

S E P T E M B E R - O C T O B E R 2 0 1 6

Four Leg News

Volume 5 : Issue 5



Do you...

Question the validity of acupuncture?

Wonder if you should add acupuncture to your practice / skill set?

Wish you could understand acupuncture better to know if, when, or how it might work?

Struggle to explain acupuncture to your clients?

Struggle to explain acupuncture to your referring veterinarians?

This newsletter may give you the tools to do all of these!

The Acupuncture Issue

I was pretty excited in finding the papers I want to share with you in this edition of Four Leg News! Since I approach things from a science background, I wanted to find papers that sought to explain acupuncture by way of medical – anatomical processes. The four studies I found succeeded in that goal! So I apologize for the length of this newsletter, but I'm sure that all of you science nerds out there will appreciate the extra effort that went into summarizing these lengthy articles for your knowledge-expanding pleasure! Cheers! Laurie Edge-Hughes

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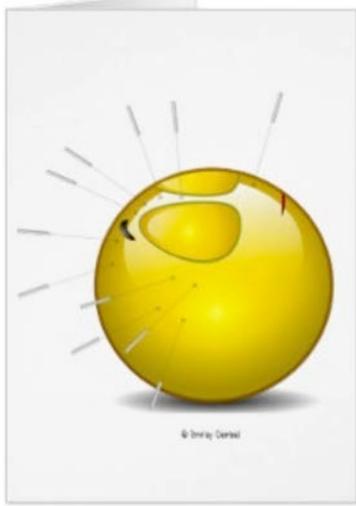
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Meridian Channels

Connective tissue interstitial fluid, mechanotransduction, durotaxis, & Mast cell degranulation...

Mechanical Signalling

What needle grasping might be communicating through the tissues...



World Health Organization. Acupuncture: Review and analysis of reports on controlled clinical trials. 2002.

Definition

Acupuncture literally means to puncture with a needle. In this publication the term “acupuncture” is used in its broad sense to include traditional body needling, moxibustion, electric acupuncture (electro-acupuncture), laser acupuncture (photo-acupuncture), microsystem acupuncture such as ear (auricular), face, hand and scalp acupuncture, and acupressure (the application of pressure at selected sites).

Need for Evaluation

Although acupuncture was introduced to Europe as long ago as the early seventeenth century, scepticism about its effectiveness continues to exist in countries where modern Western medicine is the foundation of health care, especially in those where acupuncture has not yet been widely practised.

This publication reviews selected studies on controlled clinical trials.

Therapeutic Mechanisms

To date, modern scientific research studies have revealed the following actions of acupuncture:

- _inducing analgesia
- _protecting the body against infections
- _regulating various physiological functions.

Although different acupuncture points and manipulations may have an effect through different actions, the most important factor that influences the direction of action is the condition of the patient. Numerous examples reveal that the regulatory action of acupuncture is bi-directional. Acupuncture lowers the blood pressure in patients with hypertension and elevates it in patients with hypotension; increases gastric secretion in patients with hypoacidity, and decreases it in patients with hyperacidity; and normalizes intestinal motility under X-ray observation in patients with either spastic colitis or intestinal hypotonia. Therefore, acupuncture itself seldom makes the condition worse.

Since its therapeutic actions are achieved by mobilization of the organism’s own potential, acupuncture does not produce adverse effects, as do many drug therapies.

WHO – Acup Review Continued...

Selection of Clinical Trial Reports

In recent decades, numerous clinical trials have been reported; however, only formally published articles that meet one of the following criteria are included in this review:

- randomized controlled trials (mostly with sham acupuncture or conventional therapy as control) with an adequate number of patients observed;
- nonrandomized controlled clinical trials (mostly group comparisons) with an adequate number of patients observed and comparable conditions in the various groups prior to treatment.

Review of Clinical Trial Reports

Pain

The effectiveness of acupuncture analgesia has already been established in controlled clinical studies.

Head and face

For tension headache, migraine and other kinds of headache due to a variety of causes, acupuncture has performed favourably in trials comparing it with standard therapy, sham acupuncture, or mock transcutaneous electrical nerve stimulation (TENS)

Chronic facial pain, including craniomandibular disorders of muscular origin, and temporomandibular dysfunctions, also responds well to acupuncture.

Locomotor system

Chronically painful conditions of the locomotor system accompanied by restricted movements of the joints are often treated with acupuncture if surgical intervention is not necessary. Acupuncture not only alleviates pain, it also reduces muscle spasm, thereby increasing mobility. Joint damage often results from muscle malfunction, and many patients complain of arthralgia before any changes are demonstrable by X-ray. In these cases, acupuncture may bring about a permanent cure.

The conditions concerned include cervical spondylitis or neck pain due to other, periartthritis of the shoulder, fibromyalgia, fasciitis, epicondylitis (tennis elbow), low back pain, sciatica, osteoarthritis with knee pain, and radicular and pseudoradicular pain syndromes. Acupuncture is also beneficial in the treatment of rheumatoid arthritis.

Gout

Acupuncture shows greater improvement than the conventional medication.

Biliary and renal colic

Biliary and renal colic are two conditions for which acupuncture can be used not only as an analgesic but also as an antispasmodic. In addition, acupuncture is effective for relieving abdominal colic, whether it occurs in acute gastroenteritis or is due to gastrointestinal spasm.

Traumatic or postoperative pain

For traumas such as sprains, acupuncture is not only useful for relieving pain without the risk of drug dependence, but may also hasten recovery by improving local circulation. Acupuncture analgesia to relieve postoperative pain is well recognized and has been confirmed in controlled studies. The first successful operation under acupuncture analgesia was a tonsillectomy.

