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Fu's Subcutaneous Needling, a Modern Style of Ancient Acupuncture?

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Additional information is available at the end of the chapter

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1. Introduction

Fu's Subcutaneous Needling (FSN), originated from Chinese traditional acupuncture, is a therapeutic approach for localized diseases, especially for musculoskeletal painful disorders. This procedure is performed by inserting a special trocar needle into the subcutaneous layer around the afflicted spot (Fig. 1) or nearby limbs (Fig. 2) to achieve the desired effect. In some cases, FSN could provide immediate and significant relief of the pain in trigger points (TrPs) more effectively than anesthesia.

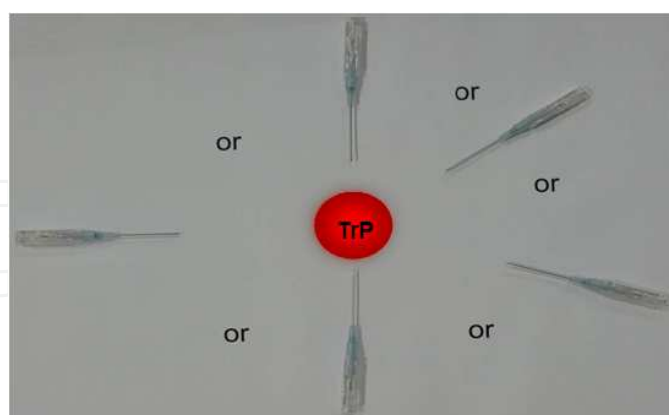


Figure 1. The situation of FSN needles with TrP

FSN, Chinese pronunciation of which is “*Fu Zhen*” (浮, in simplified Chinese; 浮針, in Traditional Chinese), has double implications: Fu is the surname of the inventor (also the first author of this chapter); in Chinese, “Fu, 浮” also means floating or superficial. “Zhen” means

acupuncture or needling. Therefore, in some English-language papers, FSN was also called Floating Acupuncture[1], Fu's Acupuncture [2], Fu Needling [3] and Floating Needling [4]. However, neither *floating* nor *superficial* is a precise translation, and it has been decided that the word *subcutaneous* is a better substitute in terms of demonstrating where the effects of FSN are acting upon, and where the FSN needle is being manipulated..



Figure 2. For neck pain, ipsilateral arm is the one chosen to be inserted in

Although it originated from classic acupuncture, FSN's manipulation and theory have little to do with the concepts of acupuncture, such as meridians, acupoints, Yin-Yang, and *Qi*. Therefore, it is not a kind of acupuncture and hence should no longer be called acupuncture, but rather FSN should be classified as its own separate identity..

The specific name, *Fu's Subcutaneous Needling*, was first mentioned in the article by Fu and Xu in the *Pain Clinic* to describe the treatment method [5]. Since then, a series of research papers have adopted the use of the name [6, 7].

FSN should be clearly distinguished from the narrow sense of dry needling, which is well known in the Western medical world. Since the 1940s, dry Needling [8-14], which refers to the insertion of a fine, single-use sterile needle, into a TrP [15-18] for myofascial pain [19-26] based on Western anatomical and neuro-physiological principles, has been increasingly utilized in the Western world, especially in the United States, United Kingdom, Australia, Germany, Brazil and Spain [27]. Unlike traditional acupuncture, dry needling ignores ancient Chinese philosophy and traditional ideas. Therefore, the manipulation method used in classic acupuncture differs from that used in dry needling because each one follows different theoretical instructions.

FSN stemmed from some ideas of traditional acupuncture, but its essential features are different from those of traditional acupuncture: 1. they are based on different theories; 2. their manipulation is different; and, 3. they use different kinds of needles. The theory of traditional acupuncture is a mystifying concept, even to Chinese doctors. FSN makes the job much easier by ignoring the traditional theories and placing more emphasis on the anatomical model. This makes FSN a modern form of acupuncture to some extent.

Compared with the current practice of common dry needling, FSN also has unique features. There are at least two differences between FSN and dry needling: 1, FSN inserts needles into non-diseased areas, but dry needling inserts the needles into TrPs; 2, FSN is confined to the subcutaneous layer, whereas dry needling goes deep into the muscles.

FSN is also considered as one type of dry needling in its “broad sense” because: 1, they both share the same theory surrounding modern scientific neurophysiology and anatomy; 2, In clinical practice, the end goal for both dry needling and FSN is to manage myofascial pain.

2. Features of Fu’s Subcutaneous Needling (FSN)

FSN is differentiated from traditional acupuncture and other alternatives in terms of manipulation and effects.

2.1. Manipulation features

The manipulation of FSN is mainly devised of the following features:

The selection of FSN insertion areas are based on the nature of TrPs or focal disorders

FSN abandoned traditional acupuncture theories, such as meridians, acupoints, and the reinforcing-reducing method, and the selection of FSN points mainly depends on the different relevant muscles or situations of the disorders.

The FSN needle inserts into non-diseased areas

Different from medicated plasters, dry needling, and cupping, which are located directly on the afflicted or painful area, FSN acts on non-afflicted areas. The tip of the FSN needle usually does not reach the lesion area. The FSN needle stimulates a healthy area to heal the unhealthy area or organ. If the area is unhealthy, FSN needles are usually not inserted. For example, if the surrounding area of the painful spot is swollen or inflamed, the FSN needle should not be inserted into the swollen part.

The insertion of the FSN needle stops at the subcutaneous tissue

The needle used in dry needling goes through the skin, passes through the subcutaneous layer, and then enters deep into muscles, whereas the FSN needle stops at the subcutaneous layer (Fig. 3).

Deqi is not required during an FSN treatment

In traditional acupuncture, *Deqi* is considered an omen of its curative effect [28-30], which is why most acupuncturists try to induce *Deqi*. However, FSN aims for the patient not to have sensations of soreness, swelling, or numbness, and for the acupuncturist not to feel any mild resistance or “needle grasp”.

