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Research and Implementation of an AI-Based Human Posture Recognition System

Wenjie Li[1], Lei Wang[2,*], Yun Ma[1], Zizheng Wang[1], Zhanyi Hu[1], Youbin Jian[1]

[1]Shaanxi University of Chinese Medicine, Xianyang 712046, Shaanxi, China
[2]Affiliated Hospital of Shaanxi University of Chinese Medicine, Xianyang 712000, Shaanxi, China
Correspondence Author

Abstract: ***Knee osteoarthritis is a common senile degenerative disease in orthopedics and traumatology. The main characteristics of knee osteoarthritis are joint swelling pain and limited movement, which seriously affects the physical and mental health of patients. Needle therapy has the advantages of quick onset, low cost and better long-term curative effect. This article comprehensively analyzed the research status of the treatment of knee osteoarthritis with fire needle by searching the articles of CNKI, VIP, PubMed and other databases.***

Keywords: Fire needle, Knee osteoarthritis, Summarize**.**

1. Introduction

Knee osteoarthritis (KOA) is a disabling disease that affects the joints and their tissues. In the early stage, the main characteristics are joint swelling pain and limited movement. With the development of the disease, joint effusion, stiffness, muscle atrophy, and joint deformity may occur, and eventually lead to prosthesis replacement. Epidemiology shows that aging, overweight, obesity and education are all risk factors for KOA [1] [2]. The total prevalence rate of KOA in middle-aged and elderly people in China is 21.51%, and the prevalence rate in females is 25.55%, higher than that in males, 14.20% [3]. With the aging process, the prevalence of KOA will continue to increase, and the number of KOA patients will also increase year by year. Therefore, the development of a safe, fast acting and inexpensive therapy has become one of the key clinical concerns.

1.1 Firepin Contact KOA

"Ling Shu · Official Needle" says: "Simultaneous, stabbing the burnt needle is to take bi also" is the first record of fire needle. In ancient times, it is called burnt needle and simultaneous acupuncture, which refers to the rapid stabbing of specific needles into acupoints or specific treatment sites through the multiple effects of acupuncture, heat and bloodletting to achieve the purpose of disease prevention and treatment. It has the effects of warming meridians, dissipating cold, activating blood and eliminating stasis. Knee osteoarthritis belongs to the categories of traditional Chinese medicine "knee arthralgia" and "bone arthralgia". It is mostly caused by wind-cold and dampness evil. It is often manifested as cold fear of lower limbs, aggravation of cold, and warming pain reduction. Western medicine treats this disease with the aim of alleviating signs and symptoms, while oral non-steroidal analgesics [NSAID] are the main non-surgical treatment, but long-term use can greatly increase the risk of gastrointestinal adverse events, serious cardiovascular harm and other secondary diseases [4]. Surgical therapy has the disadvantages of heavy trauma, slow recovery and high cost. Fire needle therapy has been continuously developed and innovated since the period of Huangdi Neijing, and its operation methods have been developed from fast entry and fast exit without needle retention to appropriate needle retention according to the needs of the disease. The scope of its treatment was expanded from cold syndrome, meridian tendon disease and bone disease to internal, external, gynecological, pediatric and ent departments [5]. And increase the effect of heat to induce heat, tonifying deficiency and draining excess, breaking through the taboo of fever; With the improvement of needles, modern fire needle therapy has a small wound, is not susceptible to infection and has a definite effect [6]. The effect of fire needle therapy on KOA is exact, the domestic related clinical studies are increasing year by year, and the number of core journal literatures is also gradually increasing.

1.2 Simple Needle Treatment

Guo Yan et al. [7] treated 72 patients in the 3-day treatment group and 75 patients in the 5-day treatment group with fire needle therapy, and 80 patients in the control group were given oral celeoxib capsules. After 30 days of treatment, the results showed that the treatment effect of high frequency of fire needle was better. Wang Bing et al. [8] randomly divided 72 patients with KOA into 36 patients with fire-needle group and 36 patients with millimeter needle group. After 2 weeks of treatment, 4 weeks of treatment and 1 month of follow-up, the changes of VAS score and total score of WOMAC scale were used as observation indexes and comprehensive efficacy were compared among the groups. Fire needle treatment of KOA has rapid effect, significant analgesic effect, stable curative effect and better long-term effect. Zhang Huifang [9] proved through experiments that selecting Dawei nose point for fire acupuncture point treatment for early KOA patients could not only relieve pain immediately, but also improve joint motion. He Tianfeng et al. [10] observed the changes of clinical efficacy, VAS and WOMAC scores of the two groups after the fire needle group and the electric needle group treated KOA. It was found that the fire needle had better efficacy in improving stiffness and joint function.

