Am J Transl Res 2021;13(7):8085-8093
www.ajtr.org /ISSN:1943-8141/AJTR0132153

Original Article

Effect of Shujin Xiaotong capsules combined with ultrashort wave therapy on pain and inflammatory cytokines in patients with chronic knee osteoarthritis

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Received February 20, 2021; Accepted March 28, 2021; Epub July 15, 2021; Published July 30, 2021

Abstract: Objective: To investigate the effect of Shujin Xiaotong capsules combined with ultrashort wave therapy on pain, high-sensitivity C-reactive protein (hs-CRP) level and inflammatory cytokines in patients with chronic knee osteoarthritis. Methods: One hundred and eighteen patients with chronic knee osteoarthritis included in this study were randomly divided into the control group (n=59) and the experimental group (n=59). The patients in the control group were treated with Shujin Xiaotong capsules, and the patients in the experimental group were treated with Shujin Xiaotong capsules combined with ultrashort wave therapy. The knee motion before and after treatment, pain and curative effect were evaluated by the Lysholm Scale, Mc-Gee Scale and Japanese Orthopaedic Association (JOA) Score, respectively. Color Doppler ultrasonography was performed to observe the blood flow in the synovium of knee joint. Serum inflammatory cytokines and oxidative stress indicators were measured using corresponding kits. The quality of life of the patients was measured using the World Health Organization Quality of Life-BREF Scale. Results: There was no significant difference in the scores of the Lysholm, Mc-Gee and JOA, synovial blood flow signal distribution, levels of hs-CRP, inflammatory cytokines, superoxide dismutase, malondialdehyde and nitric oxide as well as quality of life of patients between the two groups before treatment (all P>0.05). After treatment, the scores of Lysholm, JOA and World Health Organization Quality of Life-BREF as well as levels of superoxide dismutase in both groups were improved, while the scores of Mc-Gee as well as levels of hs-CRP, inflammatory cytokines, malondialdehyde and nitric oxide in both groups were decreased (all P<0.05). After treatment, compared with the control group, the proportion of synovial blood flow signal distribution and quality of life of patients in the experimental group were higher, while the levels of hs-CRP, inflammatory cytokines, superoxide dismutase, malondialdehyde and nitric oxide were lower (all P<0.05). Conclusion: Shujin Xiaotong capsules combined with physical ultrashort wave therapy can significantly reduce serum inflammation cytokines and hs-CRP expression and pain, as well as improve serum oxidative stress levels, knee joint function and quality of life in patients with chronic knee osteoarthritis.

Keywords: Chronic knee osteoarthritis, Shujin Xiaotong capsule, ultrashort wave, pain, inflammatory cytokines

Introduction

Knee osteoarthritis (KOA) is a clinical orthopedic disease with a high incidence, which has a great influence on the knee function of patients [1]. Epidemiological surveys showed that KOA has become a global public health problem with a prevalence of more than 60% among the middle-aged and the old-aged [2]. Chronic KOA develops from multiple factors such as family history, age and chronic loading on articular cartilage [3]. Patients with KOA may present with symptoms such as joint stiffness and pain accompanied by bone spurs, seriously affecting the patient's normal mobility. High-sensitivity C-reactive protein (hs-CRP) was initially found in Pneumococcus as a marker of inflammation and tissue damage [4]. Hs-CRP is synthesized and secreted by stem cells and regulated by various inflammatory cytokines. The expression of hs-CRP and inflammatory cytokines is increased in patients with KOA, so these indicators can be used to evaluate the degree of disease and predict the development of disease.

