Clinical effect of traditional Chinese spinal orthopedic manipulation in treatment of chondromalacia patellae

Qu Liuxin, Xing Liyang, Wanda Norman, Li Mingju, Guo Yi, Gao Song, Li Ping

OBJECTIVE: To evaluate the clinical effect of traditional Chinese spinal orthopedic manipulation (TCSOM) in treating chondromalacia patellae (CP).

METHODS: Sixty cases of CP patients were randomly assigned to a TCSOM group and a Celecoxib group according to the random number table method. All patients in the TCSOM group were treated with a maximum of 10 spinal manipulations and rehabilitation training of quadriceps femoris. The symptoms before and after treatment were assessed with visual analog scale (VAS) and Kujala functional knee scoring system (KFKSS). A symptom improvement rate (SIR) was implemented in order to evaluate the effects of the treatments.

RESULTS: The symptoms of 16 patients in the TCSOM group quickly resolved after the first spinal manipulation and 8 cases were significantly improved. The VAS scores in the TCSOM group after 4 weeks of treatment were significantly lower than those in the Celecoxib group. The KFKSS scores in the TCSOM group after 4 weeks of treatment were significantly higher than those in the Celecoxib group. Side effects of the treatment were not reported. Symptom improvement rate based on the VAS in the TCSOM group indicated more significant improvements than the Celecoxib group.

CONCLUSION: TCSOM has greater efficacy than Celecoxib capsules for relief of the symptoms of CP.

INTRODUCTION
The chondromalacia patellae was named by Aleman in 1917.1 Chondromalacia patellae (CP), defined as cartilaginous softening and fibrillation of patellar bone cartilage, is one of the possible causes of patellofemoral pain syndrome (PFPS).2 CP is characterized by pain, edema and retro-patellar crepitation,3 and is produced by repeated abnormal compressive action on the articular cartilage. This abnormal compression is derived from the non-congruence or the decrease of the patellofemoral joint (PFJ) contact area when a patellar subluxation or dislocation is caused by a poor anatomical or biomechanical relationship.4 It is an important cause of anterior knee pain in adolescents and young adults, as well as in elderly patients, often predisposing its suffer-
ers to osteoarthritis of the knee joint. Etiology of this disease remains unknown. The incidence of CP is estimated at 36.2% in China. Conservative, first line therapy for chondromalacia patellae includes exercise, physical therapy, nonsteroidal anti-inflammatory drugs (NSAIDs) and corticosteroid injections. Traditional Chinese spinal orthopedic manipulation is also a type of physical therapy. Traditional Chinese Spinal Orthopedic Manipulation (TCSOM) is a Traditional Chinese Medicine therapy in which CP is considered as the result of an “imbalance of Yin and Yang” in the spine or abnormal function of the nervous system. The TCSOM treatment is based on the theory of traditional Chinese medicine, human anatomy, biomechanics, and radiology.

MATERIALS AND METHODS

Subjects
Clinically, CP may be suspected by symptoms and signs including patellar crepitus, retropatellar pain, soft tissue swelling, tenderness, effusion, misalignment and limping. Pathological lesions of the patellar articular cartilage can be found with magnetic resonance imaging (MRI) which has been shown to be sensitive and decisive in the vast majority of CP cases. The 60 CP patients in this study were recruited from the outpatient department in Zhongda Hospital, between April 2013 and October 2014 and diagnosed by a physician by assessing the patient’s symptoms, signs and performing a knee joint MRI examination. This study was approved by The Medical Ethics Committees of the Southeast University. All patients signed their informed consent prior to their inclusion in the study. The patients were randomly assigned to TCSOM group treated with traditional Chinese spinal orthopedic manipulation (TCSOM) and Celecoxib group according to the random number table method. The TCSOM group (n = 30) included 9 men and 21 women, with ages ranging from 18 to 60 years, averaging (31 ± 8) years, and the course of disease ranging from 1 to 11 years. All the patients in the TCSOM group were treated with a maximum of 10 treatments, administered by a qualified doctor with over 10-year clinical experience of TCSOM. The Celecoxib group (n = 30) included 11 men and 19 women, with ages ranging from 19 to 58 years, averaging (30 ± 9) years, and the course of disease ranging from 1 to 12 years. There were no significant differences in age, sex, course of disease, pain severity, symptom scoring, signs and dependence between the two groups (P > 0.05).