2. Combination Fire Needle Therapy for KOA

2.1 Fumigation with Fire Needle Combined with Traditional Chinese Medicine

By the double action of medicine and heat, the effect of TCM

fumigation moves between the local meridians and textures, and the lesions fully absorb the active ingredients of the drugs, which not only direct to the disease but also avoid the side effects and gastrointestinal irritation caused by internal administration of the drugs. Wang Fang [11] et al gave traditional Chinese medicine fumigation treatment to 60 patients with congestion obstruction type KOA in the control group, and added fire needle acupuncture treatment to 60 patients in the study group. After 1 treatment, the efficacy of the study group was 93.33% higher than that of the control group 80.00%; Laboratory indicators: Serum MMP-3 and COMP levels in the study group were lower than those in the control group, and P<0.05; Adverse reactions: Compared with 5% in the study group and 0% in the control group, P>0.05. It is concluded that the combination of fire needle and acupuncture combined with Chinese medicine fumigation in the treatment of congestion obstruction type KOA is safer and better than the simple use of Chinese medicine fumigation in protecting cartilage function and improving clinical efficacy. Yuan Chunyan [12] divided 90 patients with wind-cold-damp KOA into two groups: millimousine acupuncture group, ordinary acupuncture group and glucosamine hydrochloride capsule group, and all three groups were treated with traditional Chinese medicine fumigation. VAS score and curative effect were compared after 2 courses of treatment, and it was found that the treatment of KOA with fumigation of Chinese medicine had outstanding advantages in relieving pain, improving curative effect and shortening the course of disease.

2.2 Needle Burying in Acupuncture Points

Acupoint catenary therapy refers to the absorbable line left in the acupoint, the acupoint and the body continue to generate benign stimulation so as to achieve the purpose of preventing and treating diseases. It has the advantages of saving time, cost and easy acceptance [13][14][15]. Lin Zhenjing et al. [16] selected 60 patients with KOA and randomly divided them into the control group (30 cases) and the treatment group (30 cases), who were treated with fire needling and acupoint thread embedding. In the selected Zusanli, Liangqiu, Xuehai, Yinlingquan and Yanglingquan of the affected knee, the method of broken line embedding was used to embed 1.5cm absorbable surgical suture into all acupoints towards the affected knee. After treatment, WOMAC score, symptom grading score and other observation indexes were compared. The study found that fire acupuncture combined with acupoint catgut embedding treatment of KOA can significantly reduce swelling pain, relieve stiffness and improve quality of life.

2.3 Fire Needle Combined with Acupuncture

Acupuncture treatment of KOA can relieve pain, relieve symptoms and inhibit the progression of the disease [17]. Guo Xinnian et al. [18] set up a randomized controlled clinical observation experiment in which diclofenac sodium sustained-release tablets were used in both groups. In addition, acupuncture combined with fire needle treatment was performed in the observation group, and the levels of pain mediators, TCM symptom scores and McGee pain Questionnaire summary scores before and after treatment were compared between the two clinical observation groups. The results showed that although the levels of serum pain mediators SP, PGE2, DA and 5-HT, as well as the scores of PRI, VAS and PPI were decreased in the two observation groups after treatment, the levels were lower in the observation group. It shows that the immediate analgesic effect of fire needle combined with acupuncture is more obvious in the treatment of cold coagulation and blood stasis type KOA. Tao Shanping et al. [19] randomly divided 105 KOA patients into 3 groups, namely, the filiform needle group, the fire needle group and the combined group. The results showed that the total effective rate of the combined group was 97.1%, which was higher than that of the fireneedle group (90.6%) and the millineedle group (88.2%), and the difference was statistically significant (P<0.01, P<0.05). It can be seen that the efficacy of fire needle combined with acupuncture is significant, but this experiment also shows that the effective rate of fire needle combined acupuncture is higher than that of fire needle alone, and that the combination of fire needle and other therapies can improve the therapeutic effect. In the treatment of KOA, fire needle combined with milliform needle is not only outstanding in relieving pain, improving stiffness, improving life ability and reducing TNF- and IL-1 inflammatory cytokines in joint synovial fluid, but also superior to fire needle or milliform needle alone in terms of short-term and long-term efficacy.