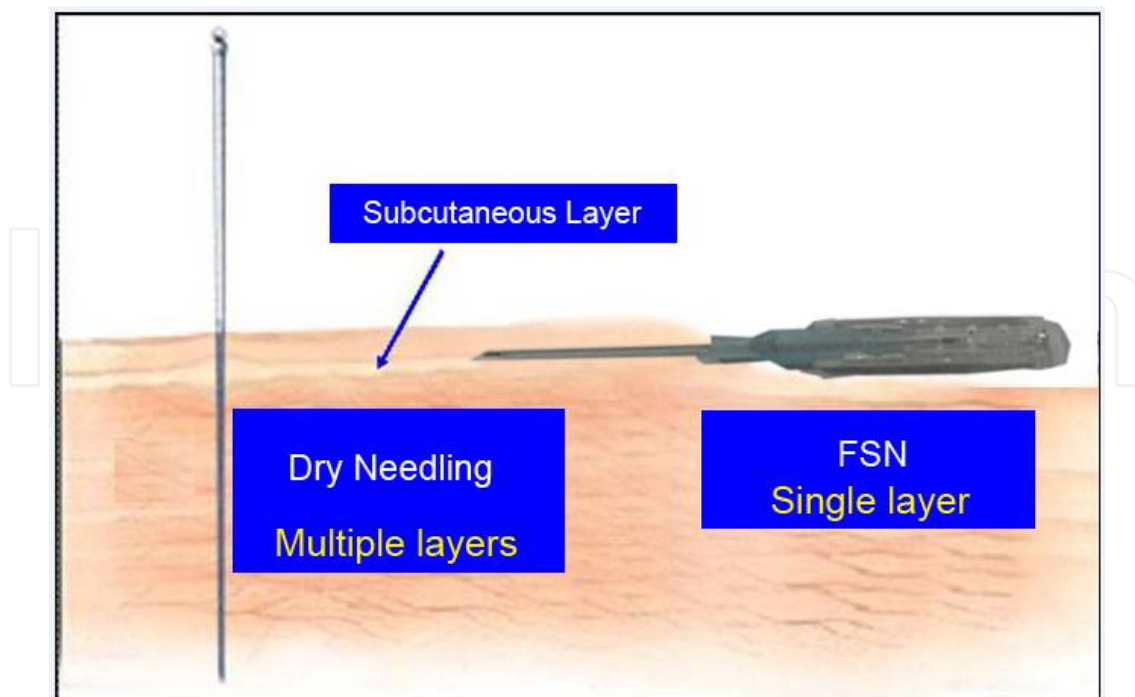


Figure 3. The different relevant layers of FSN and dry needling

The FSN needle is retained in the subcutaneous tissues for a long duration

The retention of the needles was seldom mentioned in ancient acupuncture. In modern acupuncture, however, retention is widely used, and the retention often lasts for 15 or 20 minutes. FSN needs a longer retention time, often lasting more than one hour. The patient should be allowed to move or exercising in a mild way with the FSN needles retained in the subcutaneous layer.

The tip of the FSN needle directs to the painful region

The acupuncture needle is often inserted perpendicularly or obliquely, whereas the tip of the FSN needle is inserted horizontally and is directed toward the TrP or localized disorder.

The FSN needle has to be swayed from side to side

The FSN applies a special technique, which is the swaying movement. The swaying movement is essential to FSN treatment and provides a curative effect, especially when dealing with chronic disorders. In most circumstances, FSN does not work well without the swaying movement.

The involved muscles and joints can move easily during FSN treatment

Moving afflicted joints and relevant muscles can effectively speed up the recovery from musculoskeletal injury. This kind of movement in an FSN clinic is called the reperfusion approach, which will be introduced in detail afterwards in this chapter. As mentioned above, the FSN needle is manipulated above the muscular layer, which makes it easy for the medi-

cal staff or the patients themselves to extend/contract the afflicted muscles even during FSN's swaying movement.

2.2. Characteristics of effectiveness

After clinical observations for about 16 years, FSN was found to have the following characteristics:

- a. FSN focuses on treating painful problems, although FSN can also have positive effects on some non-painful disorders, such as numbness, chronic cough without sputum, and acute onset of asthma.
- b. FSN can provide relief under most conditions. After the swaying movement, the pain completely goes away or is reduced to some extent.
- c. Retention of the FSN needle is usually necessary in order to avoid symptoms from recurring frequently, although they can be easily suppressed after therapy.
- d. FSN has adverse effects, such as minor hemorrhage, dizziness, and fainting. However, FSN is safer than acupuncture because its needles do not go deeply and do not touch focal diseases.
- e. FSN has short-term and long-term effectiveness in the treatment of a majority of soft tissue non-traumatic lesions if the relevant muscles can have enough rest. However, for painful problems caused by malignant tumors, trigeminal neuralgia, and post-herpetic neuralgia, FSN often only have short-term effects.
- f. The treatment room of an FSN clinic can be better utilized than that of an acupuncture clinic because patients can keep retention of the casing pipe, a soft part of the FSN needle, and go home after the treatment.
- g. FSN treatment is inexpensive for patients because FSN can achieve the same effect with fewer treatments compared with acupuncture. In addition, FSN is much cheaper than surgery because it can often relieve painful problems, such as lower back pain with sciatica, without an invasive surgical procedure.
- h. The effects of FSN can be seen immediately to confirm the accuracy of the diagnosis and technique. The doctor can then modify the diagnosis and treatment accordingly. FSN could provide feedback much quicker than acupuncture and medication could.

Although FSN is superior to traditional approaches in many respects, it also has its disadvantages: for example, doctors spend more time and energy on each subject, and FSN can be easily misunderstood by patients and other doctors because the FSN rationale seems too unconventional for the general public to understand. Chinese physicians doubt the results and effects of FSN because it does not obey the rules of traditional Chinese medicine. Furthermore, Chinese patients who have never previously been exposed to FSN often think that their physicians have discreetly injected them with an anaesthetic and/or steroid. Nevertheless, future studies confirming these clinical assumptions are imperative to further determine the effectiveness of FSN versus classic acupuncture.

3. Origin of Fu's Subcutaneous Needling (FSN)

The following three sources led to FSN's evolution from traditional acupuncture.

3.1. Contemplation of *De-Qi*

De-Qi [31], is an acupuncture phenomenon that occurs during needle manipulation. During needle manipulation, when the patient feels sensation, e.g. soreness, aching, numbness, and "needle grasp," and/or the acupuncturist feels a pulling sensation, it suggests that *De-Qi* is achieved [30, 32, 33]..