Inclusion criteria
(a) Patients must fulfill the diagnostic criteria for CP through MRI examination. (b) Ages of patients must be between 18-60 years. (c) Duration of the pain must be greater than 3 months. (d) No other prior or concomitant therapy was used for the condition, without NSAID use, corticosteroid injection, other physical therapy, or other treatments specifically designed for chondromalacia. (e) Patients must comply with a completion of follow-up visits. (f) Patients must complete written and verbal questionnaires provided by the research administrator. (g) Patients have voluntarily signed an informed consent.

Exclusion criteria
The patients of pregnancy or breast-feeding, heart problems, allergies to sulfa drugs, current alcohol or drug abuse, knee replacement surgery, knee surgery, absence of knee pain, lumbar surgery, vertebral fracture, central herniation of lumbar inter-vertebral disc, post-operation of the spine, serious osteoporosis, vertebral tuberculosis, vertebral tumor or cancer, absence of interest in participating in the research study, were excluded.

Treatments
Celecoxib capsule is efficacious in the treatment of the signs and symptoms of osteoarthritis and rheumatoid arthritis at the proposed doses. The patients in the Celecoxib group were treated with Celecoxib capsules, and rehabilitation training of quadriceps femoris.

The patients of the Celecoxib group were treated with Celecoxib capsules (Pfizer Pharmaceuticals LLC, Caguas Puerto Rico), 200 mg once a day, for 4 weeks. Rehabilitation training of the quadriceps femoris muscle: (a) isometric contraction of quadriceps femoris: the patient took a supine position, stretching the lower limb of the affected side, as forcefully as tolerable, so as to feel muscular tautness of thigh, for 15 seconds; (b) holding a ball with thigh: the patient took a seated position, holding a ball of 35 cm in diameter with thigh continuously as forcefully as possible, for 15 s. All the above-mentioned exercises were repeated 10 times as 1 set, 5 sets each time, and performed 3 times daily.

The patients in the TCSOM group were treated with traditional Chinese spinal orthopedic manipulations, for a maximum of 10 treatments. If the patient’s symptoms resolved within 10 times of receiving the manipulations, no additional treatment was needed. Before treatment with the spinal manipulation, the following examinations were conducted.

(a) Palpation examination: this is one type of examination and diagnosis administered by way of following Traditional Chinese Medicine practices. The pads of the fingers are used to press along the spine in order to locate the spinous processes that are not in alignment. There is often tenderness reported while palpating the soft tissue and structures adjacent to these processes. Between L₁-L₉, on both sides of the spinous processes, there can be one or two taut soft tissue projections, which are perpendicular to the spine. These taut soft tissue projections are believed to be the cause of CP. (b) Lumbar imaging examination: X-ray imaging examina-
tions of patients’ lumbar vertebrae may show displacement of vertebra, intervertebral space stenosis, intervertebral angle variation, hyperosteoegeny of vertebra, spino- nous processes deviation. These conditions are usually observed in the upper lumbar vertebrae.

**TCSOM Treatment**

The following methods of treatment were executed by practitioners with over 10 years of clinical experience of traditional Chinese spinal orthopedic manipulation. Obliquely pulling manipulation (Xiebanfa): obliquely pulling manipulation refers to a manipulation performed by obliquely pulling the thoracic and lumbar region with force in opposite directions between the upper and lower limbs. Malposition and dysfunction of intervertebral joints from T\textsubscript{10} to S\textsubscript{1} are often treated with this manipulation, for it has the function of relaxing tendons and dredging the meridians, lubricating joints, and replacing and/or reducing displaced anatomical sites.\textsuperscript{11} This manipulation also can loosen muscle spasms, promote flow of Qi and blood circulation, and relieve pain.