Dentistry

Acupuncture has been widely used in dentistry. There are reports of randomized controlled trials on the analgesic effect of acupuncture for postoperative pain from various dental procedures, including tooth extraction, pulp devitalization, and acute apical periodontitis. Its use in the treatment of temporomandibular dysfunction is also supported.

Childbirth

In childbirth, acupuncture analgesia is useful for relieving labour pain and can significantly reduce the duration of labour. In the case of weakened uterine contractions, acupuncture increases the activity of the uterus. Episiotomy and subsequent suturing of the perineum can also be carried out with acupuncture analgesia.

Surgery

Acupuncture analgesia as an anaesthetic for surgical procedures is indicated in selected patients who show a good response to needling in the preoperative trial, particularly when they may be a poor surgical risk under conventional general anaesthesia. The use of adjuvant drugs to potentiate the effect of the acupuncture treatment is preferred. Acupuncture can also be used in combination with general anaesthesia to reduce the dosage of anaesthetic agents.

WHO – Acup Review Continued...

Infections

Acupuncture has been reported to be effective for treating acute bacillary dysentery. Acupuncture may be of use in conjunction with other medical therapies for treating infections due to its stimulation of the immune system. It's been used successfully in the treatment of hepatitis B, and haemorrhagic fever, and may be useful in treating pertussis.

Neurological disorders

In the neurological field, headaches, migraines and neuralgia are the common painful conditions treated with acupuncture. Strokes and their sequelae are another major indication for acupuncture. Early treatment of paresis after stroke has proved highly effective.

Peripheral nervous disorders are often treated with acupuncture. For example, good effects for Bell's palsy have been reported in randomized controlled trials. Facial spasm is another peripheral nervous disorder for which acupuncture treatment may be indicated.

It is reasonable to incorporate acupuncture along with other therapeutic and supportive measures in the treatment of the comatose patient.

Insomnia can also be treated successfully with acupuncture.

Respiratory disorders

Allergic rhinitis is one of the major indications for acupuncture. The acute symptoms of tonsillitis can be effectively relieved with acupuncture. Bronchial asthma is not cured by acupuncture, it may be substantially relieved, at least for short periods of time. The success rates quoted in the literature are 60–70%.

Digestive disorders

Epigastric pain is a common symptom in diseases of the stomach, including peptic ulcer, acute and chronic gastritis, and gastric spasm. Acupuncture provides satisfactory relief of epigastric pain.

Another common symptom of digestive disorders is nausea and vomiting. In all these conditions, acupuncture at point *nèiguān* (PC6) seems to have a specific antiemetic effect.

Acupuncture may serve as a complementary or alternative therapeutic measure for irritable colon syndrome and chronic ulcerative colitis.

Acupuncture for the digestive system shows it influences the physiology of the gastrointestinal tract, including acid secretion, motility, neurohormonal changes and changes in sensory thresholds.

Acupuncture shows good analgesic and antispasmodic effects on the biliary tract and, as indicated previously, can be recommended for treatment of biliary colic. In the treatment of biliary colic due to gallstones, acupuncture is not only effective for relieving the colicky pain, but is also useful for expelling the stones.

Blood disorders

Leukopenia is the most suitable for acupuncture treatment.

Urogenital disorders

Urinary retention due to functional disorders, with no organic obstruction, is often treated with acupuncture. Acupuncture is not only useful for relieving renal colic, but also for expelling urinary stones (if they are not too large), because it dilates the ureter.

In a randomized controlled trial, acupuncture had a better effect than the control in the treatment of defective ejaculation. Acupuncture may also be helpful to patients with chronic prostatitis.

In women, it has been shown that acupuncture can lower urethral pressure and relieve urethral syndrome. Acupuncture has also been successfully used as a prophylaxis against recurrent lower urinary tract infections.

Gynaecological and obstetric disorders

Acupuncture is beneficial for dysmenorrhea. It relieves pain and also regulates the motility of the uterus to facilitate menstrual discharge and further alleviate the pain.

Acupuncture seems to be helpful to patients with premenstrual syndrome.

Acupuncture is also worth trying in the treatment of female infertility due to inflammatory obstruction of the fallopian tubes, where it seems to be superior to

WHO – Acup Review Continued...

conventional therapy. The mechanism of acupuncture in regulating abnormal function of the hypothalamic–pituitary–ovarian axis has been demonstrated in experimental studies.

Acupuncture in pregnant women should be undertaken with care. Needling at some points (namely, on the abdomen and lumbosacral region), as well as strong stimulation of certain distant points, such as *hégǔ* (LI4), *sānyīnjiāo* (SP6) and *zhìyīn* (BL67), may cause miscarriage. However, this action is useful if induction of labour is desired.

For morning sickness, the efficacy of acupressure at *nèiguān* (PC6) has been reported repeatedly in placebo-controlled studies. In order to prevent miscarriage induced by needling, acupressure is recommended for this treatment.

Abnormal fetal position may be treated with acupuncture during the last three months of pregnancy. Acupuncture also stimulates milk secretion after childbirth and can be used to treat deficient lactation due to mental lability or depression.

Cardiovascular disorders

Acupuncture is suitable for treating primary hypotension and early essential hypertension.

Encouraging results have been reported for a number of controlled studies on the treatment of heart disease with acupuncture, particularly in psychosomatic heart disorders, such as cardiac neurosis. In coronary heart disease, acupuncture has been shown by various authors to be effective in relieving angina pectoris. In order to avoid unexpected accidents, however, special attention should be paid to the treatment of heart disease. Acupuncturists must be able to differentiate between angina pectoris and acute myocardial infarction.

Psychiatric disorders

Acupuncture is being increasingly used in psychiatric disorders. The effect of acupuncture on depression (including depressive neurosis and depression following stroke) has been documented repeatedly in controlled studies. Acupuncture (auricular acupressure) is much more effective than psychotherapy in the treatment of competition stress syndrome.