Traditionally, *De-Qi* must be achieved in the process of acupuncture regardless of the manipulation used; otherwise, the therapeutic results are poor [31]. In every textbook on acupuncture in Chinese, the importance of *De-Qi* is always emphasized and reiterated. Acupuncturists also repeatedly emphasize *De-Qi*. As a result, most Chinese patients believe in the adage, "no *De-Qi*, no effect." Sometimes, patients will be disappointed in the acupuncturist if they fail to acquire *De-Qi*, which causes discomfort to the patient.

Acupuncturists and patients are not the only ones who consider *De-Qi* to be essential, as some scientists also believe that *De-Qi* plays an important role in acupuncture analgesia [28, 34]. Acupuncture needling could activate the afferent fibers of peripheral nerves to elicit *De-Qi*, which ascends to the brain, activates the antinociceptive system, including certain brain nuclei, modulators (opioid peptides) and neurotransmitters, and through the descending inhibitory pathway, results in analgesia [34].

However, acupuncture could work without *De-Qi* every now and then, and could fail even when the patients achieve strong *De-Qi*. Furthermore, many acupuncture substitutes, such as cupping, moxibustion, trans-cutaneous electrical nerve stimulation (TENS), and so on, do not elicit *De-Qi*, but they appear to be effective [35].

Therefore, it is supposed that *De-Qi* might be not as pivotal as traditional comments suggest. To prove the insignificance of *De-Qi*, the best method is to stimulate the tissue with less nerve endings and then observe what will happen. The elicitation of *De-Qi* is related to the needling depth[32]. There are few free nerve endings and proprioceptive receptors in the subcutaneous layer, whereas free nerve endings are abundant in the epidermis and dermis, and proprioceptive receptors exist in the muscular layer [36]. Therefore, there should be no occurrence of *De-Qi* even if the subcutaneous layer is stimulated. Under such a condition, does the needling effect still exist? For an acupuncturist, it is simple to verify the existence of the needling effect, and this simple trial was one of the factors resulting in the development of FSN.

3.2. Clinical application of wrist-ankle acupuncture

Wrist-ankle acupuncture (WAA) [37] is also called wrist-ankle needling [38]. Dr. Xinshu Zhang, a neurologist who has worked at the Second Military Medical University in Shanghai, developed WAA in 1972. WAA divides the whole body into 12 longitudinal districts, 6 for each half of the body, 3 for each side of the central line.

There are 6 points 2 *cun* (about 50 mm) above the wrist joint corresponding to the 6 districts above the diaphragm, and there are 6 points 3 *cun* (about 75 mm) above the ankle joint corresponding to the other 6 districts. If a disorder occurs in one of the districts, the corresponding point should be chosen.

Unlike conventional acupuncture, WAA inserts an acupuncture needle only superficially in the subcutaneous layer; some authors claim that WAA is effective in the treatment of pain with various origins [39]. Needling superficially in WAA wrist or ankle point to treat distant disorders often has good effect [38], leading to the idea that needling close to the afflicted area could be at least as effective as needling in an area remote from that which is afflicted, and that needling closer maybe better. These thoughts motivated the author to seek answers through clinical trials.

3.3. Ancient techniques

The Medical Classic of the Yellow Emperor (also known as *The Yellow Emperor's Canon on Internal Medicine* or *Yellow Emperor's Inner Classic*), written thousands of years ago, is a fundamental book of traditional Chinese medicine. The book says needling superficially and needling nearby are two characteristics of the ancient techniques for the treatment of painful problems. The author of the chapter learned from, and were inspired by, these techniques in the process of FSN initiation. In *The Medical Classic of the Yellow Emperor*, there is a chapter entitled "Guanzhen," which records 26 special techniques. The 26 techniques are classified into three groups: 9-technique group, 12-technique group, and 5-technique group.

The characters of superficial needling refers to quite a few techniques, such as *MAO Ci* in the 9-technique group, *Zhizhen Ci* and *Fu Ci* in the 12-technique group, and *Ban Ci* in the 5-technique group. Among them, *Zhizhen Ci* significantly resembles FSN: Hold up the skin with the thumb and index finger of the left hand; insert the filliform needle into the skin; and then go forward toward the painful spot obliquely. *Zhizhen Ci* of thousands of years ago can be said to be FSN without the use of FSN needle and its swaying movement.

Needling nearby is often seen in the 26 techniques, such as *Fen Ci* in the 9-technique group, *Hui Ci*, *Qi Ci*, *Yang Ci*, *Duan Ci*, and *Pangzhen Ci* in the 12-technique group, and *Baowen Ci*, *Guan Ci*, and *Hegu Ci* in the 5-technique group.

Aside from the practicable techniques mentioned above, *The Medical Classic of the Yellow Emperor* also describes many systemic theories, such as meridians, acupoints, and Yin–Yang. Nevertheless, from then on, the most ancient acupuncture texts took meridians, acupoints, and other theories instead of practicable techniques as their main interests. The long-term neglect of practicable techniques resulted in today's acupuncturists having little knowledge about this valuable ancient technique, which is a wise shortcut to FSN.

Based on the above ideas and thoughts, Fu, the first author of the chapter, devoted himself to seeking a new and effective treatment strategy and finally invented FSN in 1996, while the author worked at the First Military Medical University in Guangzhou, China. The university ran a TCM Clinic in Zengcheng, a city near Guangzhou. In the clinic, the patients

who were in great pain were more numerous than the author could deal with, which encouraged him to find ways to more quickly relieve the painful problems.

The author, Fu, made an attempt and received a positive response when he treated a patient with tennis elbow (lateral epicondylitis) by needling near the painful spot; this was the first successful case of FSN. From then on, a series of clinical trials were made and positive results were achieved. FSN then came into being. In the same year, Fu wrote a brief introduction to FSN, and it was published in a Chinese health newspaper. Fu also published his first research paper in Chinese in the *Journal of Clinical Acupuncture and Moxibustion* the following year.

4. Development of Fu's Subcutaneous Needling (FSN)

Fu continued using FSN in his clinics and in accumulating evidence to improve FSN. The development took place in two main aspects: the innovation of the FSN needle and the increase of FSN's indications.

