Japanese Acupuncture - Current Research

Effects of Press Tack Needle in the Sports Field

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Introduction

In recent years, treatment with acupuncture for sports injuries is drawing increasing attention. The majority of sports injuries such as tennis elbow or baseball shoulder are caused by repeated movements of a portion of the body during sports activities. In these sports injuries caused by the repetition, acupuncture, moxibustion and massage are applied in Japan. The first systematic literature on acupuncture treatments in the field of sports was published in 1949 by Honma in the journal of "Ido-no Nihon", which carried six articles in series. The literature describes that acupuncture was extensively applied, beyond the general notion of acupuncture practice, to even enhancing athletic performance and recovering from muscle fatigue, in addition to the treatments of sports injuries. Since the publication of the report, only case reports on acupuncture treatments in the field of sports have been reported sporadically. It is only after 1980 that studies in this field have begun to be actively undertaken.

Meanwhile, the press tack needle (PTN), often called the thumbtack-type needle (*empishin*), which was devised in Japan in around 1980, is like a small 0.5 – 1mm long thumbtack. The press tack needle is an acupuncture technique that the needle is stuck in the skin and attached to the site with a piece of adhesive tape. The PTM is employed in the field of sports since it does not cause pain while in use, making it possible for athletes to continue sports activities with the needle in place. Since around 1990 basic studies on PTN involving human subjects have been carried out with the muscle fatigue models to examine its effects on fatigue dissipation. PTN has been used for double blind clinical trials since around 2000 as it gives virtually no pricking sensation. This paper will present studies on PTN in the field of sports as well as double blind randomized, controlled studies on which the author would make comments.

Studies on PTN in the field of sports

Most studies on PTN in the field of sports focus on the process of acute muscle fatigue recovery. The experimental protocols were with indwelling PTN (1) to investigate muscle output by voluntarily applying isometric exercise stress with the maximum muscle strength mainly to biceps muscle of arm[1-4], quadriceps muscle[7], hamstrings[5,6], and triceps muscle of calf[8,9]; (2) to investigate the index for the number of movements for the knees and elbows to be able to carry out isotonic exercise until all-out muscular failure[14,15]; and (3) to observe an decrease in the total work and the maximum muscle strength by applying isokinetic exercise stress loading[11,12,13].

The results of these studies are summarized as follows:

1) The PTN showed the ability of suppressing the reducing process of muscle output compared to non-treated.
2) In comparison between non-treated and placebo, some cases showed differences in the maximum muscle output but some cases did not.
3) PTN was effective when it was used 1cm lateral to the spinous process of the vertebra where the cutaneous branches of the posterior branches of the spinal nerves that control muscles are distributed, whereas almost no effects were observed when it was used on any other dermatome areas.
4) A correlation between the levels of lactic acid and muscle output were suggested. However, the PTN did not affect the level of lactic acid.
5) In regard to isokinetic exercise of knee joints, PTN suppressed the declining rate of the total work in extension movements, whereas no suppression was observed in flexion movements in many cases.
6) Buffering the blood lactic acid was accelerated under low stress and high rotation.

7) No influences on hemoglobin dynamics were observed.

These results showed that PTN was effective for suppressing transient decreases in muscle strength and muscle fatigue. The mechanisms, however, are not known. Many of these studies have several issues that (1) bias factors of the study subjects might have caused influences on developing the models of muscle fatigue, (2) the relationship between subjective fatigue perceptions and the muscle strength was not examined, (3) the connection with matters of biochemistry was not examined, and (4) comparisons with other interventions than PTN were not made. Now these issues have progressively been improved, leading to the enhanced quality of studies.

There are few studies in which comparisons were made between PTN and other interventions. Izumi et al.[16] reported that for muscle fatigue of boxing players, comparisons were made based on the M-Test (meridian test) between the results of PTN and those of self-stretching performed with a ball for stretching. The results indicate that PTN improved the number of positive movements assessed by the M-Test.