At present, patients with chronic KOA are treated with medication in the clinic with a great

treatment efficacy [5]. The Shujin Xiaotong capsule is a traditional Chinese medicine preparation used to treat rheumatic disease, traumatic injury and limbs numbness. It is composed of six Chinese medicinal herbs such as ligusticum wallichii, radix angelicae tuhuo, angelica sinensis, parasitic loranthus, spatholobus stem and radix dipsaci. The prescription of Shujin Xiaotong capsule is summarized by orthopedic experts of traditional Chinese Medicine in our hospital with years of clinical experience. It has been widely used for the treatment of orthopedic diseases and trauma with a remarkable effect. In recent years, physiotherapy has become an effective method to relieve osteoarthritis. Ultrashort wave therapy is one of the modern physiotherapies, which mainly depends on the thermal effect acting on the cutaneous tissues of the knee joint. Ultrashort waves can relieve inflammation and pain as well as increase joint fluid absorption by increasing local blood circulation [6]. Currently, there are few studies on the application of Shujin Xiaotong capsules combined with ultrashort waves in the treatment of patients with chronic KOA. Based on this, this study aimed to investigate the therapeutic effect of Shujin Xiaotong capsules combined with ultrashort wave therapy and analyze the effect of this combination therapy on pain, hs-CRP and inflammatory cytokines in patients with chronic KOA.

Materials and methods

General information

A prospective study was conducted to collect 118 patients with chronic KOA who met the Western and traditional Chinese medicine criteria for diagnosis of KOA, from January 2019 to November 2020 in our hospital. The patients with chronic KOA included in this study were randomly divided into the control group (n=59) and the experimental group (n=59). The patients in the control group were treated with Shujin Xiaotong capsules, and the patients in the experimental group were treated with Shujin Xiaotong capsules combined with ultrashort wave therapy. All patients and their families signed the informed consent, and this study was approved by the medical Ethics Committee of our hospital.

The inclusion criteria were the following: Western medicine diagnosis that met the diagnostic criteria for KOA in *Practical Orthopaedics* [7]; patients who were in accordance with the clinical features of KOA and were diagnosed by CT; traditional Chinese medicine diagnosis met the diagnostic criteria in the *Criteria of Diagnosis and Therapeutic Effect of Diseases and Syndromes in Traditional Chinese Medicine* [8]; patients who had pain time >30 days; no abnormality in routine blood tests; patients who didn't receive glucocorticoids within 14 days before enrolment in the study; no allergic history to the medications used and patients who persisted in finishing the treatment.

The exclusion criteria were the following: Knee joint space narrowing and deformity as well as ankylosing arthritis; severe traumatic knee deformity; combined with nerve injury and macrovascular diseases; combined with blood coagulation dysfunction; patients with surgery therapy; patients with mental illness and language disorder and patients combined with severe organ lesions.

Methods

Shujin Xiaotong capsule is a Chinese medicine preparation prepared by orthopedic experts of traditional Chinese Medicine in our hospital. The patients in the control group were given Shujin Xiaotong capsules, 8 capsules, twice a day. The patients in the experimental group were treated with Shujin Xiaotong capsules combined with ultrashort wave therapy.

The patient assumed a lateral position when being treating with the DL-C II Ultrashort Wave Electrotherapy Machine (Dongxiyi Beijing Technology Co., Ltd., China). The electrode was connected to the outlet, and the other end was connected with an electric blanket with a power of 200 W and a frequency of 40.68 Hz. The two electric pads were put under the knee joint along the anterior-posterior direction. The above treatment was performed once per day, 20-30 min each, 5 times per week. Patients in both groups underwent 2 months of treatment.

Primary outcome measures

Comparison of knee joint function, pain degree and Japanese Orthopaedic Association (JOA) Score before and after treatment: The Lysholm knee scale was used to evaluate the knee joint function, including knee swelling and ability to walk, support and squat [9]. Patients with

Table 1. Synovial blood flow signal distribution

Classification	Characteristics of blood flow signal distribution
Level 0	Synovial blood flow without color flow signal.
Level I	Synovial blood flow has 1 to 2 punctate blood flow signals.
Level II	The synovial blood flow has 3 to 4 punctate or short-line blood flow signals, but the range does not exceed 50% of the synovial surface.
Level III	There are dendritic and reticulated blood flow signals, the range of which exceeds 50% of the synovial surface.