Acupuncture may also be beneficial for smoking cessation as well as alcoholism.

Paediatric disorders

Acupuncture seems to be worth using for treatment of diarrhoea, at least as an adjunct to conventional treatments, because it regulates intestinal function and enhances immune response without causing an imbalance in the intestinal flora as do antibiotics.

In a controlled clinical trial, febrile convulsions in young children stopped two minutes after needling was started, a result superior to that of intramuscular phenobarbital injection.

Additionally acupuncture may help with pertussis (as an adjunct to antimicrobials). It may also be helpful in the treatment of Tourette syndrome in children.

Disorders of the sense organs

A recent randomized controlled clinical trial on sudden-onset deafness in adults favoured acupuncture treatment.

Acupuncture might be useful in the treatment of Ménière disease for relieving symptoms and also for reducing the frequency of attacks.

Treatment of tinnitus via acupuncture shows mixed results. However, unexplained earache has shown to be well treated with acupuncture.

Skin diseases

Some evidence favouring acupuncture treatment of herpes zoster (human [alpha] herpes virus 3) has been reported. Acupuncture is known to have an antipruritic effect. This has been shown experimentally in volunteers, suggesting that acupuncture could be used in clinical conditions associated with pruritus. As well, for the treatment of acne vulgaris, acupuncture, particularly ear acupuncture, is worth recommending.

Cancers

No controlled study has been reported on the efficacy of acupuncture in the treatment of cancer itself. However, acupuncture still has uses in cancer treatments. One is to relieve cancer pain, and the other is to control the adverse reactions to radiotherapy and chemotherapy.

The full document can be viewed at:

<http://apps.who.int/medicinedocs/pdf/s4926e/s4926e.pdf>

Liu L, Skinner MA, McDonough SM, Baxter GD. **Traditional Chinese Medicine acupuncture and myofascial trigger needling: The same stimulation points?**

Complementary Therapies in Medicine 26 (2016): 28–32.

Background

Traditional Chinese Medicine (TCM) acupuncture is widely applied and recognized as an important analgesic therapy in the Western world. The theory of myofascial trigger point (MTrP) therapy for the management of myofascial pain has emerged, and MTrP needling has gradually developed into an accepted practice in Western medical acupuncture. MTrPs are described as being highly localized and hyperirritable

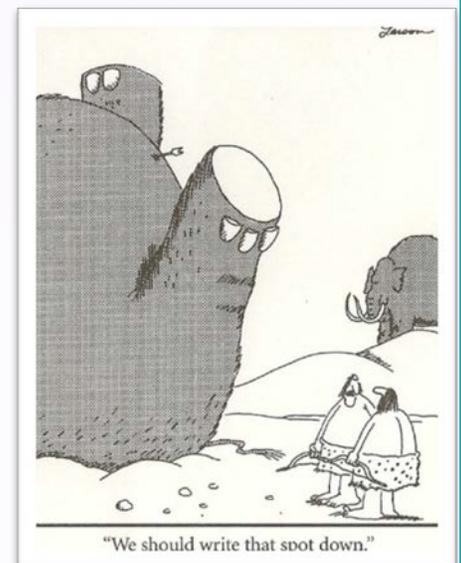


spots in a palpable taut band of skeletal muscle. They are tender to compression, and can produce local and referred pain, motor dysfunction, and autonomic phenomena. MTrP needling is an adaption of classical acupuncture, which provides mechanistic underpinnings from contemporary scientific-based medicine including anatomy, physiology, and pathology. TCM acupuncture and MTrP needling appear to be separate modalities, with different underlying theories and approaches to clinical practice. Due to the limited research, which has involved a direct comparison of the two forms of acupuncture, the effectiveness of TCM acupuncture in contrast to that of MTrP needling is still not clear. It may be suggested that a systematic review that summarizes the evidence and provides a comprehensive evaluation is worthy of consideration. However, it has been argued by some researchers

that the stimulation sites of TCM acupuncture and MTrP needling are actually similar; thus, it is reasonable to first explore the relationship between acupoints and MtrPs.

Discussion

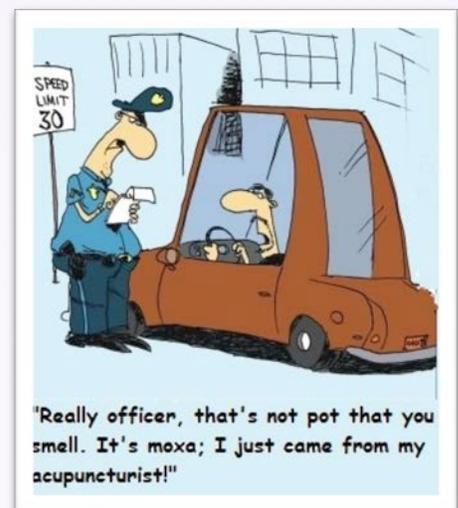
The first evidence-based study, by Melzack et al in 1977, compared MtrPs with classical acupoints. He found that all the MtrPs studied were within 3 cm of an acupoint, and 71% had the same pain indications as those acupoints. It widely influenced research on acupuncture until 2003 when Birch published the results of his examination of the validity of Melzack's claim and investigated the two classes of points through a broader range of literature. In this review, correlated TCM acupoints were defined to exhibit pressure pain, and are used primarily for pain problems. Results showed an 18% correspondence of MTrPs and TCM acupoints for the treatment of pain, and a meaningful correlation between MTrPs and Ah-shi points only. Subsequently, Dorsher re-examined the anatomic and clinical similarities of TCM acupoints and MTrPs and compared distributions of myofascial referred-pain patterns