Randomized, clinical trial in the field of sports

Documents of such placebo, sham-controlled studies as pointed out by "Acupuncture-NIH Consensus Statement" in the sports field have been published by Brattgerg et al.[17] for tennis elbow, by Julia Kleinhenz et al.[18] for rotator cuff tendinitis, and by Vrehota et al.[19] for plantar fasciitis. These studies did not satisfy the criteria for double blind and were invalid as double blind tests since both test subjects and practitioners were not "blind."

Randomized, double blind method is used as a clinical study of the highest level of evidence. Double blind is the technique to conduct a clinical test under the condition in which biases of the subjects and practitioners are eliminated. Applying the double blind method for acupuncture treatments is difficult due to the reasons that (1) unlike medication therapy, it is unfeasible to blind practitioners who manipulate needles; and (2) the skin and muscles of the subjects are stimulated, which also makes it difficult to blind them.

Thus, double blind studies on acupuncture treatments have focused on the effects of needling different points – meridian points and non-meridian points and on the effects of shallow needling and deep needling. These are comparisons of needling points or needling depths and are not double blind in the strict sense. There are studies in which the subjects were blinded under general anesthesia in operation and also randomized studies in which sham needles were used. However, practitioners in the study system were not blind. In short, no clinical studies were conducted under the condition of which both subjects and practitioners were unaware.

PTN is the acupuncture needle most suitable for double blind trials because (1) its needling does not give pain, which allows blind testing of the subjects; and (2) practitioners are able to needle without checking the presence of the needle tip and after needling, a plaster is affixed so that the needle inserted cannot be viewed.

In order to make double blind trails in the true sense, Miyamaoto[20] has developed placebo acupuncture needles that have no needle tip, packed in the package liked ones (Fig. 1). And he has conducted a randomized, double blind, placebo-controlled study to examine whether or not "acupuncture treatments have positive effects on conditioning of long-distance athletes of track and field" and reported investigation results. (The study was subsidized by the scientific research fund of the Ministry of Education, Science, Sports, and Culture.)

Papers of randomized, clinical trials with the subjects of athletes

Introduced hereunder are two representative clinical studies on PTN in the field of sports in which placebo needles were used.

Miyamoto[21] has conducted a randomized, double blind study using placebo needles to investigate the effects of PTN on muscle soreness and muscle

stiffness that resulted from running a marathon race.

The subjects were 15 university students who were to experience a marathon for the first time. They were randomly divided into two groups: the PTN group of 8 persons (6 male, 2 female) who were not involved in the acupuncture practice, examination, and data analysis; and the placebo group of 7 people (6 male, 1 female) who were assigned to placebo having no needle that was uniquely developed with the same package appearance as the one for the PTN (Fig 1). Before the marathon run either PTN or placebo was affixed according to the assignment list to the 8 acupoints of Zusanli (ST36), Sanyinjiao (SP6), Xuehai (SP10), and Liangqiu (ST34) on both legs. Needles were removed after 5 days. Measuring items were Visual Analogue Scale (VAS) for muscle soreness, serum CK activity, LDH isozyme, forward flexion from a standing position, and muscle hardness, and measurements were evaluated three times-before the start of the run after the finish and 5 days after the marathon run. The results showed following.