scores ≥84 were categorized as normal functional recovery. Patients with scores of 66-83 were categorized as good functional recovery. Patients with scores ≤65 were categorized as poor functional recovery. The full score of this scale is 100, and the lower score indicates the worse function. The Mc-Gee scale was used to evaluate pain, including pain rating index (PRI), visual analogue scale (VAS) and present pain intensity (PPI) [10]. PRI, VAS and PPI scores were rated on a 3-point scale, a 10-point scale and a 5-point scale, respectively. Lower scores indicate less pain. The JOA scale was used to evaluate the clinical efficacy of patients with a total score of 100 [11]. Joint swelling, range of motion, walking situation and stair activity of patients were rated with maximum scores of 10, 35, 30, and 25 points, respectively. The higher scores indicate less pain.

Synovial blood flow signals before and after treatment: Before and after treatment, color Doppler joint ultrasonography (Mindray, China) was used to detect the blood flow signals of knee joint lesions. The synovial blood flow signal distribution was divided into 4 grades, as shown in **Table 1**.

Comparison of hs-CRP, tumor necrosis factor-α (TNF-α), interleukin-1β (IL-1β) and matrix metalloproteinase-9 (MMP-9) levels before and after treatment: Before and after treatment, fasting peripheral blood from the patients was collected, and 2 mL of peripheral venous blood was centrifuged at 3000 r/min for 10 min to obtain the serum using TGL-15M desktop high speed refrigerated centrifuge (purchased from Hunan Pingfan Science and Technology Co., Ltd., China). Levels of hs-CRP were measured by immunoturbidimetric assay, and levels of TNF-α, IL-1β and MMP-9 were measured by enzyme-linked immunosorbent assay (ELISA). All kits were purchased from Nanchang Biotech A&C Biotechnical Industry Incorporated Company. The specific operation methods were followed according to the instructions.

Secondary outcome measures

Levels of superoxide dismutase (SOD), malondialdehyde (MDA) and nitric oxide (NO) before and after treatment: The methods of collecting peripheral blood and centrifugation were as above. Levels of SOD were detected by WST-1 kit (Shanghai Xinfan Biological Technology Co., Ltd., China). Levels of MDA were detected by TBA kit (Ningbo Purebio Biotechnology Co., Ltd., China). Levels of NO were detected by nitrate reductase kit (Jiangsu Feiya Biological Technology Co., Ltd., China). The specific operation methods were followed according to the instructions.

Quality of life: The quality of life scale (World Health Organization quality of life-BREF, WHOQOL-BREF) was used to evaluate the physiological, social, psychological and environmental domains. This scale has applied in many academic fields with a good theoretical basis. A lower score indicates worse quality of life.

Statistical analysis

GraphPad Prism 8 software was used to analyze the related research indicators in the two groups. The measurement data were expressed as mean ± standard deviation ($\bar{x}$ ± sd) and analyzed using t tests. The enumeration data were expressed as n (%) and analyzed using Chi-square test. Intergroup comparisons were conducted by independent-sample t-tests, while intragroup comparisons before and after treatment were analyzed by paired-sample t-tests. $P<0.05$ was considered statistically significant.

Results

Comparison of general information between the two groups

There was no difference in gender, average age, average course of disease, Body Mass

Table 2. Comparison of general information between the two groups

Group	Control group (n=59)	Experimental group (n=59)	χ^2/t	P
Gender			0.307	0.858
Male	33	30		
Female	26	29		
Average age (years)	53.9±6.2	54.2±5.9	0.269	0.788
Average course of disease (years)	2.4±0.5	2.3 ± 0.4	1.200	0.233
BMI (kg/m^2)	24.8±0.8	24.5±1.0	1.799	0.075
Location of lesions			1.224	0.542
Left	25	31		
Right	34	28		
Education			1.021	0.796
Primary school	16	14		
Junior high school	22	25		
High school	11	13		
College and above	10	7		
Complications			0.699	0.705
Hyperextension	16	15		
Hyperlipidemia	20	18		
Diabetes mellitus	12	16		

Note: BMI: Body Mass Index.