to acupuncture meridians. Study findings demonstrated that MTrPs were highly correlated to TCM acupoints; moreover, the myofascial referred-pain patterns of 76% of MTrPs accurately followed relevant meridian distributions. In a later study, Dorsher reviewed four acupuncture texts to examine the validity of Birch's findings, and suggested that trigger points could conceptually be compared to classical acupoints for pain disorders, as the clinical correspondence was over 95%. The extent of a correlation between MTrPs and acupoints is influenced by the definitions of acupoints. Moreover, localization of needling points is controversial. Molsberger et al. examined the localization of 23 commonly used acupoints by 71 experienced physicians with substantial training in acupuncture, and found significant variability in point locations ranging from 2.7 to 41.4 cm. This study suggested that an acupoint is not a spot but an area, and thus it is highly likely that acupoints overlap. As acupoints are intensive in the head and distal extremities, it is very likely that several acupoints correlate to the same MTrP. It may therefore be of limited significance to explore the specific extent of these correlations until a defined location of a particular acupoint can be clarified. Additionally, since the theory of channels (meridians) is vital in localizing acupoints in clinical practice, actual acupoints location is variable. This makes the precise correlation extent between acupoints and MTrPs a challenging question to be answered.

In studies on the link between MTrPs and acupoints, conclusions were based upon the premise that MTrPs have distinct anatomical locations. However, there is limited evidence to support this notion despite Travell and Simons described specific MtrPs in numbered sequences. It has been demonstrated that MTrPs are close to motor end-plate zones that are associated with excessive release of acetylcholine. Melzack et al. and Dorsher found that MTrPs correlate to all kinds of acupoints, including primary channel acupoints, extra acupoints, and Ah-shi points, at least for treating pain conditions. Research on primary channel acupoints and extra acupoints, research on mechanisms of action, localization and clinical application of Ah-shi points has been limited. However, there seems several similarities between these points in clinical practice: (1) both points are defined in terms of the pathological nature, and are primarily used to treat pain disorders; (2) they do not have fixed anatomical locations; (3) palpation is the main approach to locate these points; and (4) patients always feel painful when pressed on these points. From this perspective, Ah-shi points and MTrPs may be considered from four aspects.

Pain recognition refers to the compressed local pain and/or referred pain that is similar to a patient's usual clinical complaint; it is one of the most important characteristics of MTrPs. According to TCM theory, Ah-shi points are primarily used to treat musculoskeletal pain conditions. Ah-shi points are widely believed to be synonymous with tender points. In TCM practice



many pressure pain points have been shown to be related to internal diseases rather than body musculature disorders, and from a clinical perspective not every tender point is significant for pain relief. It may be helpful for TCM acupuncturists to pay more attention to those Ah-shi points with associated pain recognition, and treat these Ah-shi points accordingly.

MTrPs are associated with referred pain patterns. The pathogenesis of MTrPs is related to the spinal cord integration of response to the disturbance of nerve endings and abnormal contraction of multiple dysfunctional end-plates; referred pain of MTrPs is mediated through spinal cord mechanisms. MTrPs may be located outside painful regions.

There are similar treatment modalities for Ah-shi points and MTrPs, including needling, injection, and manual therapy.

Summary

We propose that MTrPs are significantly correlated to TCM acupoints, including primary channel acupoints, extra acupoints, and Ah-shi points. Considering the correlation between MTrPs and acupoints and the rarely-studied research area involving Ah-shi points, it may be reasonable to apply the findings of MTrPs as a valuable foundation for future investigation of Ah-shi points. Ah-shi points might be central or attachment MTrPs, and the most significant characteristic of Ah-shi points may be pain recognition rather than pressure pain. In addition, there is merit in searching for Ah-shi points at distal pain regions, and exploring new approaches to improve management. The correspondence of MTrPs and acupoints supports neurologic explanations of the action mechanism of acupuncture, and facilitates the increased integration of acupuncture into contemporary clinical management. While the primary channel acupoints and extra acupoints are important and are commonly studied, the need for more in-depth research on Ah-shi points is suggested. Additionally, given the correlations of MTrPs and TCM acupoints, further exploration regarding the treatment indications of MTrPs apart from the pain relief may be another fruitful research area.



**THERE MUST BE
SOMETHING TO
ACUPUNCTURE --
YOU NEVER SEE ANY
SICK PORCUPINES.**

QUOTEHD.COM

Bob Goddard



Fung, PCW. Probing the mystery of Chinese medicine meridian channels with special emphasis on the connective tissue interstitial fluid system, mechanotransduction, cells durotaxis and mast cell degranulation. *Chinese Medicine* 4: 10, 2009.

This article hypothesizes that the Chinese medicine meridian system is a special channel network comprising of skin with abundant nerves and nociceptive receptors of various types and deeper connective tissues inside the body with the flowing interstitial fluid system. Needling acupoints modulates the physiology of the body through the meridian channel network.

However, acupoints, meridians, anatomical structures, and physiological functions of Chinese medicine do not have equivalents in modern western medicine. It has been suggested that the anatomical structure of meridian channels and acupoints are related to the connective tissue and the connective tissue interstitial fluid system. The theory presented in the paper defines the meridian structure embedded in the connective tissue interstitial fluid system with acupuncture in action explained by Mechanotransduction, cells Durotaxis, and mast cell Degranulation.

The Connective Tissue Interstitial Fluid (CTIF) system

Electrolytes, proteins, O₂, and CO₂, pass through this CTIF system in transit. Cells within the CTIF system include macrophages,

lymphocytes, T- and NK cells, eosinophils, adipocytes, plasma cells, fibroblasts, chondroblasts, osteoblasts, stem cells, and mast cells. The interstitial fluid transports nutrients from the blood to the tissues and metabolic products back to the blood and lymph.

The skin is known to be the superficial fascia of the CTIF system. It is rich in nerve endings of various types of nerves (specific and polymodal nociceptive receptors). An abundance of nociceptive receptors (many types) in the deep fascia layers which are close or connecting to neurovascular as well as lymphatic structures.