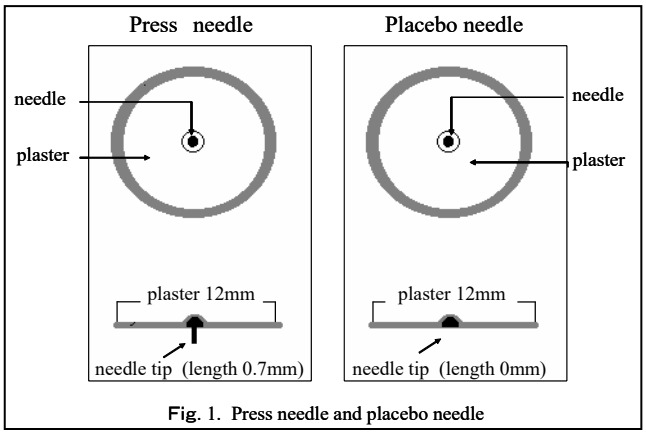

Fig. 1. Press needle and placebo needle

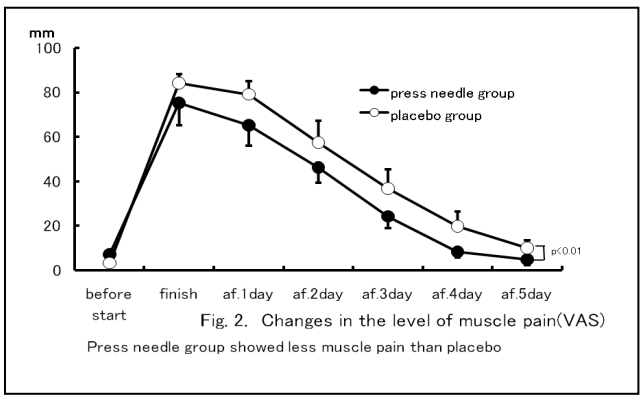

Fig. 2. Changes in the level of muscle pain(VAS)
Press needle group showed less muscle pain than placebo

1. The PTN reduced muscle soreness caused after the marathon run ($p<0.01$) (Fig. 2). 2. Although the levels of CK activity and LDH 4-5 isozyme increased after reaching the goal line ($p<0.01$), no effects of the PTN were observed. 3. No differences in a forward flexion from a standing position were observed in both groups. 4. The level of muscle hardness increased in the vastus lateralis muscle and vastus medialis muscle ($p<0.05$). However, no effects of the PTN were observed. 5. The marathon time of the PTN group was shorter. 6. The subjects were not aware of the difference between the PTN and placebo needle. It was reported from these results that the PTN was effective for relieving muscle soreness after a marathon race.

Miyamoto et al. confirmed that their study was valid as a double blind study by means of directly asking the practitioners and the subjects whether they recognized that needles used for the subjects had a tip or not and found that they did not understand the difference between the PTN and placebo needle. Although there is an issue about the study that the number of the subjects is limited, this is the first research to which the indexes were added about muscles including muscle soreness, muscle stiffness, muscle flexibility and CK activity.

Kaneko[22] has investigated the effects of the PTN on muscle soreness after a triathlon race in a placebo-controlled study.

The subjects were 149 of males and females who participated in a triathlon event. They were randomly divided into two groups: a group of 79 (67 male, 12 female) who were assigned to PTN and a group of 70 (56 male, 14 female) who were assigned to placebo. The placebo needle used in the study was the same as the one used by Miyamoto. Stimulus sites for both groups were Shenshu (BL23), Qihashu (BL24), Dachangshu (BL25), and Ciliao (BL32) of right and left sides with leaving the needles indwelled only during the race. Measuring item was VAS (visual analog scale) values for muscle soreness

in 6 regions of the lower extremity (anterior thigh, posterior thigh, anterior lower legs, posterior lower legs, lower back, and buttocks), and measurements were made before the race (PRE) and immediately after the race (POST1) and on the following day (POST2). The results showed the following (Table 1).

Each VAS score was increased on POST1 compared to that on PRE ($p<0.01$) for both groups. With PTM treatment, VAS score were decreased on POST2 compared to those on POST1 on except for Gluteus ($p<0.01$, $p<0.05$), and had recovered to the condition before the race. In the P group, VAS score of the hamstrings was decreased on POST2 compared to that on POST1, while VAS score were significantly higher than those on PRE for Quad, Hamstrings, and Calves. It was reported that these results suggested suppression of delayed onset muscle soreness by the use of the PTN during the race.