Index (BMI), location of lesions, education and complications between the two groups (all P>0.05). See **Table 2**.

Comparison of Lysholm, Mc-Gee and JOA scores before and after treatment between the two groups

There was no significant difference in Lysholm, Mc-Gee and JOA scores between the two groups before treatment (all P>0.05). After treatment, Lysholm and JOA scores were increased and Mc-Gee scores were decreased in both groups (all P<0.05), and there were significant differences between the experimental group and the control group (all P<0.01). See **Table 3**.

Comparison of synovium blood flow signals between the two groups before and after treatment

There was no difference in the distribution of synovial blood flow signals between the two groups before treatment (all P>0.05). After treatment, compared with the control group, the ratio of Level 0 (77.97%) was higher in the experimental group (all P<0.05). See **Table 4**.

Comparison of levels of hs-CRP, TNF-α, IL-1β and MMP-9 before and after treatment between the two groups

Before treatment, there was no difference in the levels of hs-CRP, TNF-α, IL-1β and MMP-9 between the two groups (all P>0.05). After treatment, the levels of hs-CRP and inflammation cytokines in the two groups were decreased (all P<0.05), and the levels of the above indicators in the experimental group were lower than those in the control group (all P<0.05). See **Table 5** and **Figure 1**.

Comparison of levels of SOD, MDA and NO before and after treatment between the two groups

Before treatment, there was no difference in the levels of SOD, MDA and NO between the two groups (all P>0.05). After treatment, levels of SOD in both groups were increased and levels of MDA and NO in both groups were decreased (all P<0.01), and the levels of the above indicators in the experimental group were lower than those in the control group (all P<0.01). See **Table 6** and **Figure 2**.

Comparison of quality of life between the two groups

Before treatment, there was no difference in quality of life scores between the two groups (all P>0.05). After treatment, the quality of life scores in both groups were increased (P<0.001), and quality of life scores in the experimental group were higher than those in the control group (all P<0.01). See **Table 7**.

Discussion

Modern clinical research has confirmed that KOA is caused by intra-articular inflammatory

Table 3. Comparison of Lysholm, Mc-Gee and JOA scores between the two groups

Group	Control group (n=59)	Experimental group (n=59)	χ^2/t	P
Lysholm score				
Before treatment	53.10±4.52	54.05±3.66	1.255	0.212
After treatment	74.30±5.51$^{###}$	79.20±6.07$^{###,**}$	4.591	0.001
t	22.850	27.250		
P	<0.001	<0.001		
Mc-Gee score				
PRI score				
Before treatment	16.20±2.33	16.61±2.10	1.001	0.317
After treatment	9.33±1.25$^{###}$	5.11±1.02$^{###,***}$	20.090	<0.001
t	19.960	37.840		
P	<0.001	<0.001		
VAS score				
Before treatment	6.54±0.77	6.40±0.80	0.969	0.335
After treatment	3.23±0.54$^{###}$	1.96±0.38$^{###,***}$	14.770	<0.001
t	27.030	38.510		
P	<0.001	<0.001		
PPI score				
Before treatment	3.70±0.55	3.81±0.46	1.178	0.241
After treatment	2.30±0.29$^{###}$	1.21±0.15$^{###,***}$	25.640	<0.001
t	17.300	41.280		
P	<0.001	<0.001		
JOA score				
Before treatment	50.22±5.62	51.31±4.58	1.155	0.251
After treatment	62.11±4.55$^{###}$	70.44±6.38$^{###,***}$	8.165	<0.001
t	12.850	18.270		
P	<0.001	<0.001		

Note: Compared with before treatment, $^{###}$P<0.001; compared with the control group, **P<0.01, ***P<0.001. PRI: pain rating index; VAS: visual analogue scale; PPI: present pain intensity; JOA: Association.

