setting, treatment times, and overall effects in an appropriate animal model are still required for optimizing clinical use. Given the osteogenic properties stimulated by LIPUS, our lab has commenced a pilot study to test the hypothesis that daily LIPUS treatment can promote bone regeneration in critical-size defects in an animal model. **Purpose:** This pilot study examined the suitability of using the rat calvaria model for investigating the effects of LIPUS on bone healing using micro-computed tomography (micro-CT) image analysis. **Method:** Full thickness calvarial defects with 7x7-mm and 5x5-mm sizes were produced bilaterally in the parietal bones of 12 female Sprague-Dawley rats. The rats were equally divided into two groups (control and LIPUS treatment). LIPUS was directly applied to the calvaria of treatment rats for 5 minutes, 5 times per week. Rats were sacrificed at 8 weeks post-operatively and their calvarium removed for bone-healing analysis by micro-CT. **Results:** Tissues surrounding the calvarium healed over the defects and there were no animal deaths or evidence of distress or infection throughout the study. Calvarial bone defects did not heal in either control or LIPUS rats after the 8-week period and no significant difference in healing between the control and LIPUS group was noted by the micro-CT imaging. Ongoing work is focused on quantifying the changes using comparative computational image analysis as well as examining the defect area at the histological level to compare cellular changes in the control and LIPUS groups. **Conclusion:** The rat-calvaria model, with critical-sized defects in the parietal region, provides an ideal means to study cranio-facial defects and for examining the effects of LIPUS on bone healing. Micro-CT radiography offers reliable, high-resolution imaging of the calvaria, and allows visualizing the defect area in 3-dimensions. Our current results, in conjunction with previous research, suggest that longer treatment times may be needed to accelerate osteogenesis by LIPUS.

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