What are acupoints?

High-density sites of polymodal and specific nociceptive receptors near neurovascular structures, lymphatic vessels, and mast cells become acupoints. Acupuncture applied at the collagen fibres embedding nerve fibres (A δ and C) could send signals to the nerve fibres via mechanotransduction mechanisms. Since nerve fibres are connected to one or more spinal cord segments, the mechanical stimulation of needling can be transmitted to internal organs via the somato-visceral organ reflex.

Stimulation of nociceptive receptors can result

in the secretion of small amounts of neuropeptides (substance P & calcitonin-gene related peptide), which when released near mast cell migration tracts could lead to degradation of these mast cells. The resulting release of biochemicals could further facilitate functions related to homeostasis, immunity responses, repair and growth. Thus stimulation of areas with a high density of polymodal and specific receptors that are also near fine blood, nervous, lymphatic structures as well as near mast cells would be most highly effective. Acupoints meet these criteria.

Acupuncture and mechanotransduction

Biophysical forces (i.e. mechanical and electrical forces) acting on the cell surface are effective and fast, leading to intracellular and intercellular architecture remodeling and result in biochemical reactions. Acupuncture applied to connective tissue causes cytoskeletal remodeling of mechanically connected cells. A pull by the connective tissue to the mechanically connected distal cells would apply stress to the surface receptors. The mechanical signals would transmit to the connected blood and lymphatic vessels.

Cell migration within the CTIF system via durotaxis

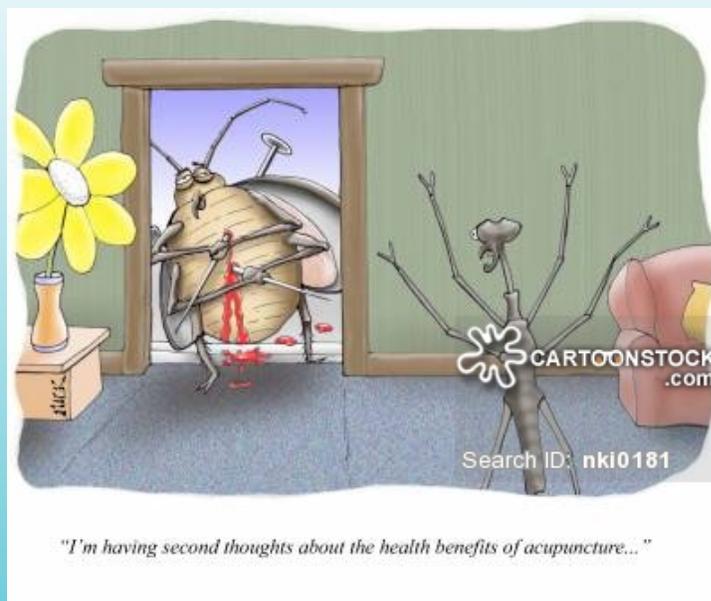
Durotaxis is a process via which cell migration is guided by gradients of substrate rigidity. As such, acupuncture may affect the stiffness of the CTIF system, which may draw certain substances (i.e. fibroblasts) towards an area of higher stiffness.

Fibroblasts maintain collagen fibres and mast cells upkeep the proliferation of fibroblasts. Fibroblasts migrate along collagen fibres with higher stiffness. One study has found that the densities of the collagen fibres are higher along certain tracts that correlate with the Chinese medicine meridian channels. Since acupoints are found to be abundant in mast cells, and are found along meridian channels that correlate with dense collagen tracts of connective tissue,

it is suggested that Chinese medicine meridian channels are special migratory tracts for fibroblasts and mast cells within the CTIF.

Mast cell degranulation caused by acupuncture

Mast cells are produced in bone marrow and migrate to the blood stream, peripheral tissues and eventually to various types of connective tissues, adjacent to blood and lymphatic vessels and to the sites associated with peripheral nerves. Mast cells can go through multiple cycles of de- and re-granulation for regulating the release of at least 15 types of biomolecules. These biomolecules can have an effect on anything from allergy response and immunity, inflammation and metabolic rate, to blood vessel tone and/or fibroblast or osteoblast activity (to name but a few effects). There is evidence that acupuncture could also cause degranulation of mast cells directly through mechanical stress or by an interaction with nerve cells.



Interstitial fluid flow along meridian channels

The entire interstitium is considered to be four times of the blood in volume. All extracellular fluids are in dynamic equilibrium with other fluid systems of the body. The pressure of the interstitial fluid is different at different locations and with different body positions.

There is experimental evidence to show that interstitial fluid flows along the meridian channels. That flow has the least resistance along the longitudinal directions of animal models. One study that utilized magnetic resonance angiography and magnetic resonance imaging techniques demonstrated in humans that the six specific migration channels of interstitial fluid were not associated with blood or lymphatic vessels. Instead, the flow followed the six Yin Chinese medicine meridian channels in the upper and lower limbs.

Boundary tissue of the Chinese medicine meridian channels

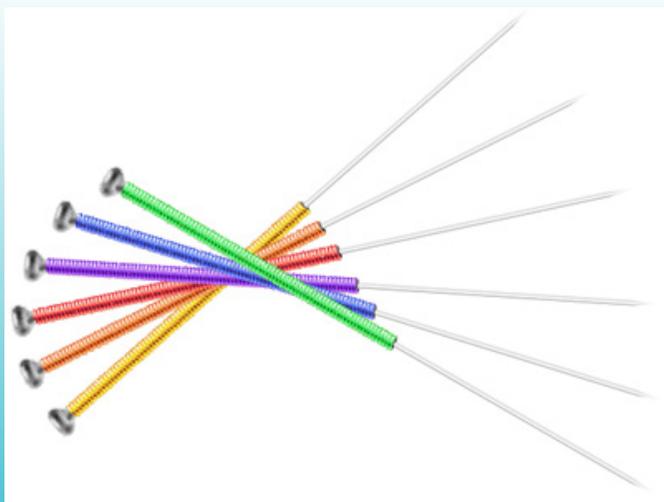
Meridian channels embedded in the CTIF system provide specific paths of cell migration and interstitial fluid flows. The tissue boundaries of the meridian channels have not been fully defined. However, it would seem

that meridian channels are bound below by a layer of connective tissue (of various types), and the upper boundary would be the skin.