Table 4. Comparison of synovial blood flow signal distribution before and after treatment between the two groups

Time	Group	Level 0	Level I	Level II	Level III
Before treatment	Control group	18	29	12	0
	Experimental group	21	26	12	0
χ^2		0.426			
P		0.808			
After treatment	Control group	32	18	9	0
	Experimental group	46	10	3	0
χ^2		8.560			
P		0.014			

infiltration which can lead to tissue edema, thereby increasing intra-articular pressure and inducing cartilage lesions [12, 13]. From a mechanical and biological point of view, the function of articular cartilage in patients with chronic KOA is limited, which affects their physical and social function.

Shujin Xiaotong capsule is a Chinese medicine preparation for the treatment of rheumatic bone pain, quadriplegia and strengthening muscles and bones [14, 15]. Ligustrazine in Rhizoma Chuanxiong of Shujin Xiaotong capsules can inhibit chondrocyte apoptosis, reduce inflammatory cell reactions such as TNF-α and accelerate articular cartilage repair by inhibiting the phosphorylation of NF-κB. Ultrashort wave is a treatment method which can improve disease by the influence of electric fields. Ultrashort wave can vibrate local tissues of patients with KOA by means of a high frequency electric field. The local tissues were heated evenly to increase joint metabolism by increasing vascular permeability and this plays a role in repairing joint cartilage [16]. Study by Xing et al. showed that traditional Chinese medicine combined with ultrashort wave therapy could improve limb motion function and reduce pain in patients with knee arthritis, which is similar to the results of this study. Compared with the control group, the improvement of knee function, reduction of pain and increase of JOA score of patients in the experimental group showed that the clinical effect of Shujin Xiaotong capsules combined with ultrashort waves was better [17]. The mechanism of action of Shujin Xiaotong

Table 5. Levels of hs-CRP, TNF-α, IL-1β and MMP-9

Group	Control group (n=59)	Experimental group (n=59)	t	P
hs-CRP (μg/mL)				
Before treatment	11.04±2.56	11.22±2.03	0.423	0.673
After treatment	8.36±1.44$^{\#\#\#}$	6.25±1.13$^{\#\#\#,***}$	8.854	<0.001
t	7.009	16.430		
P	<0.001	<0.001		
TNF-α (pg/mL)				
Before treatment	15.26±5.11	16.07±4.82	0.886	0.378
After treatment	12.30±3.25$^{\#\#}$	10.31±2.05$^{\#\#\#,**}$	3.978	0.001
t	3.754	8.447		
P	0.001	<0.001		
IL-1β (pg/mL)				
Before treatment	1.60±0.24	1.57±0.30	0.560	0.550
After treatment	1.36±0.18$^{\#\#\#}$	1.06±0.20$^{\#\#\#,***}$	8.564	<0.001
t	6.145	10.860		
P	<0.001	<0.001		
MMP-9 (μg/mL)				
Before treatment	46.80±6.60	47.15±5.99	0.302	0.763
After treatment	35.17±4.66$^{\#\#\#}$	26.16±4.22$^{\#\#\#,***}$	11.010	<0.001
t	11.060	22.000		
P	<0.001	<0.001		

Note: Compared with before treatment, $^{\#\#}$P<0.01, $^{\#\#\#}$P<0.001; compared with the control group, **P<0.01, ***P<0.001. hs-CRP: high-sensitivity C-reactive protein. TNF-α: tumor necrosis factor-α; IL-1β: interleukin-1β; MMP-9: matrix metalloproteinase-9.

capsules follows the principle of traditional Chinese medicine of "treating secondary symptoms for emergency and relieving primary symptoms in a chronic disease". Shujin Xiaotong capsule can improve joint function and pain by benefiting qi for activating blood circulation and anti-inflammatory effect. Ultrashort waves can improve blood circulation of the lesion tissue, accelerate the metabolic absorption of pathological products, improve the joint nerve excitation, alleviate skeletal muscle spasms, and accelerate the repair and regeneration of the knee joint tissue [18].

