

# Clinical Studies

**Melmak**  
Faster Fracture Healing

## Low Intensity Pulsed Ultrasound

*This Schedule lists some examples of clinical studies that have been carried out on low intensity pulsed ultrasound systems (LIPUS) such as the EXOGEN® product. (EXOGEN® is the registered trade mark of Exogen, Inc). The studies below have not utilised a Melmak LIPUS device.*

STUDY	OUTCOME MEASURES	RESULTS	TECHNICAL SPECIFICATIONS OF LIPUS DEVICE
Pilla et al, Non-invasive low-intensity pulsed ultrasound accelerates bone healing in the rabbit. <i>The Journal of Orthopaedic Trauma</i> , Vol 4, No 3, 1990: pp 246-253	Acceleration of fracture healing	Ultrasound treated bone as strong in torsion as intact fibulae, increased periosteal reaction	<ul style="list-style-type: none"> <li>➤ f = 1.5 MHz</li> <li>➤ t<sub>p</sub> = 200 µs</li> <li>➤ REF = 1 KHz</li> <li>➤ I<sub>e</sub> = 30 mW/cm<sup>2</sup></li> </ul>
Walsh et al, Effect of Low Intensity Pulsed Ultrasound on Healing of an Ulna Defect Filled with a Bone Graft Substitute. <i>Journal of Biomedical Materials Research Part B: Applied Biomaterials</i> , 86B, 2008: pp 74–81	Rate of healing of bone defect	LIPUS resulted in more new bone growth at wk 4 and 12 compared to control and increased VEGF expression	<ul style="list-style-type: none"> <li>➤ f = 1.5 ± 5% MHz</li> <li>➤ t<sub>p</sub> = 200 ± 10% µs</li> <li>➤ REF = 1 ± 10% KHz</li> <li>➤ I<sub>e</sub> = 30 ± 30% mW/cm<sup>2</sup></li> </ul>
Walsh et al, Effects of low-intensity pulsed ultrasound on tendon-bone healing in an intra-articular sheep knee model. <i>The Journal of Arthroscopic and Related Surgery</i> , Vol 23, No 2 (February), 2007: pp 197-204	Rate of healing at tendon/bone junction	LIPUS resulted in improved ability to withstand increased load at tendon/bone junction	<ul style="list-style-type: none"> <li>➤ f = 1.5 MHz</li> <li>➤ t<sub>p</sub> = 200 µs</li> <li>➤ REF = 1 KHz</li> <li>➤ I<sub>e</sub> = 30 mW/cm<sup>2</sup></li> </ul>
Siska et al, External adjuncts to enhance fracture healing: What is the role of ultrasound? <i>Injury Journal</i> . 2008 Oct.39 (10): pp 1095-1105	Effect of LIPUS on rate of fracture healing	Safe, practical and effective treatment	<ul style="list-style-type: none"> <li>➤ f = 1.5 MHz</li> <li>➤ t<sub>p</sub> = 200 µs</li> <li>➤ REF = 1 KHz</li> <li>➤ I<sub>e</sub> = 30 mW/cm<sup>2</sup></li> </ul>
Busse et al, The effect of low-intensity pulsed ultrasound therapy on time to fracture healing: a meta-analysis. <i>CMAJ</i> . 2002 Feb 19;166(4): pp 437-441	Time to fracture healing	LIPUS may significantly reduce the time to fracture healing for fractures treated non operatively	<ul style="list-style-type: none"> <li>➤ f = 1.5 ± 5% MHz</li> <li>➤ t<sub>p</sub> = 200 ± 10% µs</li> <li>➤ REF = 1 ± 10% KHz</li> <li>➤ I<sub>e</sub> = 30 ± 30% mW/cm<sup>2</sup></li> </ul>

### Melmak Ultrasound Device Specifications

- Resonant Frequency f = 1.5 MHz
- Signal Pulse Duration t<sub>p</sub> = 200 µs
- Pulse Repetition Rate REF = 1 KHz
- Spatial Average Intensity I<sub>e</sub> = 30 mW/cm<sup>2</sup>
- Waveform Puls = Pulsed

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