4.1. Innovation of the FSN needle

In physics, scientific theories always come out first, followed by technologies. However, in traditional medicine, these phenomena often occur the other way around: technologies or therapies come first, followed by theories. Without past experience to draw from or previous theories to follow, the author had to develop FSN by trial and error. During FSN's early months, the author used a filiform acupuncture needle, but the following factors made him change his mind:

- When the lesion range is large or deep, FSN did not work well with the filiform needles despite the simultaneous usage of many needles.
- FSN needs a long period of retention, and the patients could not stay in any settled position for extended periods of time. The patients should be able to move their bodies and limbs during needle retention. If the stainless-steel filiform needle is in use, patients are easily hurt.
- FSN requires the needle to sway from side to side. The filiform needle is too elastic to allow for the swaying movement.

Fu knew that some changes to the FSN needle must be made. However, the problem was determining the kind of needle that could go through the skin quickly and stay beneath the skin safely.

- Initially, a physical method was developed: a needle was invented using a new material. The material is solid at low temperature, and becomes soft at high temperature. When not in use, the needle is stored in a refrigerator. When FSN is being done, the needle is taken out and inserted into the patient's body, and the needle then becomes soft due to body

temperature. It is a fine idea except that both the material used for the needle and the refrigerators are too expensive for most acupuncturists to afford.

- A chemical method was also considered. The author tried to produce a biological hard needle made of a high-polymer material, such as absorbable catguts, which is subsequently dissolved by the tissue fluids. A large amount of time and energy were devoted to finding such a material, but none was found.
- Finally, the author was inspired by the i.v. catheter and then invented a trocar needle of the compound structure used at present. Since 1997, the FSN needle has mainly consisted of two parts: a solid stainless-steel needle and its soft casing pipe. The former is hard enough to break through the skin quickly and to ensure that the FSN needle can be easily controlled; the latter is soft enough to remain beneath the skin without pricking.

An application for the patent of the FSN needle was made in December 1997, and the Chinese invention patent was granted in August 2002.

4.2. Increase of FSN indications

When the author mentioned that a certain disorder is one of FSN's indications, the following criterion was applied: an immediate effect can come into play when FSN is used to treat the disorder or release the symptoms. This criterion is called the *gold criterion*. Disorders or symptoms for which FSN is unable to get immediate results are not incorporated into the indications for FSN.

After the first successful case, the tennis elbow case previously mentioned, the author unceasingly searched for FSN indications. The search procedure could roughly be divided into four stages.

Stage 1: FSN was mainly used to treat soft tissue injuries in the four limbs.

In the early months after the formation of FSN, the diseases treated with FSN were all painful problems in the four extremities, such as tennis elbow, stenosing tenosynovitis of the styloid process of the radius, snapping finger, osteoarthritis of the knee, sprain and strain of ankle, and so on. Due to the limited experience with FSN in its early days, the success rate of the treatment of painful problems of the extremities was only about 40%. Therefore, FSN was not useful for the treatment of complex diseases of the trunk of the body.

Stage 2: FSN was utilized to treat non-visceral diseases in the trunk.

One day in the autumn of 1998, the author and a friend met on the university campus. The friend was seeking advice for her father-in-law, who was suffering from severe neck pain and who had been treated in the university hospital for nearly one month but did not respond to the treatment. The friend inquired if Fu can do something her father-in-law before leaving in a couple of days. The author had no better choice of treatment than FSN. Surprisingly, the neck pain was immediately relieved after the FSN trial. From then on, the author started using FSN to treat non-visceral painful diseases in the trunk, such as lower back pain with or without sciatica, cervical syndrome, and slight ankylosing spondylitis.

Stage 3: FSN treats visceral benign painful problems.

FSN is performed superficially; hence, superficial illnesses such as soft tissue injuries were regarded as FSN indications. FSN was never expected to treat visceral diseases until an 80-year-old acupuncturist, who worked in Luzhou, Southwest China, wrote to Fu that he treated a patient with appendicitis using FSN. Although FSN may not be suitable for the treatment of appendicitis for safety reasons, the letter implied that FSN may possibly treat visceral diseases. From then on, FSN was used to treat acute/chronic gastritis, cholecystitis, pain due to urinary calculus, painful menstruation, and so on.

Stage 4: FSN was used to handle painful problems in the head and face and non-painful diseases.

After the successful treatments of visceral diseases, more confidence in FSN was gained. The author moved on to treat head pain and face problems. These experiences convincingly showed that FSN is effective in relieving localized headaches and in painful problems of the face caused by temporomandibular and accessory sinusitis. FSN was mainly used to deal with painful problems where an immediate response could always be achieved. A query was raised regarding FSN's capacity for effectively managing non-painful diseases. After long-term practice, it was found that FSN could also deal with non-painful problems. At present, the following non-painful indications have been determined: chronic cough without sputum, onset of chronic asthma, localized numbness, chronic cold, chronic constipation, long-term diarrhoea and so on.

5. Fu's Subcutaneous Needling (FSN) manipulations

Although FSN originated from traditional acupuncture, its manipulation is quite different.

5.1. Structure of the FSN needle

FSN needles, individually packaged and pre-sterilized with ethylene oxide gas, are designed for single use. The FSN needle is made up of three parts (Fig. 4): a solid steel needle core (bottom), a soft casing pipe (middle), and a protecting sheath (top).

The needle core consists of a steel needle stick and the needle-core handle. The former is made of stainless steel, with a beveled tip. When the needle pricks the skin, the bevel of the tip should face upward. The latter is made of plastic and is square-shaped; one of the four sides has 10 protuberances. The protuberances are on the same side as the bevel of the tip. If the protuberances face upward, the bevel will also face upward. The needle core allows the FSN needle to have sufficient rigidity to quickly go through the skin, go forward along the subcutaneous layer, and smoothly sway from side to side. A soft casing pipe encases the FSN needle.