This study showed that Shujin Xiaotong capsules combined with ultrashort waves can alleviate pain by reducing joint injury and decreasing inflammatory cell expression through anti-inflammatory and immunosuppressive effects. Synovial blood flow in patients with KOA can be used to evaluate the degree of inflammation, and a higher signal indicates more severe inflammation. Hs-CRP, TNF-α, IL-1β and MMP-9 are all the cytokines that reflect the degree of inflammation. They can accelerate the proliferation of synovial fibroblasts, accelerate the apoptosis of chondrocytes and worsen the condition of the disease [19]. The anti-inflammatory mechanism of Shujin Xiaotong capsule is that polysaccharides in radix angelicae sinensis can reduce the expression of IL-1β and inflammatory reaction in cartilage tissue. Thermal energy generated by ultrashort waves can be transferred to the deep part of the joint, which can dilate blood vessels, improve blood circulation, accelerate inflammation absorption and relieve pain [20]. Study by Jiang et al. showed that ultrashort waves could improve hemorheology and inhibit serum inflammatory expression in patients with KOA, which is similar to the results of this study [21].

In this study, we found that the quality of life scores in the experimental group were higher than those in the control group. The mechanism may be that the combination of Shujin Xiaotong capsules and ultrashort waves could significantly reduce the clinical symptoms and pain as well as increase the knee function of the patients, which then improves the physiological, social and psychological functions and quality of life. Patients with KOA have high levels of inflammatory cytokines and oxidative stress damage. SOD levels can reflect the sufficiency or deficiency of vital qi. NO is involved in oxygen transport and antioxidation. No levels in the serum of patients with KOA is up-regulated, which can accelerate the injury of synovial tissue and increase the vascular permeability and synovial swelling. MDA is produced by lipid free radical oxidation reaction, it can increase the toxicity and apoptosis of chondrocytes [22]. Shujin Xiaotong capsules can activate the blood to promote menstruation and improve meridian paralysis and muscular pain caused by blood and qi deficiency by exerting the pharmacological activity of Chinese medical herbs on the above mentioned factors. The combination of radix angelicae