The patient lies in a prone position. The practitioner uses the middle and index fingers to palpate along both sides of the spine and locate a taut cord-like nodule. Once this area has been located, the patient is instructed to take a lateral-recumbent position with the affected side facing up. The lower limb on the top should be flexed at both the hip and knee joint. The leg on the bottom is straight. The practitioner stands on the patient’s front side, with the neck, knees and hip bending slightly (flexion). The practitioner stands on the patient’s front side, finds the affected vertebra, and presses toward the opposite side with inward angle of 30 degrees and downward angle of 90 degrees with thumb on the lamina of the affected spine with 40 to 100 Newton of pressure (depending on patient’s age, physique ) for about 1 to 3 s. With this method, the practitioner can sometimes feel the movement of the vertebra. After manipulation, instruct the patient to lie supinely and rest for 3 to 5 min.

Thumb pressing manipulation is performed normally at L\textsubscript{3} or L\textsubscript{4} according to CP patient’s symptoms, signs and examinations.

The patients of the TCSOM group were treated with the above mentioned spinal manipulation methods, 2-3 times a week, for a maximum of 10 treatments. No more treatment was considered necessary if the patient’s CP symptoms resolved within 10 spinal manipulations. The patients in the TCSOM group were also required to do the same rehabilitation training of the quadriceps femoris as the Celecoxib group (quadriceps stretching and squeezing a ball between the thighs).

All of the patients of both groups were required to avoid overwork, long periods of sitting and poor postures, such as slouching the back or leaning against the bed or sofa which may lead to poor spinal stability.

**Observation indicators**

Visual analog scale (VAS): VAS was described as a 100 mm scale ranging from 0 to 10 (with 0 being no pain and 10 representing the most severe possible pain) and used to assess severity of knee joint pain. Each patient recorded a mark at the beginning and end of the treatment period for the Celecoxib group, and also recorded a mark at the beginning and end of the treatment period for the Celecoxib group, and at 3 months post-treatment was conducted for both groups. No pain to minimal pain was calculated as scores 0 through 3, Moderate pain as 4-6 points on the questionnaire, and severe pain as scores from 7-10.

Kujala functional knee scoring system (KFKSS):\textsuperscript{12} objective evaluation was undertaken using the Kujala functional knee scoring system. It is used to assess gait, ambulation, support, stair climbing, instability, pain, swelling, squatting flexion deficiency and thigh atrophy. A functional score between 0 and 100 is obtained. The closer to 100 the score is, the better the function of the knee is. Each patient was objectively measured and recorded according to the Kujala functional knee scoring system questionnaire for their symptoms pre-treatment, post-treatment and at 3 months post-treatment.

**Evaluation of therapeutic effects**

Symptom improvement rate (SIR) was used as a method of evaluating therapeutic effects.\textsuperscript{3} SIR = [(the pre-treatment score-the post-treatment score) / the pre-treatment score] × 100%
Mild gastrointestinal discomfort presented in the phar
No side effects were reported in the TCSOM group.
so consistent at
3
month post-treatment.
ences between the groups on VAS and KFKSS were al
-3
All differ-
-2
The symptom improvement rate based on the VAS in
2
of treatment were significantly higher than those in the
-1
The KFKSS scores in the TCSOM group after
4
weeks
4
were significantly lower than those in the Celecoxib
-1
The VAS scores in the TCSOM group after
2
weeks
2
were significantly im-
-1
16
cases were significantly im-
-1
The research process is shown in Figure 1. All 60 pa-
30
= n
30
= n
-1
Eligible subjects
Inform and sign on the inform consent (n = 60)
Random
Treatment group (n = 30) Control group (n = 30)
VAS and KFKSS score evaluation (n = 60)
pre-treatment and post-treatment treatment
Establish database (n = 60)
Data analysis Statistical data (n = 60)
Figure 1 Flow diagram of the study process
The VAS scores in the TCSOM group after 4 weeks were significantly lower than those in the Celecoxib group post-treatment (Table 1).
The KFKSS scores in the TCSOM group after 4 weeks of treatment were significantly higher than those in the Celecoxib group post-treatment (Table 2).
The symptom improvement rate based on the VAS in the TCSOM group indicated more significant improvements than the Celecoxib group (Table 3). All differences between the groups on VAS and KFKSS were also consistent at 3 month post-treatment.
No side effects were reported in the TCSOM group. Mild gastrointestinal discomfort presented in the pharmaceutical group, however, it did not disrupt the trial.

