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Comparison of the Clinical Efficacy of Arthroscopic Surgery and Extracorporeal Shock Wave Therapy in the Treatment of Knee Osteoarthritis

Chao Tong*

Beijing Jishuitan Hospital Guizhou Hospital, Guiyang 550000, Guizhou Province, China

***Corresponding author:** Chao Tong, tongchao4515@hotmail.com

Abstract: This paper aims to explore the clinical efficacy of arthroscopic surgery and extracorporeal shock wave therapy in patients with knee osteoarthritis. The research period was from February 2022 to January 2023. A total of 79 patients with knee osteoarthritis were included and divided into the study group (n = 40) and the control group (n = 39) by lottery method using computer software. The patients in the control group were treated with arthroscopic surgery, and the patients in the study group were treated with extracorporeal shock wave therapy. The Lysholm score, visual analogue scale (VAS) score, Western Ontario and McMaster University Osteoarthritis (WOMAC) score, superoxide dismutase (SOD) level, and malondialdehyde (MDA) level were compared between the two groups. After treatment, the Lysholm score of the study group was higher than that of the control group, and the VAS score and WOMAC score were lower than those of the control group ($P < 0.05$). While the MDA level of the study group was lower than that of the control group, and the SOD level was higher than that of the control group ($P < 0.05$). Extracorporeal shock wave therapy for patients with knee osteoarthritis can restore joint function, relieve pain, and effectively regulate the level of oxygen free radicals.

Keywords: Arthroscopic surgery; Extracorporeal shock wave; Knee osteoarthritis

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1. Introduction

Osteoarthritis of the knee joint is a common clinical chronic joint disease, characterized by knee cartilage degeneration, secondary bone hyperplasia, etc. The main clinical symptoms of patients are knee joint pain, deformity, swelling, and limited movement [1]. Arthroscopic surgery is a minimally invasive surgical technique for the clinical treatment of knee osteoarthritis. The surgical field of view is clear, and the diseased joint tissue can be removed to improve clinical symptoms. Some studies believe that the recovery of joint function in patients after arthroscopic surgery is poor and the pain is severe [2]. Extracorporeal shock wave is a physical therapy approach, and animal experiments have confirmed that it has a significant effect on the treatment of

osteoarthritis [3]. In this study, 79 patients with knee osteoarthritis were included, and the clinical effects of arthroscopic surgery and extracorporeal shock wave therapy were explored and analyzed.

2. Materials and methods

2.1. Demographic of study population

The specific process and selected samples of this study were approved by the hospital's medical ethics committee. The research period was from February 2022 to January 2023. 79 samples of patients with knee osteoarthritis were included, and they were divided into study group (n = 40) and control group (n = 39) by lottery method using computer software. In the study group, there were 24 males and 16 females, the age range was 52–66 years old, with an average of 59.74±3.66 years old. Among them, 25 cases were grade 2 and 15 cases were grade 3 according to Kellgren-Lawrence (KL) classification. In the control group, there were 22 males and 17 females, the age range was 54–64 years old, with an average of 59.68±3.71 years old. Among the control group, 23 cases were grade 2 and 16 cases were grade 3 according to the KL grading, the general data comparison results of the two groups were $P > 0.05$.

Inclusion criteria included that the diagnostic criteria of knee osteoarthritis in the "Guidelines for the Diagnosis and Treatment of Osteoarthritis" were in line with the imaging examination, patients who have not received symptomatic treatment intervention recently, and patients who understand the relevant content of the research and sign the agreement to cooperate with the research.

Exclusion criteria were patients who have other joint diseases, patients with knee joint varus or valgus deformity or knee joint injury, and patients who are unable to cooperate to complete the research.

2.2. Methods

The patients in the control group were treated by arthroscopic surgery. After the anesthesia took effect, the airbag tourniquet was tied on the upper thigh of the affected side, the skin tissue in the surgical area was sterilized, and then a towel was spread. Surgical incisions were made through the lateral and anteromedial areas of the knee joint and the arthroscope is inserted. Arthroscopic observation of the condition of the knee joint was performed, and abnormal tissues such as synovial villi in the hyperplastic state, synovial folds, and hyperemic fat pads were removed under the microscope. If there were loose bodies in the knee joint, they were removed. If the patient's meniscus ruptures, a partial resection of the damaged meniscus will be performed. After the operation, the incision was sutured and bandaged with elastic bandage.