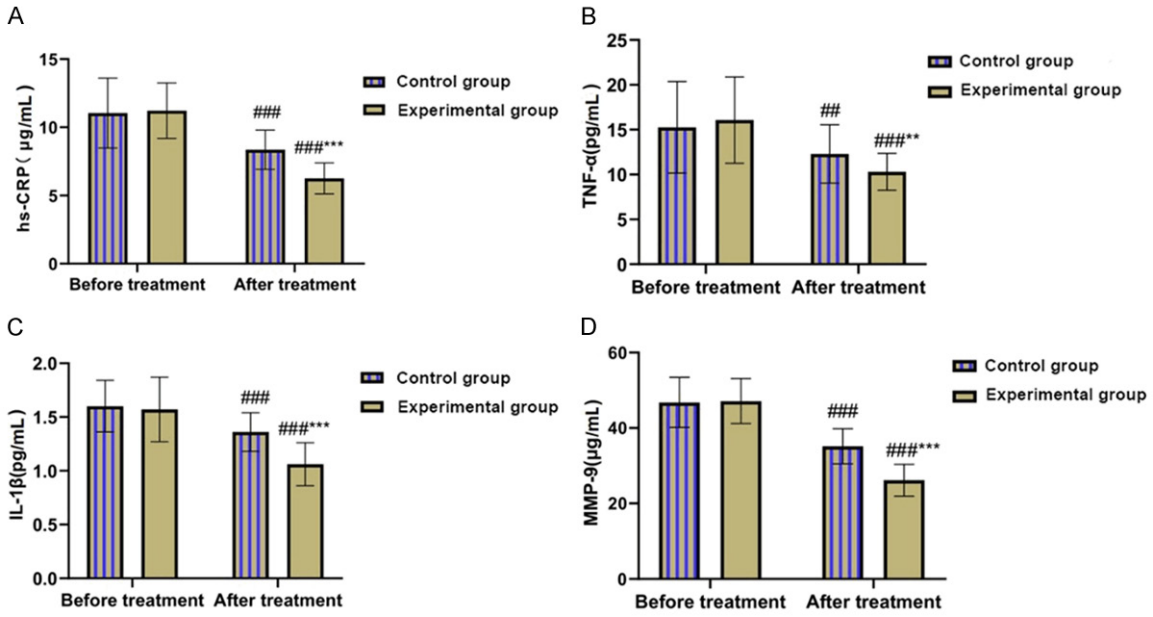

Figure 1. Comparison of hs-CRP, TNF-α, IL-1β and MMP-9 levels before and after treatment between the two groups. A: Levels of hs-CRP; B: Level of TNF-α; C: Levels of IL-1β; D: Levels of MMP-9. Compared with before treatment, ##P<0.01, ###P<0.001; compared with the control group, **P<0.01, ***P<0.001. hs-CRP: high-sensitivity C-reactive protein. TNF-α: tumor necrosis factor-α; IL-1β: interleukin-1β; MMP-9: matrix metalloproteinase-9.

Table 6. Comparison of SOD, MDA and NO levels between the two groups

Group	Control group (n=59)	Experimental group (n=59)	t	P
SOD (U/mL)				
Before treatment	104.33±17.51	105.17±16.50	0.268	0.789
After treatment	128.57±19.55###	143.25±20.36###,**	3.995	0.001
t	7.094	11.160		
P	<0.001	<0.001		
MDA (nmol/L)				
Before treatment	7.96±0.88	8.06±0.74	0.668	0.505
After treatment	5.13±0.61##	3.36±0.38###,***	18.920	<0.001
t	20.300	43.400		
P	0.001	<0.001		
NO (μmol/L)				
Before treatment	58.74±17.05	59.22±15.69	0.159	0.874
After treatment	41.28±13.54###	26.20±9.58###,***	6.984	<0.001
t	6.160	13.800		
P	<0.001	<0.001		

Note: Compared with before treatment, ##P<0.01, ###P<0.001; compared with the control group, **P<0.01, ***P<0.001. SOD: superoxide dismutase; MDA: malondialdehyde; NO: nitric oxide.

sinensis and rhizoma ligustici wallichii in Shujin Xiaotong capsules can nourish the skin, relieve the numbness of the skin and pain of bone and joint by nourishing blood. Shujin Xiaotong capsules can improve the oxidative stress of patients, and Chinese Angelica polysaccharide can reduce the activity of peroxisome proliferative activated receptor gamma (PPARG) and inhibit the oxidative damage of chondrocytes induced by hydrogen peroxide. Radix angelicae tuhuo can dilate blood vessels, improve microcirculation and increase oxygen free radical