The soft casing pipe consists of two parts: the pipe body of fluoroplastic and the pipe neilsbed of common plastic. A metal wedge connects the two parts to one another. The tip of the casing pipe is about 3 mm behind the tip of the needle core when the needle core is embed-

ded inside the casing pipe. The casing pipe has two functions: 1, it could cover the tip of needle stick until the needle stick is pulled back by 3 mm; thus, the tip of needle stick will not hurt the surrounding organs during the swaying movement; and, 2, substituting the steel needle core with the casing pipe beneath the skin can ease the patient's pain during retention.

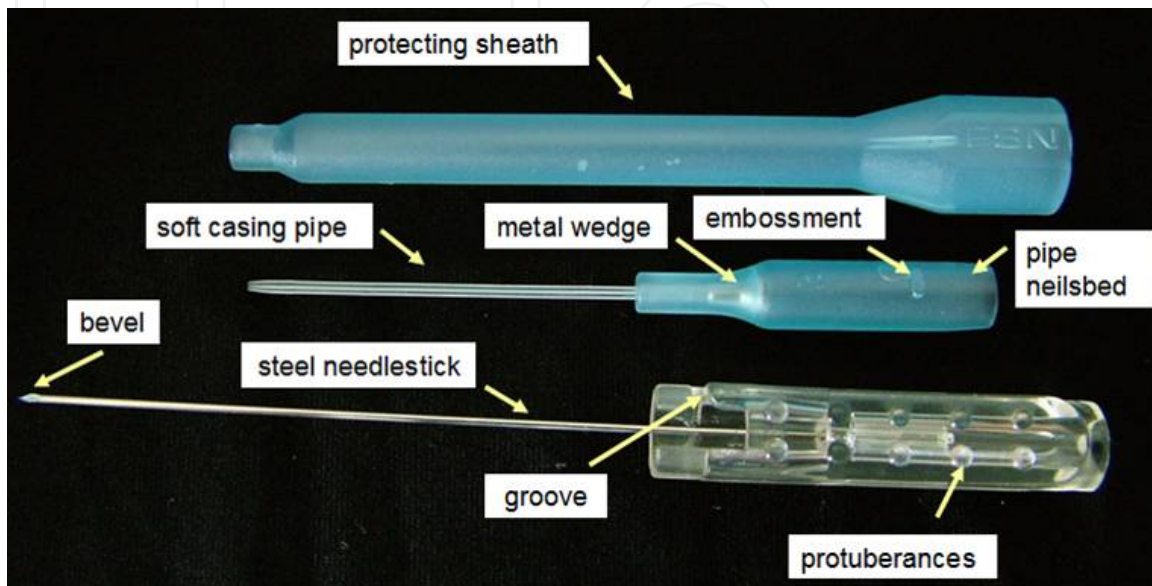


Figure 4. Three parts of FSN needle

The protective sheath is an affiliated structure and is made of common plastic. The protective sheath shields the needle core and the casing pipe from collision with something else, and it also keeps the FSN needle sterile.

5.2. Preparation prior to treatment

5.2.1. Select a treatment posture

The FSN needle is thicker than acupuncture filiform needles, and FSN manipulation lasts longer; hence, selecting a suitable posture is crucial for FSN manipulation compared with acupuncture and dry needling. The following are the common postures used when FSN is used:

Sitting position: Appropriate for manipulating locations in the head, face, neck, shoulders, upper back and upper extremities.

Supine position: A fine choice when manipulating in the abdomen.

Prone or lateral decubitus position: An appropriate posture when treating diseases of the back and the rear of lower extremities.

The demonstrations in the above figures are only several of the common examples used in an FSN clinic. In fact, the postures can be modified depending on the patient's condition.

To be more precise, we should often change the positioning of the patient under the following two conditions: 1, when there is no immediate effect after several minutes of the FSN swaying movement, another posture should be considered. For example, the sitting posture is the first choice for the treatment of neck and upper back pain. However, if the sitting position does not work, letting the patient lie down may be a better choice; 2, when a patient is sensitive to a certain position or the painful problem becomes extraordinarily uncomfortable when a patient assumes a certain position, this special posture may be the best choice for the particular patient. For example, if the back pain is felt only when the patient stands, the FSN needle could be inserted while the patient is in a prone position, and then the patient could be asked to stand up before doing the swaying movement (Fig.5).



Figure 5. The needling technique when low back pain is worse while the patient is bending forward

5.2.2. Palpate the Trigger Point (TrP)

In most cases, TrPs are the cause of painful musculoskeletal problems and are also the main targets of the FSN needle. In the following introduction to the treatment details of common diseases, the locations of relevant common TrPs are mentioned. Readers are referred to some current books for TrP dry needling.

5.2.3. Locate the insertion area

Unlike traditional acupuncture, FSN does not require the insertion of the needles into acupoints or Ah-shi points. The needles are inserted into the area surrounding the TrPs or in the nearby limbs. After ascertaining the TrP, the needles can be inserted anywhere within the district around the TrP or in the adjacent limb. How is the area chosen? Here are some principles:

Principle A: For a single small-sized TrP, the insertion area should be close to this TrP. For a large-sized TrP or for TrPs clustered in one area, the insertion points should be in the nearby limbs. For example, the insertion points should be close to the TrP in the case of tennis elbow, whereas they should be far away from the TrP cluster in the case of upper back pain. The reason being is that when the distance between the TrP and the FSN needle tip is farther, the level of FSN effectiveness may be reduced, but its coverage area may be considerably enlarged. This phenomenon is called the *flashlight* \

Principle B: Between the insertion points and TrP, there should not be scars or hollow or prominent, especially there should not be the olecranon of ulna, patella, styloid processes of the radius and ulna, malleolus lateralis, or malleolus medialis.

Principle C: For different types of diseases, the FSN needle insertion site should follow the guidelines listed in **Table 1** if the needle insertion area should be far from the lesion site.

Principle D: To reduce pain during needle insertion, the needling points should be kept away from surface blood vessels, most of which are veins.

Diseased Region	Insertion Area
Head, face, upper back	Thumb side of the forearm, outside of the upper arm
Chest, epigastric zone	Inner side of the forearm and upper arm
Hypogastrium	Middle part of the inner side of the leg, anteromedial part of thigh
Low back	Rear or outside part of the leg, outside of the thigh
Genitals, anus	Middle part of the inner side of the lower limb

Table 1. Insertion areas corresponding to the diseased region

5.2.4. Sterilize

Sterilization is necessary and essential before FNS insertion. Both the surface of the insertion point and the practitioner's fingers should be sterilized.