In Conclusion

The author puts forth the following hypothesis:

The Chinese medicine meridian channel system has a structure bounded by the skin where there are abundant nociceptive receptors of various types and bound below by another layer of connective tissue and flowing interstitial fluid (including proteins with surface charges and ions) as ground substance. The interstitial fluid in the meridian channel participates in the continuous redistribution of the interstitial fluid pressure P_i in the body during body movement. These extracellular channels provide favourable migratory tracks mainly due to durotaxis for the mast cells, fibroblasts, and other cells (including adult stem cells) which carry out a number of physiological functions like triggering neurogenic inflammation, vasotone homeostasis, wound repair, giving the organism the optimum chance of survival. Acupoints are functional sites along the meridian channels. Acupuncture applied to these sites could improve the efficiency of the above functions through mast cell degranulation with specificity.



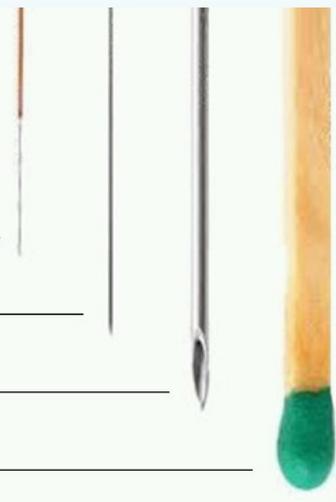
How Tiny Is An Acupuncture Needle?

Acupuncture Needle
.25 mm

Sewing Needle
1.02 mm

Medical Syringe
28.5 mm

Match Stick
42 mm



Langevin HM, Churchill DL, Cipolla MJ. Mechanical signalling through connective tissue: a mechanism for the therapeutic effect of acupuncture. *The FASEB Journal*, Vol. 15, October 2001, pages 2275-2282

Introduction

The mechanism of action of acupuncture remains largely unknown. The reaction to acupuncture needling known as 'de qi', widely viewed as essential to the therapeutic effect of acupuncture, may be a key to understanding its mechanism of action. De qi includes a characteristic needling sensation, perceived by the patient, and 'needle grasp' perceived by the acupuncturist. During needle grasp, the acupuncturist feels pulling and increased resistance to further movement of the inserted needle. We hypothesize that 1) needle grasp is due to mechanical coupling between the needle and connective tissue with winding of tissue around the needle during needle rotation and 2) needle manipulation transmits a mechanical signal to connective tissue cells via mechanotransduction. Such a mechanism may explain local and remote, as well as long-term effects of acupuncture.



Proposed Mechanism of Needle Grasp

Needle grasp is unlikely to be due to a muscle contraction, as has been suggested, since it can be observed even at locations where no skeletal muscle is present. Tenting of skin observed during needle grasp also suggests that tissues superficial to muscle are grasping the needle.

To investigate the role of the skin and/or subcutaneous (s.c.) connective tissues in needle grasp, we used rat abdominal wall explants to examine histological changes in the tissue samples from needle rotation. We observed that needle rotation was accompanied by marked thickening of the s.c. connective tissue layer in the area surrounding the needle. There was no structural change in dermis, s.c. muscle, or abdominal wall muscles other than displacement by the thickened s.c. tissue layer. Collagen was seen winding around the needle track with acupuncture needle rotation. Together, these observations support the hypothesis that connective tissue winds around the needle during needle rotation.

In a study of the biomechanical response to acupuncture needling in humans, we quantified needle grasp by measuring the force required to pull out an inserted acupuncture needle (pullout force). Pullout force was significantly greater with needle rotation compared with needle insertion without rotation. This result demonstrates that needle rotation enhances needle grasp.



The winding of strands of material around a rotating drum or shaft, resulting in progressive tightening, is a common phenomenon observed in many settings. Simple friction resists sliding of the material around the shaft. If the material is allowed to wrap over itself, as we believe happens in the case of connective tissue winding around an acupuncture needle, the material can become self-locking in several revolutions. That is, the friction force is amplified so much that the material cannot slip on the shaft no matter how much tension is applied.

Winding of connective tissue around the needle results in a marked amplification of the mechanical coupling between the needle and the local connective tissue. We believe that the initial mechanical coupling results from attractive forces between needle and tissue, such forces likely being surface tension and electrical attraction.

Electrical attraction may therefore occur between the metal needle and fixed tissue charges. Such attractive forces are likely to be relatively weak, but strong enough to cause initial winding of tissue around the rotating needle. Once some wrapping has occurred, frictional forces take over.

In human experiments, we typically observed that the torque required to rotate the needle increases continuously as needle rotation proceeds. This is consistent with our hypothesis of connective tissue winding around the needle. Once the acupuncture needle becomes coupled to tissue, movements of the needle (rotation or pistoning) may send a signal through connective tissue via deformation of the extracellular matrix. To investigate this hypothesis, we examined the orientation of collagen fibers in rat s.c. tissue with and without needle rotation.

Collagen bundles were straighter and more nearly parallel to each other after needle rotation than after needle insertion without rotation, clearly demonstrating local alignment of tissue with needle rotation. The importance of this effect is that pulling of collagen fibers during needle manipulation may transmit a mechanical signal, through deformation of the extracellular matrix, to cells such as fibroblasts that are abundant in connective tissue. The subsequent signal transduction events may contribute to the therapeutic effect of de qi.

