

# Prof. M. Kravchik. Focused shock wave therapy in the treatment of the spine. Oxford, UK 2013

## Non-invasive treatment of herniated discs by focused shockwave therapy

In orthopedic practice meets a number of pathologies, surgical treatment which is necessary because of the inefficiency of the traditional conservative therapy. These pathologies, in particular, diseases of the spine - such as protrusion, herniated disc, low back pain, osteoporosis and spondylitis. At present, there are solutions of non-surgical treatment of these diseases - manual therapy, skeletal traction, epidural blockade, physiotherapy etc.

The disadvantages of the known methods is that in their application eliminates only a consequence of disease (soft tissue swelling, inflammatory and infiltrative reaction and pain), but the reason (actually a herniated disc) remains unchanged and continues to progress.

The technical result is achieved using focused shock wave therapy (F-SWT), is the high efficiency of treatment, the possibility of outpatient treatment, no scarring, no postoperative complications, a low likelihood of recurrence of a herniated disc. The claimed technical result is achieved in the implementation of a method for treating morphological and anatomical abnormalities of the intervertebral discs, which takes place in three stages.

In the first stage of treatment is carried out, at least one course of adjuvant therapy, aimed at maximizing the softening of the disc hernia (determined based on MRI), as well as to suppress the inflammatory response and relief of pain. Combined therapy in the first stage of treatment involves microwave heating of muscles and ligaments in the affected area, phonophoresis, electrical muscle stimulation and anti-inflammatory drug therapy.

Microwaves are electromagnetic radiation between radio waves and infrared between 1 m and 1 cm at a frequency of 30 MHz 300 MHz In medicine, uses three frequencies of microwaves (respectively - three lengths): 2450 MHz (12.245 cm), 915 MHz (32.79 cm) and 433.9 MHz (69.14 cm). In Europe, use all three frequency microwave therapy, in the U.S. - only the first two. Physiological effects of microwave exposure therapy in a living organism are to improve the metabolic activity of cells, reducing the viscosity of fluids, increased extensibility of collagen, increase in blood flow, the effective impact on the nervous system. Therapeutic effect of microwave radiation is shown as an anesthetic (due to direct effects on pain gate, rapid removal of irritants and by increasing blood flow, reduce muscle spasms, sedation), the reduction of muscle spasm, the acceleration recovery by increasing metabolic activity, which has an impact on post-traumatic process, and for a chronic infectious process, the softening of the collagen tissue, scar tissue and other fibrosis, treatment of muscle tissue by increasing intramuscular blood flow.

Drug phonophoresis is based on a combination of the physiological effect of the galvanic current, in combination with drugs. In general, this mechanism can be represented as follows: pain gates have an effect on A-delta (fast) and C (slow) pain fibers in the posterior horns of the spinal cord by stimulation of mechanoreceptors (A-beta), a high-fiber low-intensity electric shock, and in combination with selected drugs produce morphine effect on C-fiber system for the production of stimulation A-delta fiber pain receptors, resulting in changes around the ionic balance of cells, accelerates the healing of skin wounds and bone, fibrous tissue is restored, increases cellular metabolism and cell membrane potential is restored increases microcirculation.

Interferential current therapy is to pass simultaneously through the same thing two different mid-field pulses. As a result, the tissues formed a new current. The amplitude of the new current is composed of two amplitudes of the electric current flows. If the amplitude of the currents is directed in opposite directions - the new current is formed. Are summarized as frequencies and both the current flow, if the frequency of one of the threads 4000 Hz, 4100 Hz and the other, the frequency of the new current will be 4050 Hz. Midrange currents is much easier to pass through the skin and have less resistance to the use of short pulses. At a frequency of 4000 Hz each individual phase lasts 0.125 ms, which corresponds to a very high intensity stimulation of the nerves. Potentiate the effect it produces, which never reached the low-frequency therapy and stimulation. This thread is much easier to pass through the fabric as it midrange, and nerve stimulation provides the modulation

amplitudes. Analgesic effect Interferential current is provided: Activation mechanism of the gate pain due to stimulation of large diameter, low threshold of excitability of nerve fibers by high-frequency - about 100 Hz, the activation of A-delta and C fibers. Activation of their production takes place under the current frequency of 10-25 Hz, the possibility of high frequency (50 Hz) to form a block in the endings of fibers and the local increase of current output of fluid and tissue fluid as a result of moderate muscle contraction and stimulation of the autonomic nervous system contribute to the exit of the nerve chemicals that block pain impulses conduct.

