Does Acupuncture improve strength and nerve conduction in RA patients with hand affection? A protocol study

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Abstract
Rheumatoid arthritis (RA) is a chronic systemic inflammatory disease which an unknown cause triggers an autoimmune reaction, leading to synovial hypertrophy and chronic joint inflammation along with the potential for extra-articular manifestations, and it is theorized to correlate to genetically susceptible individuals. With this protocol study we intend to assess the impact acupuncture might have in RA patients strength level as well as nerve conduction impairment. It is expected that the results of the clinical data can reveal positive enough to support a future investigation, required to be done in a randomized, controlled, ideally double-blinded methodology.

Being RA a chronic condition affecting such an important number of people around the globe, it would be extremely beneficial to have further treatment options that could be used as co-adjuvant therapy, to the regularly prescribed Western pharmacological drugs.

The results of this clinical case reveal a positive and significant enhancement of nerve conduction. However, in order to obtain clear observations on the chronic systemic inflammatory disease with acupuncture treatment, a deeper research with larger individual samples should be carry out under control and experimental conditions.

Key words: rheumatoid arthritis, acupuncture, electromyography, dynamometer, clinical case

Introduction
Rheumatoid arthritis (RA) is an inflammatory, multisystem, and chronic autoimmune disease which manifests by symmetrical persistent inflammatory synovitis involving destructive polyarthritis of the synovium. This disease has a higher incidence rate in women than men and affects approximately 0.3% and 1% of the world’s population, mostly in developed countries. This condition is popularly designed as a disease attacking mainly older people but in fact, it tends to affect between the ages of 20-40 years old (1). In Portugal alone, this pathology affects approximately 40,000 people properly diagnosed (2). The damage caused by RA is irreversible and can cause disability for the loss of movement, limitation for work and very low quality of life.

Due to the incapacitating characteristic of this disease, patients are dependent of pharmacology on a daily basis to kill the pain and try to delay the disease progress which implicates an extreme high cost for the society as well as for their own finance status. Gradually these people become more limited and a least 50% are unable to work up to 10 years after the initial diagnose (1). Treatment of RA is dominated by the use of anti-inflammatory non-steroids, including Cox-2 inhibitors, modifying anti-rheumatic drugs and analgesics. Recently, it became common to prescribe biological agents (4). However, this type of drugs is associated with unwanted side effects, toxicity and limited efficacy (5,6). Biological agents have higher costs and side effects, such as life threatening infections and increased risk of malignancy, limiting their use (4). These and other limitations have led about 60 to 90% of patients with RA dissatisfied with conventional treatments, resort to Complementary and Alternative Medicines treatment, including acupuncture (3,4,5).

It is known that acupuncture stimulates the nervous system releasing neurochemical and inducing bio-
chemical changes that influence the homeostatic mechanisms of the body. It can also positively affect brain areas that reduce the sensitivity to pain, inflammation and stress, by promoting the release of vascular factors and immunomodulators and improve the biomechanical functions (9).

Acupuncture in RA may decrease pro-inflammatory cytokines IL-1 and IL-6, and increased cytokine inhibitors IL-4 and IL-10 (8); induce the expression of vasoactive intestinal peptide, an anti-inflammatory neuropeptides (9); inhibit the function of synovial mast cells (which are substantially involved in the initiation of inflammatory arthritis) and restore the hypothalamic-pituitary-adrenal axis (10). It is also known that acupuncture stimulates the nervous system, which leads to the release of endorphins and other neurohumoral factors, changes in the treatment of pain in the brain and spinal cord (11) and an increase of local microcirculation (12) that helps the reduction of edema.

The nerve fiber is the name given to an axon or a dendrite of a neuronal cell. In the central nervous system, the nerve fibers are referred as neural tracts and the ones of the peripheral nervous system are called peripheral nerves (13).

It is known that there are two types of nerve fibers: myelinated nerve fibers, which have a myelin sheath in the casing; and unmyelinated nerve fibers that do not have myelin sheath case (13).