**DISCUSSION**
The results showed that the clinical effect of the TCSOM treatment was significantly better than the Celecoxib treatment; in addition, the patients’ knee joint pain symptoms in the TCSOM group resolved or significantly improved soon after TCSOM.

2000 years ago, traditional Chinese medicine understood much about the spine and spinal cord. They described the spinal nerves and sympathetic nerves around the spine with the word "meridian". The Foot-Taiyang (Bladder) Meridian travels along a line which is 1.5 cun lateral to the spine and also close to the location of the intervertebral foramen in which the spinal nerve passes through. The CP was treated by TCSOM at or around L1, L2, L3, L5. The thumb pressing manipulation can stimulate Jiaji (EX-B 2) in addition to correcting displaced vertebrae. The obliquely pulling manipulation can stimulate the Du Meridian, the Jiaji points Shenshu (BL 23) and Qihaishu (BL 24) in this research. Shenshu (BL 23) is located at 1.5 cun lateral to Mingmen (GV 4), at the level of the lower border of the spinous process of the second lumbar vertebra, and its innervation is the lateral branch of the posterior ramus of the first lumbar nerve, deeper, its lateral branch. Qihaishu (BL 24) is located at 1.5 cun lateral to the Governor Vessel, at the level of the lower border of the spinous process of the third lumbar vertebra, and its innervation is the lateral cutaneous branch of the posterior ramus of the second lumbar nerve. The indications of Shenshu (BL 23) are “low back pain, weakness of the knee, knee joint pain, diarrhea, impotence, irregular menstruation, and enuresis.” And the indications of Qihaishu (BL 24) are “low back pain, weakness of the knee, knee joint pain, and irregular menstruation.” Therefore, these points can both treat pathologies of “low back pain, weakness of the knee, and knee joint pain”. The innervation of the knee joint also comes from the first and second lumbar nerves. The Jiaji (EX-B 2) were first named by Mr. Cheng Danan, a famous educationist and acupuncturist in modern China, and also a member of The Chinese Academy of Science. He first explained the theory of acupoints by the theory of modern anatomy and set up a society of acupuncture research. He insists that acupuncture is an effective medical therapy, because its mechanism of action is the stimulation of the nerves described in European medical theory. Jiaji (EX-B 2) were named and located in his works named Zhong Guo Zhenjiu Xue. In this book, the location of Jiaji (EX-B 2) are 0.5 cun lateral to the middle of the spinous processes from the first thoracic vertebra to the fifth lumbar vertebra on both sides, so there are altogether 34 points. The location of Jiaji (EX-B 2) is very similar to the distribution of spinal nerves. The Jiaji (EX-B 2) of the lumbar region are used for treatment of disorders of the lumbar region and the lower limbs. So, this is the theoretical foundation by which the CP is treated by TCSOM, applied mostly from L1 to L5.
Retrogression occurs at the inter-vertebral discs and accelerates with aging. The speed of this retrogression will vary with the individual's constitution and is affected by other factors such as poor posture habits and a lack of exercise. When the fluid in the inter-vertebral disc is consumed, the height of the inter-vertebral disc decreases. This may make the inter-vertebral foramen smaller, and thereby affect the nerves passing through the foramen. The nerves can change to fit this difference. However, if the speed of retrogression is too rapid and the nerves cannot change expediently enough to suit the diminishing accommodations, clinical symptoms can occur. In view of this, the aim of spinal manipulation is to restore the appropriate position of the vertebra, and decrease the stimulation to the nerves. The TCSOM exerts pressure on the vertebra to move them a little and reduce the stimulation to the nerves, and also to relieve the tension of the muscles around the spine. This small movement of vertebra can quickly reduce the pressure and stimulation on nerves from vertebrae or inter-vertebral discs. In TCM theory, these two spinal manipulations both can loosen muscle spasms, relax tendons and dredge the meridians, promote flow of Qi and blood circulation to relieve pain, replace and/or reduce displaced anatomic sites.