Table.1 Changes of muscle pain(VAS)

press needle (N=79)

	before start	after finish	af.1day
Quads	32.1±24.2	48.4±22.0 **	36.0±24.9 ##
Hamstrings	32.2±23.6	47.0±20.6 **	30.9±22.5 ##
Calves	25.8±18.9	40.4±23.5 **	30.5±22.4 ##
Tibialis	32.7±23.1	49.0±24.2 **	35.1±24.6 ##
Glutes	37.8±24.5	46.8±24.1 **	37.5±24.2 ##
lower back	31.4±22.6	40.3±22.4 **	32.8±22.4 ##

placebo (N=70)

	before start	after finish	af.1day
Quads	30.2±23.0	41.9±24.2 **	38.1±22.8 **
Hamstrings	25.6±19.7	41.6±25.1 **	33.0±21.3 *#
Calves	25.5±21.7	35.4±23.3 **	28.9±20.6 **
Tibialis	30.0±23.0	43.3±26.4 **	36.7±25.6 **
Glutes	30.3±22.6	37.8±23.0 **	33.2±21.8 **
lower back	28.0±21.1	35.9±23.0 **	34.4±21.0 **

**: vs. before start (p,0.01) *: vs. before start (p,0.05)

##: vs. after finish (p,0.01) #: vs. after finish (p,0.05)

The study by Kaneko et al. is an excellent study that was properly designed as a randomized, double blind study with an adequate number of subjects involved. Although variations with time for each group were statistically treated, comparisons between the two groups were not made. Moreover, muscle soreness was reviewed as DOMS (delayed onset muscle soreness). It is, however, not clear if the soreness was the type of DOMS or not since it was more intense immediately after the race than on the following day (next day) and the intensity was not measured continually on the days following the next day after the race.

From the studies by Miyamoto and Kaneko, it is becoming clear that a placebo-controlled study using a needle without a tip packed in the same package as the one for PTN is suitable for a double blind study since both subjects and practitioners are unaware of which needle is assigned to and that the PTN is able to relieve muscle soreness caused by marathon run, triathlon race, or long distance running. Sedative mechanism of the PTN, which has not been investigated, is a subject for future studies.

References

1) Takahashi M, et al.: The Influence of Acupuncture and Moxibustion Stimulation on the Experimental Acute Muscle Fatigue Model - The Effects of Press Tack Needle on the Flexor Muscle Group in the Upper Arm. The Journal of Oriental Medicine College Association 14: 60-64, 1990

2) Anzai T, et al.: The Influence of Acupuncture and Moxibustion Stimulation on the Experimental Acute Muscle Fatigue Model, Report No. II - The Effects of the Press Tack Needle used on Distant Points. The Journal of Oriental Medicine College Association 15: 40-45, 1991