The nerve fiber conduction velocity is proportional to the cross-sectional area of the axon caliber so, the higher the caliber is, the faster the driving speed. The speed also depends on the fiber being or not being myelinated.

Nerve conduction is faster in myelinated nerve fibers. The myelin sheath case works with insulation and fiber can be stimulated in Ranvier nodes, where the axon is exposed and ions can freely pass through the plasma membrane, between the extracellular fluid and axoplasm. The potential action of a node “jumps” to the next, presenting a “jumping” conduction, which is much faster than in non-myelinated fibers, where the action potential passes continuously along the axon progressively exciting the surrounding areas of the membrane (13,14).

Conduction velocity also varies depending on the length of the nerves and metabolic factors.

The frequency of muscle contraction depends on the amount of acetylcholine that is released to the motor plate which, in its turn depends on the number of nerve impulses that reach the nerve terminal.

Therefore, the contraction of skeletal muscle fiber is controlled by the frequency of nerve impulses that reach the motor nerve ending. The amount of nerve impulses that are transmitted are, in this way, limited by the absolute refractory period and the intensity of the stimulus.

This clinical case aims to acquire initial results of the effect of acupuncture, as an adjunctive treatment to RA condition, and assess the possible benefits on the strength and nerve conduction improvement.

**Methodology**

This is a clinical case and the patient is female, 43 years old, and has RA diagnosed for 18 years, with a licentiate degree. She has a medical history of joint surgery and refers that the exposure to cold relieves pain and exposure to heat worsens, the application of cold relieves pain, the application of heat worsens.

She mentions a high consumption of mineral water and does not eat dairy or derivatives, ingests with moderate frequency red meat and farmed fish, as well as cold and raw foods such as salads and fruits.

In order to be eligible for the study, the patient was diagnosed on a TCM (Traditional Chinese Medicine) base, and confirmed to have a so-called Turning Point syndrome, being this determined based on the Shang Han Lun theory.

This clinical case has been selected based on the following criteria:

**Inclusion criteria:**

- present active RA fulfilling the ACR criteria of RA
- patient must be taking western drugs on stabilized dosages for at least 3 months prior to intervention
- show impairment of hand strength with or without pain in the hands during the grip procedure
- chronic pain: either persistent or intermittent over a minimum period of three months prior to recruitment
- current pain: greater than 30/100 mm on a visual analogue scale (VAS) within the last 24 hours despite medication and stable dose treatment for at least 3 weeks

**Exclusion Criteria:**

- patient who are under the age of 18 years
- previously had acupuncture
- have localized skin infections
- have severe chronic or uncontrolled co-morbid disease
- have the wish to get a pension

To measure the nerve conduction and strength we have used Biopac model UM100. For the strength we have used a dynamometer tool connected to the Biopac.

The nervous conduction was measured by applying disposable electrodes and the electromyography was done by the Biopac as well. Measurement tape was used to measure the length of the forearm to allow us to calculate the nerve conduction velocity after stimulation (electromyography).

For the acupuncture intervention we have used sterile subcutaneous needles (0.30mmx8mm). The initial measurement is taken before acupuncture intervention (T0). The second measurement is taken 5 minutes after the acupuncture technique (T1). After 24 hours we have repeated the measurements before (T2) and after acupuncture (T3). The nerve conduction is always measured on the

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dominant arm while the strength was evaluated on both arms. It has been decided to use the Leopard Spot technique, a bloodletting acupuncture therapy that uses sterile subcutaneous needles (0.30mmx8mm) and is clinically applied by pricking 4 times each of the selected acupoints.

**Results**

In the present work, the diagnosis was based on the Heidelberg Model of TCM and for the treatment of this pathological picture, we choose the points Tk5 (*clusa externa/ waiguan*), C3 (*mare minus, shao-hai*), R7 (*amnis recurrens, fuliu*) and F39 (*campana suspensa, xuanzhong*). These are all points from conduits/orbs that are affected in the Turning Point syndrome: Tricaloric orb and felleal orb (Stage III) as well as cardiac orb and renal orb (Stage VI). In general, it seems that this protocol was well succeeding and it is adequate for future deep research on hand affection. So, the results concerning nervous conduction and muscle strength are showing on the Table 1, Figures 1 and Table 2, Figure 2, respectively.