5.3. Needling method

The needling procedure for FNS, including needle insertion, needle swaying, needle direction, needle retention, etc., is described below.

5.3.1. Needle insertion

The posture of the patient should be adjusted to ensure that the skin on the inserting point is neither tight nor loose. If the skin is too tight, relevant blood vessels dilate, and the FNS needle is more prone to inducing pricking; on the other hand, if the skin is too loose, it is harder to penetrate. During the whole process, the needle tip should always be directed toward the TrP.

First, the protective sheath of FNS needle is gently taken off, and then Fix the FNS needle into fixing groove of a kind of inserting device (Fig.6), which was specially designed for FNS Needle inserting, and then pull the fixing groove back to the locked position..

Hold the device as shown in Fig. 7.

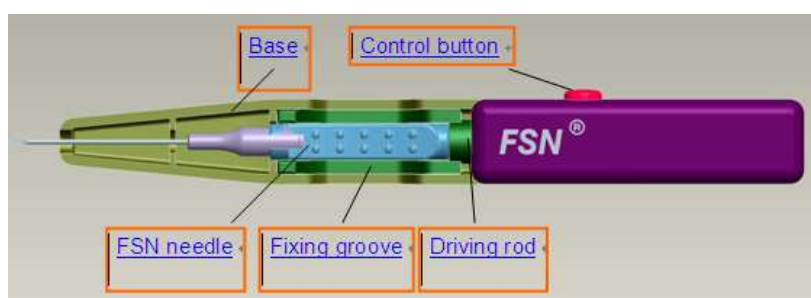


Figure 6. A FNS inserting device with a FNS needle in



Figure 7. The way of holding the inserting device

Push and press the device to the area of intended insertion to form an indentation (Fig.8).

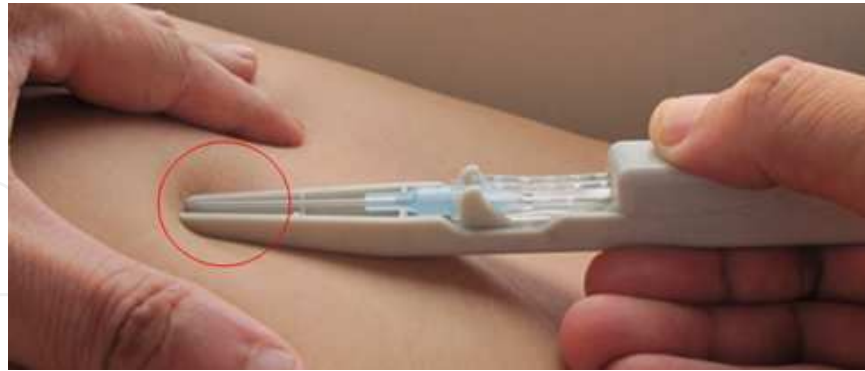


Figure 8. Before ejecting, the device should be pushed in

Press the control button with your right index finger, and then the FSN needle will immediately eject and penetrate the surface of the skin.

Use your left hand to take the FSN needle out from the fixing groove, and remove the device with your right hand (Fig.9).



Figure 9. After insertion of the needle tip into the skin, the method to separate the device from the needle

Afterward, the needle should be laid flat and then carefully pushed in until the needle has been fully inserted. While being pushed forward, the needle tip should be slightly elevated in order to observe if the skin hunch is moving along with the needle tip. At this point, the therapist's right hand should feel loose with no resistance; while the patient feels something moving under the skin, but there is no feeling of *De-Qi*.

After the casing pipe is totally embedded beneath the skin, the needle-core handle should be withdrawn by about 3 mm and turned 90° to the left; this way, an embossment in the pipe neilsbed goes into a groove in the needle-core handle. The swaying movement can be done. Once the swaying movement is finished, the needle-core handle is turned right by 90° out of the groove, and then the steel needle core is withdrawn. The steel needle core is placed into the protective sheath so as not to hurt the medical staff and the garbage collector.

The casing pipe is then embedded beneath the skin using an adhesive tape. After 1-2 hours of retention, the adhesive tape is removed and the casing pipe is pulled out. At the same time, the insertion point should be pressed using a sterilized cotton ball for at least one minute to prevent bleeding.

5.3.2. Swaying movement

The swaying movement, a key procedure for FSN, is a smooth, soft, fan-style waggle using the thumb as its fulcrum. The index finger, middle finger, and ring finger stay in a line. The middle finger and thumb affix the needle in a face-to-face way, while the index finger and ring finger alternately move back and forth (Fig. 10).



Figure 10. The way of hold the needle while the swaying movement.

The frequency of the swaying movement is about 100 times a minute. The duration of the swaying movement for one insertion point is often within 2 minutes. After 50 repetitions of the swaying movement (about half a minute), you can palpate the TrP or ask the patient about the condition of his/her problems. If the TrP has been deactivated or the patient says the problem is gone, the swaying movement should be stopped; otherwise, it should be continued. If the problem persists, the entire needle should be pulled out and the insertion point should be adjusted.

At the same time of swaying movement, the clinicians should move or ask the patient himself to move the relevant muscles or joints. Fig. 11 shows consecutive photos taken while manipulating the needle in upper extremity pain. The lifting of the sleeve by the practitioner's left hand and the movement of the left thigh should be noted. The rocking of the relevant muscles or joints is one of methods called the *reperfusion technique*.

