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### Original Research

## Temperature Increases in the Human Achilles Tendon During Ultrasound Treatments With Commercial Ultrasound Gel and Full-Thickness and Half-Thickness Gel Pads

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### Abstract

**Context:** Although originally manufactured for use in diagnostic imaging of internal structures, 2-cm-thick gel pads are also used as conducting media for therapeutic ultrasound over areas with bony prominences. Research on the ability of these pads to conduct enough energy to adequately heat tissues has provided mixed results. However, this research has mainly been performed on the triceps surae muscle, an area over which gel pads are not typically used. We wondered how much heating might be produced if a thinner pad was used over a tendon.

**Objective:** To compare temperature rises in the human Achilles tendon during ultrasound treatments using ultrasound gel, a 2-cm-thick pad, and a 1-cm-thick pad.

**Design:** Cross-sectional study.

**Setting:** University therapeutic modality laboratory.

**Patients or Other Participants:** Forty-eight healthy volunteers (24 women, 24 men).

**Intervention(s):** We inserted a rigid thermocouple 1 cm deep into the Achilles tendon. Ultrasound was delivered at the following settings: 3 MHz, continuous, 1 W/cm<sup>2</sup>, 10 minutes.

**Main Outcome Measure(s):** Temperature was recorded every 30 seconds for 10 minutes.

**Results:** Temperature increased the most in the ultrasound gel group (increase = 13.3°C, peak = 42°C). The 1-cm-thick pad resulted in higher tendon temperature (increase = 9.3°C, peak = 37.8°C) than the 2-cm-thick pad (increase = 6.5°C, peak = 4.8°C). The 1-cm pad produced approximately 30% more heating than the

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2-cm pad (SE = 0.72,  $P < .03$ ).

**Conclusions:** The thinner pad transmitted ultrasound more efficiently than the thicker pad. Thus, a gel pad of less than 1-cm thickness might be useful for superficial areas, such as the hands and ankles.

**Keywords:** [therapeutic modalities](#), [coupling agents](#), [tissue temperatures](#)

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