**Discussion**

It is known that the chronic condition of RA patients, have massive repercussions on their daily life, affecting simple tasks and hugely impacting on the quality of life. A study of *Ekdahl et al.* shows that rheumatoid group, compared with the healthy group, had significantly reduced function on all isometric and isokinetic tests of the extensors and flexors of the knee. Being a condition which involves chronic pain, the patients get gradually more and more conditional to daily tasks and the muscle fibres become less required and tend to become impaired by loss of muscle tonus as well. As referred on a study performed by *Bekkelund Sl et al.* (*Ekdahl et al.*), decreased values for nerve conduction studies found in the patients may indicate impaired nerve functions in RA (*Ekdahl et al.*).

It is known that acupuncture stimulates the central nervous system and thereby causes the release of neurochemical messenger molecules as well as biochemical changes that influence the body's homeostatic mechanisms. It might also positively affect areas of the brain that reduce sensitivity to pain, stress and inflammation, by promoting the release of vascular and immunomodulatory factors.

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<th><strong>Figure 1</strong> – Nerve conduction velocity (meters per second – m/s) and reaction time (milliseconds – ms).</th>
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<th><strong>Table 1. Electromyography (mV)</strong></th>
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<td>Dominant Arm</td>
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<td>T0</td>
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<th><strong>Table 2. Strength test performed by the dynamometer (Kg)</strong></th>
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<td>Evaluation moment</td>
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We have performed the dynamometer test on both arms. The results obtained on the dynamometer test are not relevant whereas we can verify a light decrease on the strength of the left arm on the 1st day and a slight decrease on the right arm on the 2nd day.
and improving biomechanical functions (17).

This clinical case and preliminary protocol aims to get initial data to assess the feasibility of using acupuncture as an adjuvant therapy to the regularly Western treatments prescribed. We can objectively say that the nerve conduction was significantly improved after the acupuncture intervention whilst the strength has shown no positive progress. In this clinical case, we have only evaluated the acute effects of acupuncture treatment. In an attempt to answer the research question regarding the strength results, these show that acupuncture did not improve hand strength. Both assessments were performed 5 minutes after treatment. The instrument used to evaluate hand strength (dynanometer) has a mechanism which involves bone compressing. The technique chosen to assess the grip strength may be one of the factors associated with the data values being worsened since we are evaluating patients with an associated inflammatory factor.

The patient was diagnosed at an early age with Rheumatoid arthritis which means that the chronicity of her condition is 18 years old. It is reasonable to assume that the results obtained on the strength might not be significant as the muscle fibres have been less and less required over the years which led to some visible muscle atrophy. It would be necessary to extend the acupuncture interventions to verify if this could stimulate the fibres and improve strength of the hand grip.

This clinical case enables us to determine that there are also some limitations needed to be taken into consideration on a posterior enlarged-scale study:
- A future study should be done as a randomized, double-blinded protocol;
- The small sample size does not allow statistical data;
- An enlarged study should include minimum of 2 groups: control group and experimental group.

Conclusion
The results obtained on the nerve conduction improvement look promising regarding the possible therapeutic action of acupuncture. Tests performed to the strength show no improvement at all, however, seems pertinent to think that, by improving the nerve conduction, it is likely to achieve, in a more prolonged treatment, an improvement on the muscle fibres function, therefore increasing the strength of the hand grip.

Due to the fact that this is a single clinical case, it is recommended to be cautious on the positive action of the acupuncture intervention. Nevertheless, it seems appropriate to suggest an investigation of larger scale, randomized, preferably of a double-blinded, with a minimum of 2 study groups (control group and experimental group) in order to assess the scientific veracity of these preliminary results.

If these corroborated that acupuncture has a positive action in enhancing nerve conduction and increase strength, this could be an adjuvant treatment option to offer to patients suffering from this chronic, limiting disease.

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