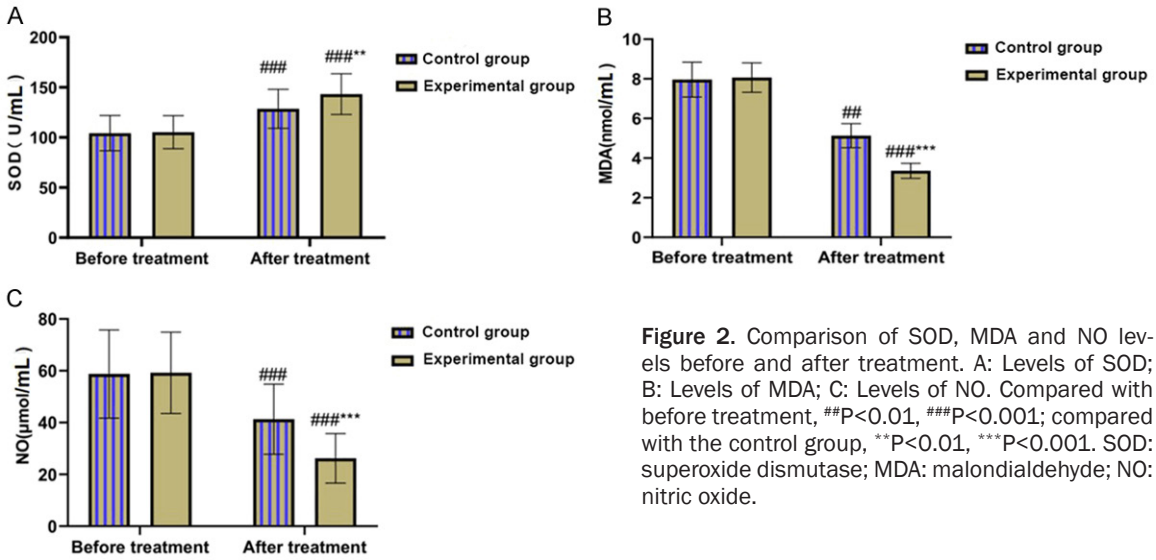

Figure 2. Comparison of SOD, MDA and NO levels before and after treatment. A: Levels of SOD; B: Levels of MDA; C: Levels of NO. Compared with before treatment, ##P<0.01, ###P<0.001; compared with the control group, **P<0.01, ***P<0.001. SOD: superoxide dismutase; MDA: malondialdehyde; NO: nitric oxide.

Table 7. Comparison of the quality of life between the two groups

Group	Control group (n=59)	Experimental group (n=59)	t	P
Physiological field				
Before treatment	68.95±3.21	69.15±3.08	0.345	0.730
After treatment	73.15±5.62###	79.55±6.02###,***	5.969	<0.001
t	4.985	11.810		
P	<0.001	<0.001		
Social relationship				
Before treatment	69.25±3.36	69.70±3.50	0.712	0.478
After treatment	72.39±4.11##	77.25±4.50###,***	6.125	<0.001
t	4.543	10.170		
P	0.001	<0.001		
Psychological field				
Before treatment	67.20±5.51	68.12±5.33	0.922	0.359
After treatment	73.92±5.83###	79.60±6.11###,***	5.166	<0.001
t	6.435	10.880		
P	<0.001	<0.001		
Environmental field				
Before treatment	67.19±6.21	68.04±5.88	0.763	0.447
After treatment	75.50±6.14###	79.82±6.73###,**	3.642	0.001
t	7.309	10.120		
P	<0.001	<0.001		
Total quality of life				
Before treatment	68.14±4.57	68.73±4.45	0.711	0.479
After treatment	73.74±5.43###	79.06±5.84###,**	5.124	0.001
t	6.061	10.810		
P	<0.001	<0.001		

Note: Compared with before treatment, ##P<0.01, ###P<0.001; compared with the control group, **P<0.01, ***P<0.001.

scavenging. Spatholobus caulis plays a role of scavenging free radicals, anti-oxidation and anti-inflammation. The mechanism of ultrashort waves to improve the oxidative stress in patients with KOA may lie in the elimination of arthritis and the acceleration of local blood circulation [16].

However, there are some shortcomings in this study, such as a short follow-up time, being from a single-center study and a limited sample size. Further studies are needed to provide a strong clinical basis for the clinical treatment of KOA through a variety of experimental protocols.

In conclusion, Shujin Xiaotong capsules combined with physical ultrashort wave therapy can significantly reduce the expression of serum inflammation cytokines and hs-CRP and pain as well as improve serum oxidative stress levels, knee joint function and quality of life in patients with chronic knee osteoarthritis.

Disclosure of conflict of interest

None.

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