Anti-inflammatory therapy is to perform paravertebral blockade of the affected disk. As the use of analgesics and/or homeopathic drugs - Discus compositum, Traumeel, Placenta compositum etc.. If necessary, in the case of acute inflammatory process, increase the intramuscular treatment of non-steroidal anti-inflammatory drugs (Voltaren 75mg) once a week. In exceptional cases, we can recommend the appointment of small doses of corticosteroids (5 mg Diprospan) at 0.25-0.5 mg of paravertebral blockades on the condition that the total quantity of the substance does not exceed 1.5 mg (1 \ 3 ampoules) per week. In the treatment of the thoracic spine dose of medication to increase by 25-30% compared to the above treatment of the cervical and lumbar spine in the treatment dose is increased by 10-15%.

The success of the first phase of treatment is determined by the results of the repeated images of magnetic resonance imaging (MRI) of the affected disk, which is determined by the dynamics of the consistency of disc hernia. In some cases, you may need during the contrast enhancement MRI images.

In the second phase of treatment is applied, at least one session F-SWT aimed directly at the area of pathological focus - hernia (protrusion) of the intervertebral disc. Number of sessions depends on the anatomical and physiological characteristics of a herniated disc

As used in the second stage of treatment method focused shock wave therapy (method F-SWT) based on a short (0.1-0.3 sec) application to the field of disease focused high-impact low-frequency sound waves, which improves local blood circulation, loosens the calcium deposits and fibrotic lesions, which cause inflammation and pain. One of the major effects of the shock wave is to stimulate the development of a new microvascular subject area.

A theoretical aspect of F-SWT is based on creating a shock wave with a high flux density, which focuses on a limited target area. This is to ensure that the shock wave will develop a total energy only in the selected treatment area without harming surrounding tissues. Hyperbaric effect of F-SWT is based on the ability of acoustic vibrations in the tissues to form cavitation in the migration of liquid into a gas and leaving it out. This component of treatment F-SWT is crucial in the treatment of protrusion and hernia of intervertebral discs.

Stabilization of the microcirculation around the cavities: F-SWT produces massage, which is very important in the treatment of edema. In the acute stage of inflammation shock waves helps to remove histamine from the tissues and prevents the formation of other risk factors in the cells, which is associated with an increase in the diffusion of calcium ions across the cell membrane. The outcome of this process is to reduce the intensity of inflammation in the tissues. In the granulation phase of the inflammatory process stimulated the formation of fibroblasts for a new vascular network, as well as collagen and new capillary system of the vascular network.

Thus, the different effects produced in the tissue, may lead, for example, the reversible deformation of cell membranes due to mechanical impact or shock waves to stimulate the healing process due to the intensification of metabolic processes, such as in the cases observed in the orthopedic practice in the treatment of inflammatory degenerative changes of intervertebral discs. The parameters that determine the success of extracorporeal therapies are mostly energy and energy flux density. These parameters depend on the characteristics of disc hernia, and are selected for each patient individually.

Mechanical or acoustic energy of the shock wave is determined by the pressure amplitude and duration, the acoustic properties of the medium (density and acoustic velocity) and the spatial distribution of the shock wave.