2.4 Fire Needle Combined Puncture Collaterals and Bloodletting

Bloodletting by puncturing collaterals can improve the local blood supply in KOA patients, reduce the excitability of neuromuscles, and promote the local nutrient metabolism. It has reliable efficacy in improving pain, joint stiffness and functional difficulties in KOA patients, and is simple and easy to implement, low cost and high safety [20].Fang Haofeng [21] will clear diagnosis of 70 cases of KOA patients were randomly divided into the oral diclofenac sodium zyban treatment of the control group with fire needle stab winding bloodletting treatment group, each group of 35 cases. After 4 weeks of treatment, the total effective rate of the treatment group was 91.43% higher than that of the control group (65.71%), and the TCM syndrome score, VAS score, ISOA score, JOA knee osteoarthritis score, knee motion improvement and other observation indicators of the treatment group were superior to the control group. These results indicated that the combination of fire needle and bloodletting in the treatment of KOA has obvious advantages, which can significantly reduce the pain of patients, improve the range of joint motion and improve the quality of life. Ling Yaoquan et al. [22] set up a randomized controlled clinical observation experiment, in which the experimental group was treated with fire needle combined with collateral puncture and bloodletting, while the control group was given oral diclofenac sodium sustained release tablets for continuous treatment for 4 weeks and observation indicators were recorded. The experiment showed that the experimental group was superior to the other group in ISOA score, JOA score, joint motion, TCM symptom score, VAS score and total effective rate, and the differences were statistically significant (P<0.05). These results indicate that the combination of fire needle and bloodletting in the treatment of KOA can effectively relieve symptoms, improve curative effect and promote the recovery of joint function, and is worthy of clinical promotion.

2.5 Acupuncture Combined with Exercise Therapy

Exercise therapy can strengthen the muscles of the lower extremities, thereby altering the biomechanics and reducing the joint load rate or local stress on the articular cartilage, thereby delaying the progression of the disease in patients with KOA. In patients with KOA, both open and closed chain exercises can effectively reduce knee pain and stiffness, and improve isokinetic muscle strength, WOMAC and SF-36 scores [23]. Cai Guofeng etc. [24] early 60 cases of KOA patients were randomly divided into 30 cases of treatment group and 30 cases of control group. The control group was given ordinary acupuncture, and the treatment group was given mild acupuncture combined with exercise therapy. During operation, the treatment group selected the same acupuncture position, point, depth and needles as the control group, quickly stabbed the acupuncture point after more than 2/3 of the needle body was burned red and left the needle for 30min, then instructed the patients to do the muscle strength and isometric contraction training of the open chain muscle and quadriceps muscle during acupuncture, and did the strength training of the open chain muscle and the closed chain muscle after starting the needle. The total effective rate of the treatment group was 93.33% after 2 courses of treatment, which was significantly higher than that of the control group ($p<0.05$), and the VAS, WOMAC, SF-36 scores and serum NO levels in the 2 groups were significantly improved, and the treatment group was superior to the control group, with statistical significance ($P <0.05$). After 1 month follow-up, there were no statistically significant differences in each observation index ($P>0.05$). Therefore, it is concluded that the treatment of early KOA with millimatic acupuncture combined with exercise therapy is better than that with ordinary acupuncture.

2.6 Fire Needle Combined with Tendon Manipulation

Tendons manipulation can reduce inflammation and protect articular cartilage [25]. Liu Haiyong [26], such as the establishment of a randomized controlled clinical observation experiment, 80 cases of KOA patients were randomly divided into treatment group and control group. All patients in 2 groups were treated with tendon manipulation combined with oral diclofenac sodium sustained-release tablets, in addition, the treatment group was treated with milialneedle. During the manipulation, the muscles, tendons and ligaments of the affected knee joint were plucked from bottom to top, first heavy and then light, first outside and then inside; Then knead the tendons and ligaments of the knee joint and push the patella for up and down and internal and external activities. After 2 courses, the total effective rate of the treatment group was higher than that of the control group, the WOMAC score and VAS score of the 2 groups were lower, and the treatment group was better than the control group. These results indicate that the treatment of KOA by the combination of the hair-fire needle and tendon manipulation is effective, safe and worthy of promotion.

