Journal of Pharmaceutical and Medical Research
Print ISSN: 2663-1954
Online ISSN: 2663-1962
DOI: https://doi.org/10.61784/jpmr3045

MICRO-ADJUSTMENT MANIPULATION COMBINED WITH TRADITIONAL MANIPULATION FOR KNEE OSTEOARTHRITIS WITH VARUS DEFORMITY

KaiLong Sun, ShangJun Xia, Jian Zhang*
Department of Traditional Chinese Medicine, Hongmei Community Health Service Center, Shanghai 200231, China.
Corresponding Author: Jian Zhang, Email: 2711810907@qq.com

Abstract: Objective: To observe the effect of micro-adjustment manipulation combined with traditional manipulation versus traditional manipulation alone in the treatment of varus knee osteoarthritis (KOA) by analyzing kinetic parameters, WOMAC scores, and clinical efficacy; and to explore the mechanism of adding micro-adjustment manipulation to traditional manipulation in the treatment of KOA. Methods: A total of 80 patients with varus knee osteoarthritis (7 cases dropped out during the process) were randomly divided into two groups. The combined group (n=37) received micro-adjustment manipulation during the first knee joint treatment, followed by traditional manipulations such as “One-Finger Meditation” and “Tui Fa.” The traditional group (n=36) received only traditional manipulations such as “One-Finger Meditation” and “Tui Fa.” Both groups were treated for 4 weeks, twice a week, one course of treatment lasting 4 weeks. WOMAC scores, kinetic parameters, and clinical efficacy were observed. Results:Osteoarthritis scales: After the first manipulation and after 4 weeks of manipulation, WOMAC scores, functional scores, and VAS scores in both groups were significantly lower than before treatment ($P<0.05$). After the first manipulation, the pain score in the micro-adjustment group decreased more significantly than that in the traditional group ($P<0.05$). After 4 weeks of treatment, the stiffness score in the combined group decreased significantly compared with before treatment ($P<0.05$). Kinetic parameters: After 4 weeks of manipulation, the flexion torque in both groups increased compared with before treatment ($P<0.05$). After the first manipulation, the adduction moment impulse in the combined group decreased significantly compared with before treatment ($P<0.05$). Clinical efficacy: The effective rates of the combined group after the first manipulation and after 4 weeks were 83.78% and 91.89%, respectively; while those of the traditional group were 80.56% and 91.67%, with no statistical difference. Conclusion: Both methods are effective for the treatment of KOA. The micro-adjustment manipulation of the knee joint has a better immediate analgesic effect, and the combination of micro-adjustment and traditional manipulations shows superior improvement in stiffness after one treatment course compared with traditional manipulations alone. The adduction moment impulse after the first treatment with micro-adjustment manipulation decreased significantly compared with before treatment.
Keywords: Varus knee osteoarthritis; Micro-adjustment manipulation; One-finger meditation; Tui Fa; Kinetic parameters

1 INTRODUCTION

Knee osteoarthritis (KOA) is a chronic degenerative joint disease. Epidemiological data show that the incidence of varus knee osteoarthritis in middle-aged and elderly women in China is 60%–70%[1]. Pain and functional impairment are the main clinical manifestations of KOA. In traditional Chinese medicine (TCM), KOA corresponds to the diagnosis of “Gu Bi” (bone impediment). In recent years, the clinical efficacy of Tuina therapy for KOA has been widely recognized, and micro-adjustment manipulation for knee osteoarthritis has also been extensively studied[2]. In the Shanghai school of Tuina, traditional manipulations such as “One-Finger Meditation” and “Tui Fa” are mainly used to promote blood circulation, resolve the pathological factors leading to “tendon injury,” and restore the tendon functions of “binding bones” and “facilitating joints”[3]. Micro-adjustment manipulation has shown good immediate clinical effects, but its long-term efficacy is not as significant as traditional Tuina[4]. Therefore, this study conducted a preliminary investigation comparing micro-adjustment manipulation combined with traditional manipulations versus traditional manipulations alone. The results are reported as follows.