The patients in the study group received extracorporeal shock wave therapy. The physician instructed the patients to actively flex and extend the knee joint, and stretched the knee joint. During the treatment, the patient was asked whether there was pain, and the pain point was confirmed and marked. The pain point is taken as the impact point, the shock wave energy focus is made to coincide with the impact point, the treatment pressure is set to 300kPa, and the shock wave frequency is set to 10Hz. There were 2000 shock treatments, with 1 treatment per week and 5 treatments in total.

2.3. Evaluation criteria

Lysholm score, visual analogue scale (VAS) score, and Western Ontario and McMaster University Osteoarthritis (WOMAC) score were compared between the two groups before treatment and after 3 months of treatment. Lysholm score is the knee joint function score, with a full score of 100 points, and the higher the score, the better the knee joint function. The VAS score is a visual analogue pain scale with a full score of 10, with higher scores indicating more severe pain. WOMAC score is the osteoarthritis index, with a full score of 100, and the

higher the score, the more severe the symptoms. Before treatment and after 3 months of treatment, the joint fluid of the two groups was extracted, and the level of superoxide dismutase (SOD) was detected by xanthine oxidase method, and the level of malondialdehyde (MDA) was detected by nitrate reductase method.

2.4. Statistical methods

SPSS23.0 software was used to analyze the research data, measurement data ($\bar{x}$±s) was *t* test, count data % was x^2 test, $P < 0.05$ indicated that there was a statistical level difference.

3. Results

3.1. Comparison of Lysholm score, VAS score, and WOMAC score

The data in **Table 1** showed that after treatment, the Lysholm score of the study group was higher than that of the control group, and the VAS score and WOMAC score were lower than those of the control group ($P < 0.05$).

Table 1. Comparison of Lysholm score, VAS score, and WOMAC score between the two groups ($\bar{x}$±s)

Group	Lysholm score		VAS score		WOMAC score	
	Before treatment	3 months after treatment	Before treatment	3 months after treatment	Before treatment	3 months after treatment
Study group (n = 40)	55.89±3.64	78.62±4.71	5.62±1.13	1.94±0.52	48.33±5.26	34.06±2.11
Control group (n = 39)	55.94±3.57	62.44±2.06	5.57±1.08	3.02±0.97	48.38±5.21	41.25±3.97
t value	0.062	19.693	0.201	6.189	0.042	10.087
P value	0.951	0.000	0.841	0.000	0.966	0.000

3.2. Comparison of SOD level and MDA level

The data in **Table 2** showed that after treatment, the MDA level of the study group was lower than that of the control group, and the SOD level was higher than that of the control group ($P < 0.05$).

Table 2. Comparison of SOD level and MDA level between the two groups ($\bar{x}$±s)

Group	SOD level (nU/ml)		MDA level (nmol/L)	
	Before treatment	3 months after treatment	Before treatment	3 months after treatment
Study group (n = 40)	88.31±4.63	95.77±5.28	6.94±1.12	5.81±0.56
Control group (n = 39)	88.27±4.58	89.71±2.56	6.88±1.17	6.77±1.02
t value	0.039	6.464	0.233	5.203
P value	0.969	0.000	0.816	0.000

4. Discussion

Epidemiological survey data confirm that the incidence rate of knee osteoarthritis in China is about 8%. There are symptoms such as swelling, and knee joint deformity in some severe patients, accompanied by clinical manifestations such as muscle atrophy [4].