The mechanism of mechanical load detection is thought to be a mechanosensory complex composed of



extracellular matrix integrin- cytoskeletal components linked to a kinase cascade. In this model, load deformation displaces matrix molecules tethered to clustered integrins at focal adhesions. The result of mechanical load deformation of an integrin molecule via extracellular matrix attachment is activation of a signaling cascade leading to a wide range of cellular responses, including changes in the actin cytoskeleton with formation of stress fibers.

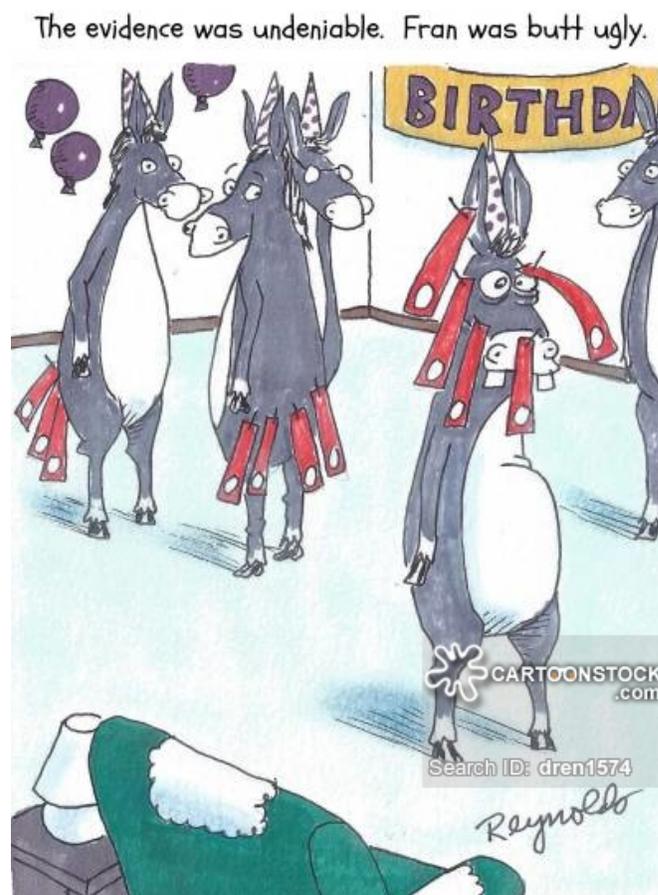
Using rat s.c. tissue explants, we have found that acupuncture needle rotation caused fibroblasts to become aligned with collagen fibers and change shape from a rounded appearance to a more spindle-like shape. The

pulling of collagen fibers induced by acupuncture needle manipulation appears to have an effect similar to that of applying magnets or mechanical traction on connective tissue fibroblasts (redistributing polymerized actin) via the attachment to collagen fibers at focal adhesion complexes.

These observations suggest that the mechanical signal created by acupuncture needle manipulation can induce intracellular cytoskeletal rearrangements in fibroblasts and possibly in other cells present within connective tissue, such as capillary endothelial cells.

Cytoskeletal reorganization in response to mechanical load signals has been shown to induce cell contraction, migration, and protein synthesis. Potentially powerful effects may derive from this mechanical signal transduction, including autocrine and paracrine cellular effects, with modification of the surrounding extracellular matrix.

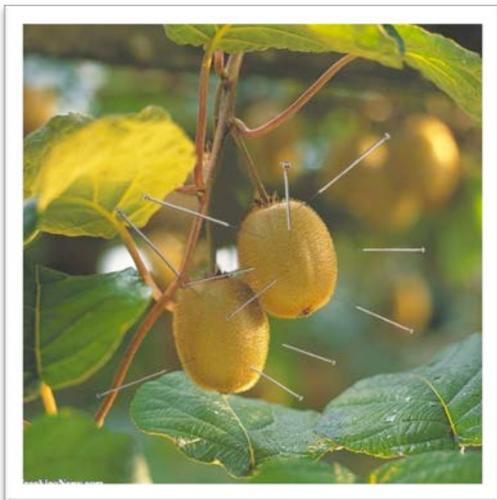
Our proposed mechanism for needle grasp involving mechanical signaling through connective tissue is: 1) winding of connective tissue around the acupuncture needle, 2) pulling of collagen fibers and matrix deformation, 3) transduction of the mechanical signal into fibroblasts and/or other cells attached to collagen fibers at focal adhesions, and 4) cellular response, including cytoskeletal rearrangement, with potentially therapeutic downstream effects.



Possible Downstream Effects of Needle Grasp

Downstream effects of the mechanical signal generated by acupuncture needle manipulation potentially include synthesis and local release of growth factors, cytokines, vasoactive substances, degradative enzymes, and structural matrix elements. Release of these substances may influence the extracellular milieu surrounding connective tissue cells and further modulate signal transduction to and within the cell.

Modification of interstitial connective tissue may have important biomechanical, vasomotor and neuromodulatory effects. During acupuncture needle manipulation, pulling of collagen may cause reversible contraction of large numbers of fibroblasts near the acupuncture needle. Furthermore, the contraction of fibroblasts itself would cause further pulling of collagen fibers, resulting in a 'wave' of matrix deformation and cell contraction spreading away from the needle through interstitial connective tissue, thus mediating acupuncture effects remote from the acupuncture needle site.



Different types of sensory receptors may be stimulated directly as a result of the matrix deformation generated by acupuncture needle manipulation. The importance of this effect is that 1) connective tissue matrix deformation may not be restricted to the area of the needle, but may spread along interstitial connective tissue planes; 2) a wave of sensory receptor activation occurring over seconds to minutes may simultaneously follow the mechanical signal away from the needle site; 3) a second wave of cellular activation, followed by altered gene expression, protein synthesis, and extracellular matrix modification, may ensue after a certain time delay and last hours to days; and 4) subsequent stimulation of these connective tissue sensory receptors by body movement may be modulated by this sequence of events.

