Laser vs. Shockwave: What is the Best Choice for Soft Tissue Injuries?

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Modalities are generally devised to help promote healing and/or decrease pain. Two advanced devices that focus on treating soft tissue injuries include Class IV laser and shockwave technology. While both can be effective, how they work and what conditions they are best suited for can be confusing.

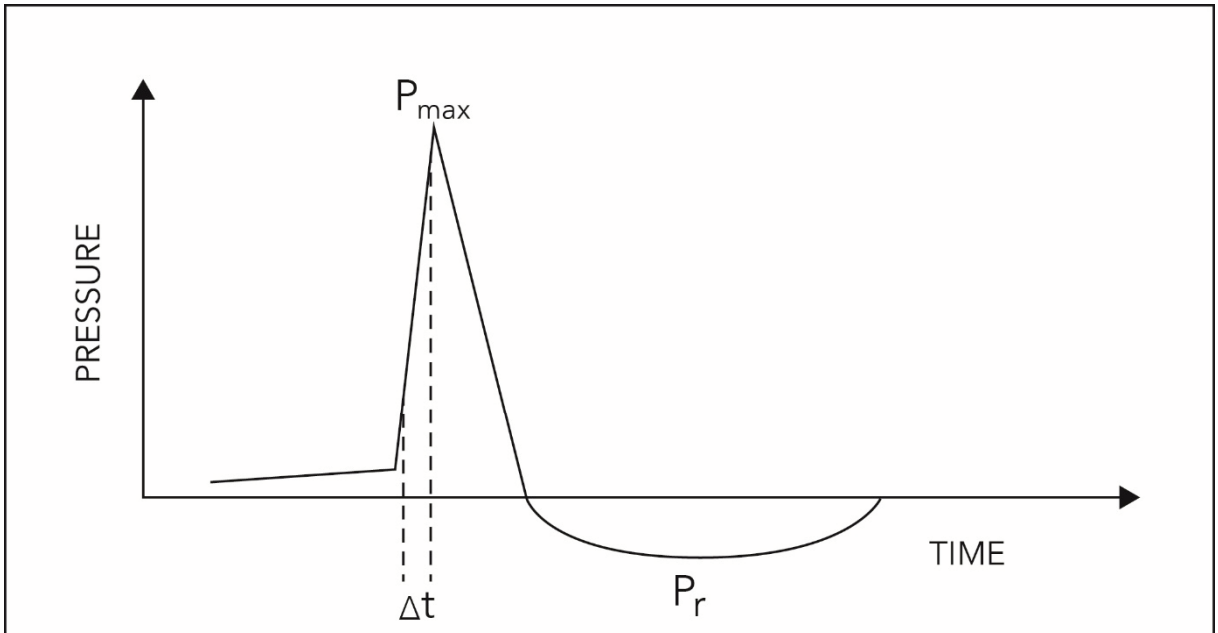

Fig. 1. Characteristics of shockwaves. $\mathbf{P_{max}}$ = pressure maximum; $\mathbf{P_r}$ = negative peak pressure; **Δt** = pressure rise time.

Mechanism of Action

While laser imparts photonic energy into tissue to create photochemical changes at the mitochondrial level in a process referred to as photobiomodulation (PBM), therapeutic shockwave (ESWT) devices deliver radial or dispersive sound waves into tissue. The uni-phasic waveform of a shockwave provides peak pressures that are 1000 times greater than a biphasic ultrasound wave, followed by a second phase of negative peak pressure that creates a cavitation effect. This is believed to create microscopic damage to tissue which spurs on the inflammatory responses[1,2].

Clinical Effects

While shockwaves' MOA is not completely understood[2], established treatment effects include the following, some of which are shared with PBM:

- Mechanical stimulation
- Increased local blood flow*
- Increase in cellular activity* – release of substance P*, prostaglandin E2*, NO*, TGF β*, VEGF, and almost certainly other inflammatory cytokines*
- Transient analgesic effect on afferent nerves*
- Breakdown of calcific deposits (primarily, but not exclusively in tendon)

**Indicates shared treatment effects with PBM. It should be noted that laser generally downregulates inflammatory mediators and associated pain factors like Substance P, as opposed to the increase Shockwave creates. This is an important differentiator.*

Target Tissues

Since laser impacts mitochondrial activity, it can influence most eukaryotic cells. This means it can be used on nerves, tendons, muscle, ligaments, joint capsules, bone, and wounds. This provides significant flexibility when treating both acute and chronic conditions in different areas of the body.

Shockwave is best applied to recalcitrant problems such as chronic insertional tendinopathy (lateral epicondylitis, plantar fasciitis, patellar tendonitis) and calcific tendonitis of the shoulder[1,2]. There is also research that supports treatment of non-union fractures of long bones[3,4,5] and avascular necrosis of the femoral head[6,7,8,9].

Similarities/ Differences

The two modalities are similar in that they both can help improve blood flow and promote growth factors to damaged tissue. They differ in that while they both influence inflammation, laser generally helps reduce it, while shockwave increases it. Think of the laser as cellular concierge helping guide cells through the stages of healing in a faster and more efficient manner. Shockwave is a professional wrestler that is body slamming tissue; restarting the inflammatory process in order to promote blood flow to areas that need it.

Recent Research

Despite their differences, a 2019 study endorsed the use of both devices together to treat plantar fasciitis. Laser was applied after shockwave which had better outcomes then using either modality independently[10]. A separate 2017 plantar fasciitis study concluded that laser and shockwave were equally effective for improving pain and functional scores, and that both were more effective than treating with standard ultrasound[11].

Contraindications

Regarding contraindications, laser *can* be used over total joints, hardware, and lung fields; whereas shockwave should not be used over lung tissue and can cause cemented implants to loosen. Other contraindications are fairly similar between the two. You would not want to use these devices over an active infection, the lower trunk of pregnant women, epiphyseal lines, or active cancer sites.

Knowing the tissue type, pathology, and the acuity level of an injury should help define whether one or both of these modalities should be used to stimulate healing and maximize outcomes.

References:

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