Arthroscopic surgery is a routine surgical solution for the clinical treatment of early and mid-stage knee osteoarthritis. Its main features are minimally invasive, clear surgical field of vision, and it can clean up the diseased tissue inside the knee joint cavity and restore the flatness and smoothness of the articular surface, relieve pain, swelling, and other clinical symptoms [5]. According to the latest clinical research, arthroscopic

surgery can destroy the internal environment of the knee joint, which is not conducive to the recovery of knee joint function, and some patients have severe postoperative pain [6]. Extracorporeal shock wave therapy is a physical therapy approach for knee osteoarthritis. It is mostly used in the treatment of urinary calculi. The application of extracorporeal shock wave therapy in the treatment of knee osteoarthritis can produce strong physical stimulation to the patient's knee joint, promote microvascular regeneration, and accelerate the repair of damaged tissues [7]. Extracorporeal shock wave therapy can inhibit the synthesis and secretion of pain-causing substances and induce the body to synthesize endorphins. These substances can reduce the patient's sensitivity to pain, thereby achieving the effect of pain relief. At the same time, this approach can also improve the internal environment of the knee joint to speed up the repair process of damaged joints. According to another study, extracorporeal shock wave therapy can improve the local biological environment of the knee joint, increase the secretion of osteoblast cytokines, accelerate subchondral bone remodeling, promote cartilage metabolism, proliferation, and differentiation, and effectively repair cartilage tissue [8]. Compared with the treatment options of arthroscopic surgery, extracorporeal shock wave therapy has the characteristics of non-invasiveness, simple treatment operation, reduction of interference to the internal environment of the knee joint, and create favorable conditions for the recovery of joint function, and the analgesic effect is more obvious, with high clinical application value [9,10].

The results of this study showed that after treatment, the Lysholm score of the study group was higher than that of the control group, and the VAS score and WOMAC score were lower than those of the control group, suggesting that extracorporeal shock wave therapy is better than arthroscopic surgery in terms of improving knee joint function and relieving pain. Further analysis shows that arthroscopic surgery is an invasive operation that can traumatize the knee joint and affect the internal environment of the knee joint, resulting in varying degrees of pain after treatment and poor recovery of joint function [11,12]. Extracorporeal shock wave therapy can impact the pain points of the knee joint. Through continuous impact, the inflammatory factors accumulated in the pain point area can be dispersed and absorbed by the synovial tissue, thereby alleviating the local inflammatory response and reducing pain. Extracorporeal shock wave therapy is a non-invasive treatment plan. During the treatment period, it has a slight impact on the internal environment of the knee joint, and can induce the local biological response of the knee joint, thereby inhibiting the synthesis of pain-causing factors, increasing the level of local growth factors, and promoting the repair of articular cartilage injury, thereby improving joint function [13,14].

The results of this study showed that after treatment, the MDA level of the study group was lower than that of the control group, and the SOD level was higher than that of the control group, suggesting that extracorporeal shock wave therapy can regulate the level of oxygen free radicals and improve the health of the knee joint in patients with knee osteoarthritis. MDA is a product of lipid peroxidation, and its level is related to the degree of attack by free radicals. SOD level is related to the body's ability to scavenge oxygen free radicals. By improving the ability to scavenge oxygen free radicals and reducing the ability to synthesize oxygen free radicals, it can improve the health of the knee joint. Compared with arthroscopic surgery, extracorporeal shock wave therapy can destroy the cell membrane of pain receptors and play a role in denervation, induce the dispersion and absorption of free radicals through shock, and significantly reduce the level of free radicals in the knee joint of patients [15]. This study believes that extracorporeal shock wave therapy is a non-invasive physical therapy approach, in which the treatment process is safe and simple, with short treatment time, rapid onset, low treatment cost, early relief of pain and other symptoms, and promotion of the recovery of knee joint function in patients. In order to ensure the therapeutic effect of extracorporeal shock wave therapy, physicians need to accurately locate the pain points, reasonably set treatment-related parameters, and constantly adjust the

treatment plan.

In summary, extracorporeal shock wave therapy for patients with knee osteoarthritis can restore joint function, relieve pain, and effectively regulate the level of oxygen free radicals. Its clinical efficacy is better than that of arthroscopic surgery. Patients undergoing knee replacement receive extracorporeal shock wave therapy to prolong the life of the knee joint, relieve pain and other symptoms, and improve knee joint function. The total number of patients with knee osteoarthritis selected in this study is small, and multi-center data comparison has not been carried out. The relevant mechanisms of extracorporeal shock wave therapy and arthroscopic surgery still require further research.

Disclosure statement

The author declares no conflicts of interest.

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