In order to achieve a noticeable effect in the tissue, the energy of the shock wave should focus on just a limited target area, where it exceeds the threshold value and produce a therapeutic effect. It is believed that shock waves are effective when the pressure reaches 50 bar (5 MPa), and more. This zone corresponds to the so-called 5 MPa focus. This takes into account only the positive component of the amplitude of the shock wave and the negative component (stretching waves) are neglected

Extracorporeal shock wave therapy is performed at threshold energy, selected from a range of 3-12 MPa. At the same time is considered to be the best way to find a course focused extracorporeal shock wave therapy, at a time when the hernia is reduced by 0.2-0.3 mm. As shown by studies to achieve a similar effect in the treatment of the cervical spine disc hernia is to achieve an optimal threshold value of energy at the focus of the 3-5mPa, to the thoracic spine threshold is increased to 6-8 MPa, and for lumbosacral spine threshold is increased to 10 - 12 MPa. The energy is settings during the session F-SWT, and the pulse frequency (from 2 to 8 Hz) is determined by the doctor depending on the dynamics of the effectiveness of the therapy.

If the patient begins to experience pain even when properly focused stream of shock waves, it is necessary to reduce their energy at 1.0-1.4 MPa. You can also reduce the frequency of the pulses at 1-2 Hz. Practice shows that in most cases this is enough for a relatively small decrease in the effectiveness of therapy. For maximum effect, the penetration of waves in the tissues of the body is desirable to use the gel agents, such as conductive gel for ultrasound therapy/diagnosis. At the same time the head of the emitter F-SWT tightly pressed against the surface of the body, slowly moving across the surface so as to focus the radiation has always been concentrated in the area of the damaged disc.

As mentioned above, the rate of F-SWT consists of a large number of sessions. To reduce the size of a herniated disc at 1 mm is required from 3 to 6 treatments. It is absolutely necessary to perform control magnetic resonance imaging (MRI) to be treated spine every 10-15 sessions to manage the process of regression. Completion of the second phase must also be accompanied by a final MRI study.

The third stage is the final treatment and serves to secure the result, and to restore the damaged nerve due to the complex, which includes electrical muscle stimulation, massage and exercise. Experience shows that fixing the number of procedures in the third stage is determined by the degree of pre-compression of the nerve and can be 3-15 sessions. In the third phase of treatment can additionally be introduced by intramuscular injection of vitamin B12 and injections of homeopathic remedies, such as Neurology 1.0 and 2.0 for the purpose of 1 ml 2-3 times a week.

The table below compares the traditional invasive methods of treatment of hernias of intervertebral discs (the disc prosthesis, endoscopic aspiration or coagulation) and method focused shock wave therapy:

surgical treatment	F-SWT
1. Inpatient treatment (from 4 to 45 days), requiring hospitalization for a period of treatment*	1. Outpatient treatment allows the patient to maintain for the duration of treatment with their lifestyle
2. Scarring changes of the operated tissues, leading to long-term periods to the compression of nerve plexus	2. No scarring, no postoperative complications
3. The relatively high rate of relapse (38%) herniated disc*	3. The relatively low rate of relapse (less than 4%), herniated disc*
4. High levels of postoperative complications (8%), including complications of anesthesia*	4. Absence of postoperative complications
5. The outcome of invasive intervention is relatively little dependent on compliance with post-operative mode	5. The outcome of therapy is largely determined by adherence

\*According to statistics obtained «Pain Clinic Unique methods of medical treatment»

Thus, the advantage of the focused shock wave therapy compared with invasive treatment is its high efficiency, physiology, and a small number of complications (including the long-term).

These conclusions were based on a 15-year experience of 27 000 patients with different pathologies of the intervertebral discs. Some of the patients underwent surgery in different hospitals in Israel. Another part of the course was focused extracorporeal shock wave therapy. By a combination of factors - the effectiveness of treatment, number of complications, the presence of the indications and contraindications - the effectiveness of F-SWT was 97% compared with surgical treatment - 42%, and endoscopic intervention - 83%. Thus, the above examples demonstrate the high efficiency of the proposed method of non-invasive treatment of pathologies of the intervertebral discs, and allows its use in cases where previously been shown to invasive intervention.

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