INFLAMMATION CONTROL WITH ULTRAHIGH FREQUENCY SOUND

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It has been demonstrated that ultrahigh frequency sound (***ultrasound***) may be used to drive chemicals into living tissues. This process is called ***phonophoresis***. It is thought that ultrasound's demonstrated ability to increase cell membrane ***permeability*** may be a major factor in this process, allowing whole molecules of a particular medication (if small enough) to be driven into the tissues (hydrocortisol is a prime cited example). Additionally, it is thought that increased cell membrane ***permeability*** may be augmented by ***radiation pressure*** produced by the ultrasound, forcing the medication away from the transducer head into the tissues.

Phonophoresing a carpal tunnel

An effect called ***acoustic streaming*** apparently causes the medication forced into the tissues to follow the well-focused ultrasound beam into the tissues, concentrating the medication in the tissues in the path of the beam, with some of the medication ultimately reaching the extreme depth of ultrasound penetration. Following phonophoresis, measurable amounts of ***hydrocortisone*** have been recovered from skeletal muscle tissue, at least six cm. below the skin.

Population and double blind studies on humans have been performed testing the efficacy of phonophoresis. The results of these tests have varied a good deal. All tests have shown, however, that subject groups suffering from pain demonstrate a statistically higher success rate when treated with ***anti-inflammatory*** chemicals, or ***analgesics***, applied through phonophoresis than those groups treated with a ***placebo*** and ultrasound, or a placebo and ultrasound at zero intensity. Clinically, the phonophoresis of various medical preparations has been shown to be a safe alternative method for the delivery of concentrated doses of chemical agents without the risk of the infection and pain inherent in percutaneous injections.

Application:

- The ultrasound unit should be preset to deliver a 1 Mhz, ***pulsed*** waveform, at between 0.8 and 1.5 W/cm².

- A medical preparation containing an ***anti-inflammatory*** active ingredient (***topical ibuprofen*** is preferred) should be thinly and evenly spread over the treatment site.

- The sound head should be applied with a ***light touch***, in an even distributing manner. The sound head should be slowly moved over the treatment site (being careful to keep the sound head flat up against the skin) in continuous circle within a circle motion, or as continuous stroking back and forth motions. The sound head should be moved at a slow, steady rate. If a stationary sound head and a ***pulsed*** waveform are used, no motion of the sound head is necessary, but the practitioner should remain in constant attendance, being careful to maintain the subject's comfort.

- Treatment should continue for six minutes (assuming an area less than or equal to 72 cm²).

- Treatment should occur daily until treatment goals are reached**.**

Of the techniques explored to date, by far the most effective means of relieving soft tissue inflammation has been shown to be the phonophoresis of ***anti-inflammatories*** directly into affected tissues.

Of the anti-inflammatory medical preparations commonly used in phonophoresis for the treatment of soft tissue inflammation, ***hydrocortisone*** is the best known. Its beneficial effects include its ability to decrease cell membrane permeability, thereby preventing further bradykinin and other irritant components (the precursors of ***prostaglandin***) from being released from the cell, and its ability to stabilize ***lysosome bodies***. These attributes aside, corticosteroid treatment can result in some ***bad side effects*** (i.e., it can make things a lot worse). The cortisone used is derived from ***non-human*** sources and, as a result, can serve as an irritant by virtue of its incompatibility with the subject's own biochemistry. Consequently, the author is less than enthusiastic about using hydrocortisone for phonophoresis due to the uncertainty of its direct effect on the pain.

Some practitioners have begun to treat human inflammations with the phonophoresis of various ***salicylates***. These are generally selected for their ability to retard the formation of ***prostaglandins*** through the inactivation of cycloozygenase, an enzyme that converts fatty acids into concurrent interstitial swelling. Clinical experience has shown this treatment to be effective, but comparatively ***slow***.

The phonophoresis of ***di-alpha tocopheryl*** (vitamin E) reportedly provides the effect of decreasing cell membrane and capillary bed permeability (providing much of the beneficial effect expected of hydrocortisone) with the added facility of suppressing histamine production and relieving venule constriction (claudication). This treatment provides fairly rapid relief of pain without the dangers to ***renal function*** posed by the salicylates. Phonophoresis of di-alpha tocopheryl has also been found to be useful in increasing the healing rate of ***open wounds*** and reducing ***scar formation***.

Ibuprofen in topical form has been clinically shown to be superior to all the other above-mentioned chemicals for stopping the inflammation process when sonicated into irritated tissues. It does this by dramatically halting the production of prostaglandins**.**

Clinical studies on humans have established that ***ultrasound alone*** is ***not*** an effective treatment of ***soft tissue inflammation***. Indeed, several ***double blind controlled studies*** have demonstrated that ultrasound alone is no more effective than sham ultrasound (not turned on) for the treatment of inflammation. Indeed, other data would seem to indicate that ultrasound used alone might be considered contraindicated for the treatment of inflammation. One of the factors that make ultrasound effective for phonophoresis is its ability to increase cell membrane permeability; its application may therefore be more likely to spread inflammation by causing the "***leaking***" of ***inflammatory chemicals*** (bradykinin, histamine and prostaglandins) into adjacent soft tissues, thereby spreading the inflammation. This may be a bit “far-fetched”, but worth consideration in lieu of more definitive research.

Considering the above, and having clinically studied the lack of positive results from applying ultrasound without an anti-inflammatory coupling agent, it is the ***author’s opinion*** that such treatment is a waste to time and effort (except possibly for a ***placebo effect***).

[See ULTRAHIGH FREQUENCY SOUND, Precautions]

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