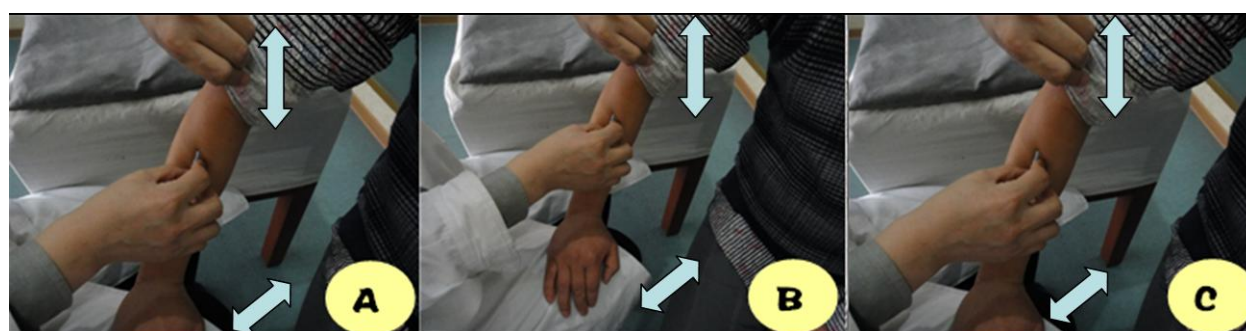


Figure 11. The consecutive photos of needle manipulation for upper extremity pain.

5.3.3. Reperfusion technique

Chinese acupuncturists often make use of a kind of technique for the treatment of acute painful problems. This technique is often conducted by the patients' themselves: the patients exercise their afflicted body part while acupuncturists insert the needles in an area other than the afflicted region. For example, when a Chinese acupuncturist treats pain associated with a sudden sprain in the lower back, he will ask the patient to stand up and rock his back during needling at the acupoint *Renzhong* (DU26). Although widely used, this practical rocking technique has seldom been introduced in textbooks. At present, this technique has no regular name; sometimes, it is called *Yundong needling* (kinetic needling) [40], other times, *Dong-qi* (meaning moving the energy) therapy and movement therapy [41]. In the Western world, there are also some similar techniques, such as exercise [42] or ischemic compression [43,44].

Inspired by these techniques, Fu tried to apply them in conjunction with FSN. To his surprise and delight, these techniques immediately enhanced FSN in many patients, especially for stubborn pain. To say that FSN is a much better fit for these conditions than acupuncture is no exaggeration. The reason is that the insertion point of acupuncture should be far from the afflicted area if these techniques are applied; there is no such restriction in FSN because FSN needles are not inserted deep into the muscles. Thus, these techniques could be done easily during FSN manipulation, regardless of whether your FSN insertion point is far from or near the afflicted area.

Fu once wondered about the mechanism of these techniques, and then searched for relevant studies. To his disappointment, there are only a few studies on these techniques both in Chinese and English papers. The limited number of studies could probably be blamed on the shortage of appropriate techniques, such as ischemic compressions, that could be done while exercising. These techniques are known to increase the effectiveness of FSN. Why do they work this way?

In the energy crisis theory [17,25], the contraction of a muscle segment creates a demand for energy and cuts off local circulation. Thus, improving local circulation is crucial. FSN can relieve muscle contraction from TrPs and then improve the local circulation, but this consumes both time and the practitioner's energy. FSN can be better utilized with the help of

other methods that can help to improve circulation. Can these reperfusion techniques help in improving circulation? The answer can be illustrated using the change in the hand's skin color when the fist is clenched and loosened alternately (Fig. 12)



Figure 12. The changes of the skin color when the fist clenches and unclenches,

Fu named the course of techniques the *reperfusion approach (RA)*. RA here refers to the mechanical methods that extent/contract repetitively the relevant muscles to improve the local circulation in non-inflamed ischemic tissues, especially in musculoskeletal injured tissues.

Reperfusion is a word often found in the phrase *reperfusion injury*, which refers to tissue damage caused when blood supply returns to the tissue after a period of ischemia. Reperfusion injury is often involved in stroke and brain trauma, and sometimes, also in muscular trauma.

Could RA lead to reperfusion injury in ischemic tissues? This possibility should not exist because: (1) the ischemic state is a chronic one; and (2) the approach calls for the actions to be performed in a sequential and repetitive way; each action can only slightly improve the circulation.

There are two kinds of RA: active RA and passive RA. Active RA means that the actions are carried out by the patient's afflicted joints or some afflicted organs. Passive RA means that the actions are implemented by the practitioner or the patient's healthy limbs. The application range of active RA is larger than that of passive RA. Active RA can be used in most conditions. Passive RA is more applicable in the following conditions: (1) the patient does not know how to perform the RA; (2) the patient does not know how to control the amplitude and frequency; and (3) the TrP is located in a body part that the patient finds hard to move, such as in the scalp.

Active RA and passive RA could be used alternatively. Passive RA in small joints can often be implemented by the practitioner, whereas passive RA in large joints could be carried out by either the practitioner or the patient. For different muscles afflicted with musculoskeletal disease, practitioners should use different methods of RA during FSN.

With RA, the range of extension or contraction should be as large as possible under the safe condition. The transition between extension and contraction had better be slow.

5.3.4. Retention

After the swaying movement and RA, the solid steel needle core should be taken out (Fig. 13), and then go to retention. Retention is the process of retaining the casing pipe beneath the skin after the needle core is pulled out. The goal of retention is to maintain the immediate effects of the treatment. Therefore, if the treatment has no immediate effect, retention is meaningless. If the treatment has an immediate effect, then retention is necessary. The pain that just disappeared might recur without retention.



Figure 13. The method of separating the needle core from the tube.

The rubberized fabric that is used for retention should be big enough to cover the pipe neils-bed and insertion point (Fig. 14). Sometimes, rubberized fabrics can cause local itching and swelling due to allergy. In this case, the rubberized fabric should be changed.