3) Sugiyama T, Tone K, Takahashi M, et al.: The Effects of Acupuncture and Moxibustion Stimulation on the Experimental Acute Muscle Fatigue Model, Report No. III - The Enduring Effects of the Press-Tack Needle on Recovering from Muscle Fatigue. Journal of Japan College Association of Oriental Medicine 16: 32-37, 1992
4) Tone K, Sugiyama T, Otake S, et al.: The Influence of Acupuncture and Moxibustion Stimulation on the Experimental Acute Muscle Fatigue Model, Report No. IV - The Relationship between Fatigue Recovery and the Amount of Stimulation - The Journal of Oriental Medicine College Association 17: 21-26, 1993
5) Inoki H, Furuya E, et al.: The Influence of Acupuncture and Moxibustion Stimulation on the Experimental Acute Muscle Fatigue Model, Report No. V - Study on Hamstring Muscles. The Journal of Oriental Medicine College Association 18: 48-52, 1994
6) Ueno M, Ishibashi Y, Watanabe K, et al.: The Influence of Acupuncture and Moxibustion Stimulation on the Experimental Acute Muscle Fatigue Model, Report VI - The Influence of Muscle Output depending on the Timing of Acupuncture. The Journal of Oriental Medicine College Association 19: 102-108, 1995
7) Adachi J, Nagao M, Murakami T, et al.: The Influence of Acupuncture and Moxibustion on the Experimental Acute Muscle Fatigue Model, Report No. VII - The Effects of Press Tack Needle on Quadriceps Muscle Fatigue. The Journal of Oriental Medicine College Association 20: 27-33, 1996
8) Aritake H, Kogure M, Kumade T, et al.: Effect of Acupuncture and Moxibustion on Experimental Muscular Fatigue Models. Effect of Press Tack Needle on Muscular Output of Lower Leg Triceps, Report No. VIII - The Journal of Oriental Medicine College Association 22: 64-68, 1998
9) Kurita H, Ozono I, Hattori N, et al.: The Effects of the Press Tack Needle on Muscle Training of the Lower Extremities. The Journal of Oriental Medicine College Association 23: 53-57, 2000
10) Kaneko Y, Ito H, Iida M, et al.: The Effect of Press Tack Needle Treatment on Time-dependent Change in Various Index Values when Maximal Exercise Stress is applied. The Journal of Oriental Medicine College Association 25: 85-93, 2002
11) Sugiyama N, Miura Y, Sato R, et al.: Effects of Press Tack Needle on Lowering Muscle Output Accompanied with Knee Joint Flexion/Extension – Study on Isokinetic Exercise. The Journal of Oriental Medicine College Association 27: 33-39, 2003
12) Takahashi N, Komuro S, Aoyama T, et al.: Effects of Press Tack Needle on Lowering Muscle Output Accompanied with Knee Joint Flexion/Extension (Report No. II) – Study on Isokinetic Exercise under Heavy Load and Slow rotation. The Journal of Oriental Medicine College Association 28: 103-107, 2004
13) Aoyama T, Gowa N, Tsukahara Y, et al.: Effects of Press Tack Needle on Lowering Muscle Output Accompanied with Knee Joint Flexion/Extension (Report No. III) - Study on Isokinetic Exercise under Light Load and Rapid Rotation. The Journal of Oriental Medicine College Association 29: 73-76, 2005
14) Egashira I, Goto M, Kobashi M, et al.: Effects of Press Tack Needle on Muscle Fatigue Accompanied with Knee Joint Flexion/Extension – Study on Isotonic Exercise. The Journal of Oriental Medicine College Association 30: 66-70, 2007
15) Imokawa Y, Kitano Y, Nakamura Y, et al.: Effects

of Press Tack Needle on Muscle Fatigue Accompanied with Knee Joint Flexion/Extension – Pilot Study on Different Acupoints. The Journal of Oriental Medicine College Association 31: 82-86, 2008

16) Izumi S, Miyamoto T, Hiura M, et al.: The effects of acupuncture and stretching in muscle fatigue of Boxers were compared. – The Meridian Test is used for evaluation-. Oriental Medicine and The Pain Clinic 37(3, 4):61-69, 2007

17) Brattber G: Acupuncture Therapy for tennis elbow. Pain, 16: 285-288, 1983

18) Vrchota K D, Belgrade M J, Johnson R J, et al.: True Acupuncture vs. Sham Acupuncture and Conventional Sports Medicine Therapy for Plantar Fasciitis Pain: A Controlled, Double-blind Study, International Journal of Clinical Acupuncture. 2, (3): 247-253, 1991.

19) Kleinhenz J, Streitberger K. Windeler J, Güssbacher, A, Mavridis, G, Martin, E, et al.: Randomized clinical trial comparing the effects of acupuncture and a newly designed placebo needle in rotator cuff tendinitis. PAIN, 83: 235-241, 1999.

20) Miyamoto T: Does Acupuncture Treatment have Positive Effects on Conditioning of Long-Distance Track Athletes? Reports of Research Results that

21) Miyamoto T, Hamada J, Wada T, et al.: Effect of Acupuncture using Press Needle on Muscle Pain and Stiffness after Marathon Race Double Blind – Randomized Control Trial. Kampo Medicine 54(5):939-944, 2003

22) Kaneko Y, Furuya E, Sakamoto W: The Effects of Press Tack Needle Treatment on Muscle Soreness after Triathlon Race – Placebo-controlled Study. Journal of the Japan Society of Acupuncture and Moxibustion 56(2):158-165, 2006