Rehabilitation training of quadriceps femoris can restore the stability of knee joints, enhance myodynamics of quadriceps femoris, improve myoatrophy, and reduce pressure on patellofemoral joint so as to restore the equilibrium between resistance force and mechanical stress and to enhance the likelihood of repairing patellar cartilage. The therapeutic result of the TCSOM in this study shows that symptoms are reduced, slowly resolve or are relieved immediately after treatment, and the VAS of the TCSOM group is significantly lower than that of the Celecoxib group post treatment. The results of this study suggest that the displacement of inter-vertebral discs of the lumbar vertebrae is a contributing factor to the development of CP. Correcting the displacement of the vertebra and/or inter-vertebral disc of the lumbar vertebra with TCSOM is an effective way for CP, by relieving the stimuli caused by the increased pressure around the nerves adjacent to the spine. TCSOM also can dredge the meridians, promote flow of Qi and blood circulation, replace and/or reduce displaced anatomic sites to relieve knee joint pain.

Thumb pressing manipulation on Jiaji (EX-B 2) and the obliquely pulling manipulation in the lumbar region, applied mostly from L1 to L5, can correct the displacement of inter-vertebral discs and/or vertebra, resolving the stimuli caused by pressure being exerted on the nerves which pass through the intervertebral foramen. TCSOM also can dredge the meridians, promote flow of Qi and blood circulation, replace and/or reduce displaced anatomic sites to relieve knee joint pain.

**REFERENCES**


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**Table 1 Comparison of VAS scores between the TCSOM group and the celecoxib group before and after treatment (±)**

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Pre-treatment</th>
<th>Post-treatment</th>
<th>3 months post-treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCSOM</td>
<td>30</td>
<td>7.9±1.3a</td>
<td>1.5±0.6a</td>
<td>1.6±0.7b</td>
</tr>
<tr>
<td>Celecoxib</td>
<td>30</td>
<td>7.8±1.4</td>
<td>4.9±1.7</td>
<td>5.6±1.5</td>
</tr>
</tbody>
</table>

Notes: the celecoxib group was instructed to take 200 mg once a day, for 4 weeks. The TCSOM group was treated with traditional Chinese spinal orthopedic manipulation, 2-3 times a week, for a maximum of 10 treatments. TCSOM: traditional Chinese spinal orthopedic manipulation; VAS: visual analog scale. Compared with the celecoxib group, ‘P > 0.05; ‘P < 0.001.

**Table 2 Comparison of KFFSS scores between the TCSOM group and the celecoxib group before and after treatment (±)**

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Pre-treatment</th>
<th>Post-treatment</th>
<th>3 months post-treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCSOM</td>
<td>30</td>
<td>34±6c</td>
<td>87±9c</td>
<td>82±7c</td>
</tr>
<tr>
<td>Celecoxib</td>
<td>30</td>
<td>34±6</td>
<td>54±7</td>
<td>48±7</td>
</tr>
</tbody>
</table>

Notes: the celecoxib group was instructed to take 200 mg once a day, for 4 weeks. The TCSOM group was treated with traditional Chinese spinal orthopedic manipulation, 2-3 times a week, for a maximum of 10 treatments. TCSOM: traditional Chinese spinal orthopedic manipulation; KFFSS: Kujala functional knee scoring system. Compared with the celecoxib group, ‘P > 0.05; ‘P < 0.001.

**Table 3 Comparison of effective rates between the TCSOM group and the celecoxib group (%)**

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Excellent (n)</th>
<th>Good (n)</th>
<th>Excellent+Good (n)</th>
<th>Poor (n)</th>
<th>Effective rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCSOM</td>
<td>30</td>
<td>20</td>
<td>7</td>
<td>27</td>
<td>3</td>
<td>90</td>
</tr>
<tr>
<td>Celecoxib</td>
<td>30</td>
<td>6</td>
<td>9</td>
<td>15</td>
<td>15</td>
<td>50</td>
</tr>
</tbody>
</table>

Notes: the celecoxib group was instructed to take 200 mg once a day, for 4 weeks. The TCSOM group was treated with traditional Chinese spinal orthopedic manipulation, 2-3 times a week, for a maximum of 10 treatments. TCSOM: traditional Chinese spinal orthopedic manipulation. Compared with the celecoxib group (excellent + good), ‘P < 0.001.
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