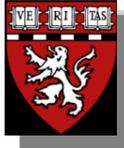


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### THE EFFECTS OF ACOUSTIC WAVES ON A VARIETY OF TISSUES

The effects of acoustic waves on a variety of tissues is under continuous investigation. Some of the effects are more widely accepted by the medical community than others;

**Shock waves are acoustic waves that are characterised by high pressure amplitudes and an abrupt increase in pressure in comparison to the ambient pressure. As mechanical waves, they can pass through the surface of a body without injury and may act therapeutically in predetermined areas within the body...**

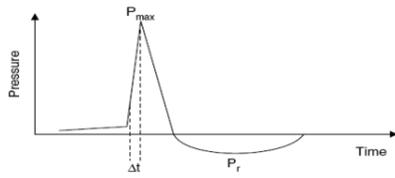


Fig. 1. Characteristics of shockwaves.  $P_{max}$  = pressure maximum;  $P_r$  = negative peak pressure;  $\Delta t$  = pressure rise time.

Energy category	Range of energy density (mJ/mm <sup>2</sup> )
Low	<0.08
Medium	0.08-0.28
High	>0.6

...there, occur a pressure disturbance that propagates rapidly through a medium. The wave appears an acute rise in pressure amplitude (represents the time between 10 and 90% of the total initial rise time) at the wave front of less than 10 nsec ( $\Delta t$ ), a low tensile amplitude, a short life-cycle (less than 10 msec), a broad frequency spectrum (16 to 20 MHz) and a variable negative pressure at the end...

Although it is not fully clarified what the specific universal mechanism is that leads to the clinical benefits of ESWT, it is believed to result from direct mechanical effects on the cells to increase porosity; a mechanotransduction type effect from the acoustic differences between cells and the surrounding extracellular matrix, which results in a shear stress on the cell; the violent collapse of cavitation bubbles and their effects on cells; and on a tissue level due to increased angiogenesis. Whether the effect is direct or indirect the release of growth factors and the upregulation of cell activity is responsible for the histogenesis and repair processes.

**Harvard-MIT Health Sciences and Technology**

- We investigated the effects of ESWT on rat hind limb tissue (skin, muscle, bone, vasculature);
- 3 # 8 wk old Female Rats (wt. 140 – 160gm), were subjected into three therapeutic sessions, 1week apart.
- The treatment head was aligned with the operational area (median femur).
- 1000 shocks delivered at 0.15mJ/mm<sup>2</sup>
- Sacrifice, fixation, decalcification, sectioning and staining H/E, followed

### Normal leg full view

### Normal bone

### Shocked cortical bone

Dramatic increase in thickness of parenchyma (consistent with the other shocked sample)

### RESULTS:

The results showed dramatic increase in thickness of parenchyma, reduction of trabeculae in bone marrow, increased osteoblast density in outer periphery of cortex, which lead to the evidence of new bone growth on outer periphery of cortex. No other peripheral tissue observations appeared...