2.7 Needle and Bone Setting

The bone setting technique mainly acts on the lumbar spine, and restores the mechanical balance of the spine through biomechanical adjustment, so that the spine can better play a synergistic role when the knee joint is moving. Liu Haiyong [27] choose 90 cases of KOA patients, such as the treatment group to fire needle combined with bonesetting therapy, the control group using bonesetting with non-steroidal analgesics. During the operation of the needle, the red-hot tip of the needle is quickly stabbed into the affected side of the Dubi, Neishi eye, Zusanli, Yinlingquan and other points, insert 0.5 to 1 inch, and leave the needle for 30 minutes. Correct the dislocation of the lumbar posterior joint with bonesetting manipulation, and restore the normal sequence and mechanical balance of the vertebral body. The results showed that the total effective rate of the treatment group was 91.1% higher than that of the control group (82.2%), and the VAS score of both groups decreased significantly, but the treatment group was superior to the control group. These results indicate that the treatment of KOA with firebone acupuncture can significantly reduce the pain of patients and has a definite effect.

2.8 Fire Needle Combined with Ozone Joint Cavity Injection

Ozone therapy can relieve pain, reduce fluid accumulation, and make joints more flexible [28]. Liu Yanwei et al. [29] randomly divided 120 patients diagnosed with KOA into treatment group A, group B and control group. The control group received oral celecoxib, group B received joint cavity ozone injection, and group A received combined fire needle therapy based on group B. VAS score and Lysholm score were used as observation indexes, and the occurrence of complications during the experiment was recorded. The results showed that the improvement of observation indexes in the treatment group was better than that in the control group, and $P<0.05$; In terms of clinical efficacy, the total effective rate of treatment group A was 92.5% higher than that of treatment group B (80.0%) and control group (70%), and the difference was statistically significant ($P<0.01$). No adverse reactions occurred in all treatment groups. The results indicated that the combination of fire needle and ozone injection in the treatment of KOA was effective and could avoid the gastrointestinal and cardiovascular injury caused by long-term oral non-steroidal analgesics.

3. Mechanism of Fire Needle Therapy for KOA

The fire needle can alleviate KOA by intervening in the biological process of the human body. The main mechanism of action is: (1) regulation of related inflammatory factors. For example, the content of inflammatory cytokines such as IL-1, IL-6 and TNF-α in knee joint fluid was decreased [30]. (2) Slow the degeneration of cartilage tissue. For example, the expression of LC3, the signature protein of autophagy, can alleviate inflammatory infiltration and alleviate the destruction of chondrocytes [31]. Millifire needle can promote the expression of chondro-specific expression protein type II collagen (COL-II), which may affect the homeostasis of cartilage by activating SOX9 pathway [32]. Thorough needling of the knee can improve the arrangement of cartilage and the smoothness of cartilage surface, significantly increase the level of LOXL2 (Lysyl oxidase-related protein 2) in cartilage, and alleviate the damage of K0A articular cartilage [33]. (3) Regulate the balance of articular cartilage synthesis and decomposition.

Wang Wenjing [34] suggested that fire needles could reduce inflammatory stimulation and joint injury in KOA patients through the decrease of IL-1β content and the increase of IL-1Rα content and IL-1Rα/IL-1β ratio in IL-l signal transduction pathway, thus adjusting the balance of articular cartilage synthesis and decomposition. (4) Fire needle can inhibit the expression of matrix metalloproteinases. It may regulate the Wnt/β-catenin signaling pathway, reduce the downstream expression of MMP-3 and MMP-13, thereby alleviating the inflammatory response of KOA, inhibiting cartilage degeneration, and improving clinical symptoms [35] [36]

4. Summary and Prospect

To sum up, the treatment of KOA with fire needle is convenient, effective, long-term effect is outstanding and there is no obvious adverse reaction. Not only the acupuncture therapy alone has a significant effect, but the combination of other therapies can better relieve pain, improve curative effect, promote the recovery of joint function and improve the quality of life. However, there are still many shortcomings in the treatment of KOA with fire acupuncture: (1) There are still insufficient clinical studies, such as the selection of points mainly in the local area, the frequency of operation, whether to retain needles, and the interval time of treatment are not unified standards. In terms of mechanism, there are many different mechanisms, which have not been fully clarified and verified. Prospects: (1) The use of fire pins should be standardized and unified; In clinical observation, the evaluation of curative effect should increase objective data and reduce subjectivity. (2) Through more animal experiments, more fully elucidate the mechanism of fire needle treatment of KOA.

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