2 CLINICAL DATA AND METHODS

2.1 General Information

A total of 80 patients with diagnosed varus knee osteoarthritis, all middle-aged and elderly women, who received treatment between January 2024 and August 2025 at the Tuina Department of Putuo Traditional Chinese Medicine Hospital in Shanghai, the Tuina Department of Hongmei Community Health Service Center in Xuhui District of Shanghai, the Tuina Department of Longhua Hospital Affiliated to Shanghai University of Traditional Chinese Medicine, the Tuina Department of Yueyang Hospital of Integrated Traditional Chinese and Western Medicine Affiliated to Shanghai University of Traditional Chinese Medicine, and the Tuina Department of Shanghai Eighth

People's Hospital, were enrolled in this clinical observation. Patients were randomly assigned into two groups. During the clinical process, 7 cases dropped out for various reasons. Finally, 73 patients were included in the study, with 37 in the combined group and 36 in the traditional group.

Table 1 Comparison of Baseline Characteristics between the Two Groups

Variable	Combination group (n=37)	Traditional group (n=36)	P value
Height (cm)	162.51 ± 6.21	162.11 ± 6.69	0.798
Age (years)	62.34 ± 9.03	60.21 ± 9.61	0.568
BMI (kg/m²)	24.19 ± 1.99	24.51 ± 2.01	0.723
Weight (kg)	62.07 ± 8.05	64.14 ± 8.97	0.811
Right knee (cases)	17	15	—
Left knee (cases)	20	21	0.506

From the analysis of the above table 1, the average height of patients in the combined group and the traditional group was 162.51 ± 6.21 cm and 162.11 ± 6.69 cm, respectively, with no statistically significant difference between the two groups (P>0.05). The average age of the combined group and the traditional group was 62.34 ± 9.03 years and 60.21 ± 9.61 years, respectively, with no statistically significant difference between the two groups (P>0.05). The average BMI of the combined group and the traditional group was 24.19 ± 1.99 kg/m² and 24.51 ± 2.01 kg/m², respectively, with no statistically significant difference between the two groups (P>0.05). The average body weight of the combined group and the traditional group was 62.07 ± 8.05 kg and 64.14 ± 8.97 kg, respectively, with no statistically significant difference between the two groups (P>0.05). In the combined group, there were 17 cases of KOA affecting the right knee and 20 cases affecting the left knee; in the traditional group, there were 15 cases of right knee KOA and 21 cases of left knee KOA, with no statistically significant difference between the two groups (P>0.05). Therefore, the two groups were comparable.

2.2 Diagnostic Criteria

(1) Clinical diagnostic criteria: According to the Guidelines for the Diagnosis and Treatment of Osteoarthritis in China (2021 edition) issued by the Orthopedics Branch of the Chinese Medical Association[5].
(2) Knee pain for most of the time during the previous month.
(3) X-ray (standing position) showing narrowing of the knee joint space, osteophyte formation at the joint margins, subchondral bone sclerosis and/or cystic changes.
(4) Age ≥ 50 years.
(5) Morning stiffness ≤ 30 minutes.
(6) Crepitus during joint movement.
A diagnosis of KOA can be established if item (1) is met, plus any two of items (2), (3), (4), and (5).

2.3 Inclusion Criteria

(1) Patients meeting the diagnostic criteria for knee osteoarthritis (KOA), clinically classified as the middle stage: frequent severe pain; recurrent swelling; mild varus or valgus deformity of the knee joint may be present; imaging showing definite joint space narrowing, moderate osteophytes, mild subchondral bone sclerosis, and possible bony deformity of the knee joint; Kellgren–Lawrence (K-L) grade III[6].
(2) Patients with varus knee osteoarthritis: full-length lower limb radiographs showing the mechanical axis passing through the medial side of the center point of the tibial plateau, more than 2 mm from the midpoint.
(3) Patients able to walk independently (without assistive devices).
(4) Female patients aged 50–70 years.
(5) BMI < 28 kg/m².
(6) Voluntarily participating in this clinical observation and signing informed consent.

