

THERAPEUTIC ULTRASOUND

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Therapeutic ultrasound (US) may be used for superficial and/or deep heating of tissues. Ultrasound selectively heats tissue with high protein/collagen content. The most intense heating occurs at tissue interfaces, much like a diagnostic US image has sharp delineations between tissue interfaces such as skin, tendon, and fluid. In dog thigh muscles, US treatment with a 3.3-MHz transducer at 1.5 W/cm² resulted in temperature increases of 4.6° C, 3.6° C, and 2.4° C at 1 cm, 2 cm, and 3 cm depths, respectively.¹ Soft tissue temperature in man has been shown to increase 0.2° C per minute with a 1-mHz transducer set at 1.5 W/cm².²

This deeper heating effect of ultrasound has not been identified in equine studies. In equine epaxial muscles mean temperature rise after 20 minutes of treatment at 3.3 MHz at 1.5 W/cm² was 1.3° C at a depth of 1.0 cm, 0.7° C at 4.0 cm, and 0.7° C at 8 cm.² However, temperatures in tendons were significantly elevated following 10 minutes of treatment at 3.3 mHz: mean temperature rise was 3.5° C in the SDFT and 2.5° C in the DDFT at the end of the 1.0 W/cm treatment and 5.2° C in the SDFT and 3.0° C in the DDFT at the end of the 1.5-W/cm treatment.³

An additional benefit of therapeutic US is the deep massage of tissues caused by the sound waves referred to as cavitation and streaming. These non-thermal effects result in compression and expansion of tissues and tissue fluids that may improve tissue healing. Fibrous connective tissue scars may be more effectively stretched following heating with therapeutic ultrasound.

Treatment protocols:

The hair must be clipped and coupling gel must be used to provide good contact between the transducer and the skin. In horses, standard therapeutic ultrasound treatment is usually conducted with a 1-MHz transducer for deepest penetration (2.5-5 cm depth) and 3-MHz transducer for superficial penetration (1-2.5 cm depth). Energy levels administered are 1-2 W/cm², with a continuous wave for 10 minutes.⁴ The transducer should be slowly moved throughout the treatment area. Pulsed wave may be used over a bony prominence to reduce discomfort. The ability to manipulate the transducer and adjustment of treatment output for specific circumstances makes traditional therapeutic ultrasound the most versatile means for applying this modality.

Low-intensity ultrasound may be applied for 2-3 hours of treatment for acute injuries and 3-4 hours once daily for chronic injuries. The device does not have adjustable settings with output set at 2.75 MHz at 0.85 W/cm². For accessible anatomic locations the device is placed on the limb for the appropriate treatment time (UltrOZ; ZetrOZ LLC: Trumbull, CT US).

REFERENCES

1. Levine D, Millis DL: Effects of 3.3 MHz ultrasound on caudal thigh muscle temperature in dogs. *Vet Surg* 30:170, 2001
2. Draper DO, Castel JC, Castel D: Rate of temperature increase in human muscle during 1 mHz and 3 mHz continuous ultrasound. *J Orthop Sports Phys Ther* 22:142, 1995

3. Montgomery L, Elliott SB, Adair HS. Muscle and tendon heating rates with therapeutic ultrasound in horses. *Vet Surgery*. 42:243-249, 2013
4. Draper DO, Prentice WE. Therapeutic ultrasound. In: Prentice WE, editor: *Therapeutic Modalities in Sports Medicine*. 5th edition. Madison (WI): McGraw-Hill; 2003. p. 103.

Therapeutic ultrasound for tendon injury