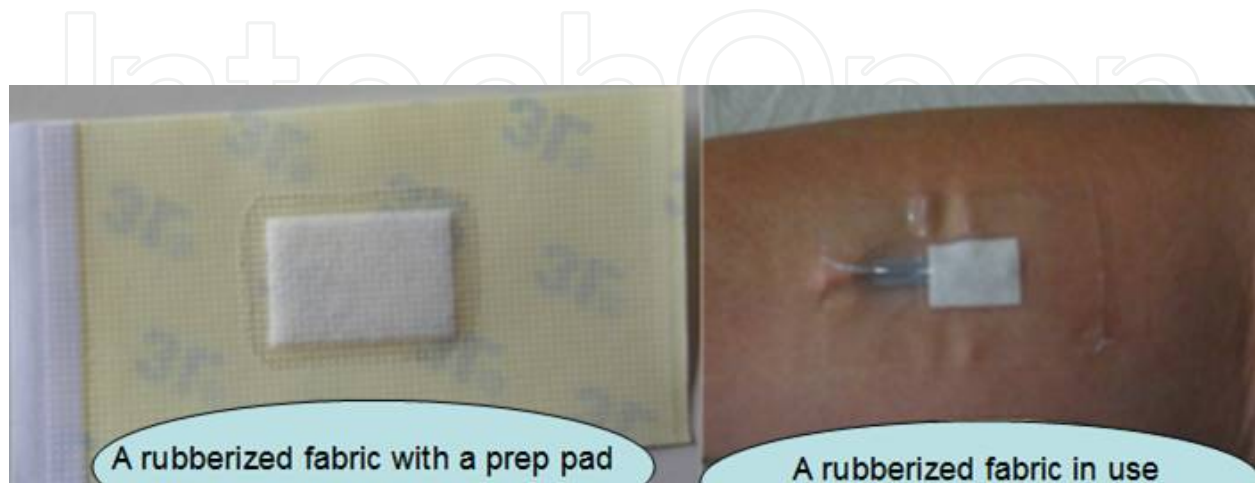


Figure 14. Fixing the soft tube by an adhesive tape.

For the sake of safety, retention time should last for 1 hour. According to our experience, the patients had better to stay in your clinic and to feel the condition. After 1 hour, if the pain is still present, do another swaying movement or insert other FSN needle. If the pain goes away or there is no change at all, take the whole FSN needle out without retention and let the patient go home.

6. Precautions, contraindications, and management of side effects

During traditional acupuncture, many people feel a brief stinging sensation, like a pinprick, when the needles are inserted. Others experience a dull ache around the needle after it goes in. A handful of patients have been injured because the needle was pushed into a vital organ, such as a lung. Nevertheless, acupuncturists have an extremely good safety record.

Given that an FSN needle does not go deep and does not elicit *De-Qi*, it is also a safe form of therapy, even safer than traditional acupuncture. However, no form of therapy is absolutely safe. When using FSN, close attention should be given to the following to gain satisfactory effects and to avoid causing patients discomfort:

- a. FSN treatment should be delayed for those patients who are famished or who have overeaten, and also those who are intoxicated, over fatigued, or very weak.
- b. The insertion of an FSN needle into the lower abdomen of pregnant women is contraindicated.
- c. During needling, the blood vessels should be avoided to prevent bleeding, especially in the region of the superficial temporal artery, posterior auricular artery, and radial artery. When a patient suffers from spontaneous hemorrhage, do not give FSN treatment..

When performed correctly, FSN is free from any adverse effects. However, there are some potential yet temporary side effects that the practitioner should be aware of.

Bruise: A bruise appears where small blood vessels have broken, leaking blood under the skin. Bleeding under the skin results in a red or purple mark, which fades to yellow or green over time? Bruises often feel tender or swollen in the first few days. There are many small blood vessels, mostly veins, in the subcutaneous layer. During FSN manipulation, care should be taken to avoid the veins. However, some conditions make it impossible to avoid all blood vessels; hence, bruising under skin sometimes occurs. If the bruise under skin is not severe, there is no need to manage it. What needs to be done is to tell the patient not to worry, and ask him/her to relax. If the congestion is severe and causes pain or affects local function, the casing pipe should be pulled out immediately, and then cold, soft materials, for example, cold and wet towels, should be applied to compress the local area and stop or reduce the bleeding.

Syncope: People occasionally feel faint while undergoing FSN, especially at the start of the first treatment. When the patient is faint, he/she feels tired, dizzy, and nauseous, and his/her face turns pale. Sometimes, the patient also exhibits profuse sweating, flushing, and cold-

ness of the extremities, or even goes into a coma or falls to the ground. The prevention of fainting is more important than its treatment. When a patient undergoes FSN treatment for the first time and feels nervous or is in a weak condition, you should explain the FSN procedure and help the patient relax by selecting the suitable posture. During manipulation, the patient's expression should be observed; if any aura of faintness is seen, stop the FSN and let the patient lie down on a bed. In most cases, the patient will recover with the help of drinking water within 3-5 minutes.

7. Factors that influence Fu's subcutaneous needling effects

Many factors influence the effects of FSN, but some of them, for example, smoking, have not been proven. However, some of the factors have already been clinically proven in some cases.

7.1. Main factors that influence short-term effects

Edema: Stopping FSN treatment is advisable if the patient is suffering from general edema, such as when patient with lupus or rheumatoid arthritis received steroid treatment. Moreover, even if the patient has a concurrent painful problem, using FSN will have no effect.

Fever: Regardless of the cause of fever, the effects of FSN would not be as good as when a patient is in a normal healthy state. FSN should be stopped and the fever should be managed

Other previous treatments: Some previous treatments, such as local steroid injections, heavy cupping, plaster medicine, local ointment medicine, and local application of the coupling medium for an ultrasound check, will obviously influence the effects of FSN.

Bad manipulation: Any type of manipulation has an impact on the effect. If one step has not been performed well, the short-term effect will be influenced.

Wrong diagnosis: FSN is good for soft tissue non-traumatic lesions, but not for traumatic lesions, such as acute ankle sprain or pain caused by a hairline fracture

7.2. Factors that influence long-term effects

Short-term effectiveness: If there is a good short-term effect, there is likely to be a good long-term effect. If the short-term effect is not easily achieved, the long-term effect will probably not be good.

Chronicity of the lesion: If the soft tissue non-traumatic lesion has been present for a long time, the long-term effect will not be as good as if the lesion has only been present for a short time.

Completeness of FSN treatment for TrPs: Beginners of FSN can easily deactivate active TrPs, but ignore the palpation and the treatment of latent TrPs, which are also the engines of soft tissue lesions.

Personal Habits: Some routine habits or customs aggravate FSN's long-term effects. These routine habits include watching TV in the bedroom, playing poker or mahjong for extended periods of time, using an electric fan while sleeping, indulging in online gaming, walking or standing for long time, and not having enough sleep.

Health Condition: If the patient also suffers from other diseases such as immunologic diseases, chronic infection, hypothyroidism, diabetes, hyperuricemia or malignant change, the therapeutic effects may be poor.

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