Whether the sensation evoked by stimulation of various types of sensory receptors is experienced as pain (or not) depends not only on the type of receptor, but also on the status of the tissue and of synaptically related spinal cord neurons. It is now widely accepted that target organs can influence the neurons that innervate them. This connective tissue milieu has the property of responding to mechanical signals such as those produced by acupuncture needle manipulation. The effect of acupuncture needle manipulation on blood flow, cytokines, and/or growth factors may result in long-term modulation of sensory information. The delayed cellular and molecular events triggered in connective tissue by acupuncture needle manipulation may therefore modulate processing of mechanical sensory stimuli that occur hours to days later.

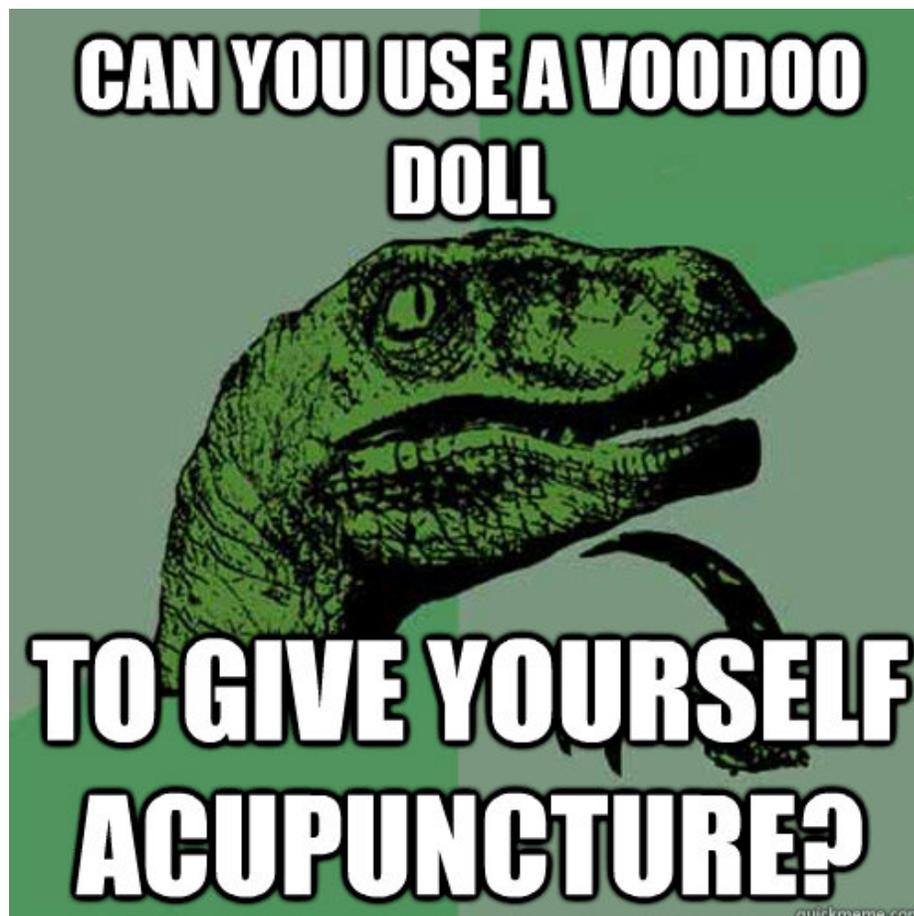


Conclusion

In summary, the insertion and manipulation of acupuncture needles may have both local and remote therapeutic effects based on the same underlying mechanism: mechanical coupling of needle to connective tissue, winding of tissue around the needle, generation of a mechanical signal by pulling of collagen fibers during needle manipulation, and mechanotransduction of the signal into cells. Downstream effects of this mechanical signal may include cell secretion, modification of extracellular matrix, amplification and propagation of the signal along connective tissue planes, and modulation of afferent sensory input via changes in the connective tissue milieu.

We propose that mechanical signal transduction is a common mechanism underlying the effects of a variety of acupuncture needling methods. Modern acupuncture techniques using electrical stimulation may have additional effects through prolonged stimulation of nerves or muscle. However, de qi is a common denominator to both traditional and modern acupuncture treatments. Indeed, documentation of de qi is used as a criterion for evaluating the adequacy of both manual and electrical acupuncture treatments in clinical trials. Acupuncture needle rotation (either uni- or bidirectional) may be important to initiate needle grasp, but other types of needle manipulation such as pistoning may also effectively transmit a mechanical signal to cells once needle grasp has been initiated. Transduction of the mechanical signal into cells with subsequent cellular response and downstream effects may explain the perplexing claim that acupuncture treatments have long term effects lasting for days to weeks and even permanently.

The field of mechanotransduction may now provide scientific grounding for this ancient form of therapy. In return, acupuncture may provide an important clinical application for the current explosion in basic knowledge of the powerful and diverse biological effects of mechanical signaling.



13 Ways Acupuncture Can Change your Life

http://www.huffingtonpost.com/sara-calabro/acupuncture-benefits_b_2398193.html

1. It will open your mind, 2. It can help make you less stressed, 3. It will inspire you to get outside more, 4. It can help give you more energy, 5. It will clear your head, 6. It will allow you to give yourself a break, 7. It can help you sleep, 8. It will get you to think differently about food, 9. It will help you embrace change, 10. It will give you something to talk about at parties, 11. It will make you more patient, 12. It will make you tough, 13. It will make you believe in yourself.



(Ha, now some of these don't make sense in point form... guess you'll have to go and read the original article!!)



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