2.4 Exclusion Criteria

(1) Knee osteomyelitis, tuberculosis, tumors, etc.
(2) History of knee surgery or trauma.
(3) Neurological diseases such as Parkinson's disease or cerebrovascular disease.
(4) Mental illness or cardiovascular disease preventing cooperation with gait analysis.
(5) Receiving treatment for KOA (e.g., NSAIDs, acupuncture, Tuina, rehabilitation) within 4 weeks prior to enrollment.

3 TREATMENT METHODS

3.1 Combined Group

The Tuina regimen for this group consisted of two steps. The first treatment used knee micro-adjustment manipulation, and the subsequent treatments mainly adopted Ding's Tuina techniques of One-Finger Meditation and Tui Fa (reference: Cao Renfa Clinical Experience Collection). Treatment was administered twice per week, with one treatment course lasting four weeks.

3.1.1 First treatment

Micro-adjustment of the patellofemoral and tibiofemoral joints: The patient was seated, facing the practitioner. The practitioner placed the patient's affected ankle joint in the anatomical neutral position. Both thumbs of the practitioner were positioned at the medial and lateral "knee eyes" below the patella, pushing upward and backward, while the other four fingers encircled the patellar fossa. The tibia was rotated to mobilize the tibiofemoral joint, while the patient, following verbal instructions, performed slow sit-to-stand movements. This procedure was repeated three times. Subsequently, the practitioner used four-finger kneading techniques on the affected lateral thigh muscles, posterior thigh, popliteal fossa, and posterior calf[7].

3.1.2 Subsequent treatments

Traditional One-Finger Meditation and Tui Fa were applied (reference: *Cao Renfa Tuina Academic Experience Collection*). The patient was placed in the supine position. First, One-Finger Meditation manipulation was applied to Xuehai (SP10), Heding (EX-LE2), Futu (ST32), Liangqiu (ST34), Dubi (ST35), and Neixiyan (EX-LE4) for approximately 3 minutes. Then, Tui Fa was applied to the quadriceps muscle above the patella for about 3 minutes. Next, the practitioner grasped the patella with the palm and performed gentle circular rubbing until mild heat was felt at the patellofemoral joint, lasting about 3 minutes. The patient was then placed in the prone position, and the practitioner's middle fingers were placed on the medial and lateral heads of the gastrocnemius and the hamstring muscles to perform transverse manipulations. Tui Fa was then applied to the posterior thigh, popliteal fossa, and posterior calf, followed by pressing and kneading of Weizhong (BL40), Chengshan (BL57), and Chengjin (BL56), until the patient reported a sensation of soreness and distension, lasting about 3 minutes. Finally, the patient returned to the supine position, where passive knee flexion, extension, internal rotation, and external rotation were performed in combination with flexion-shaking manipulation. The session was concluded with rubbing around the knee joint until warmth was generated[8].

3.2 Traditional Group

This group was treated with the traditional methods of One-Finger Meditation and Tui Fa (reference: Cao Renfa Tuina Academic Experience Collection), twice per week for four weeks, constituting one treatment course[9].

4 EFFICACY OBSERVATION

4.1 Observation Indicators

Data were collected before Tuina treatment, after the first Tuina session, and after four weeks of Tuina treatment, including osteoarthritis scales and kinematic parameters.

4.1.1 Primary outcome measures

Knee joint torques: KAM (knee adduction moment), KFM (knee flexion moment), KAMI (knee adduction moment impulse).

4.1.2 Secondary outcome measures: WOMAC index.

4.1.3 Criteria for clinical efficacy

According to the criteria for the efficacy of "Gu Bi" (bone impediment) in the Standards for the Diagnosis and Efficacy of TCM Syndromes issued by the Ministry of Health of the People's Republic of China:

(1) Symptom control: Symptoms completely disappear, joint function is restored to normal, and major laboratory and imaging indicators return to normal.

(2) Markedly effective: Main symptoms disappear, joint function basically recovers, patients can resume normal work and activities, and major laboratory and imaging indicators are basically normal or show great improvement.

(3) Improved: Main symptoms are mostly relieved, joint function basically recovers or shows significant progress, patients regain the ability to live independently, and laboratory and imaging indicators show some improvement.

(4) Ineffective: No improvement in symptoms or signs.

5 STATISTICAL ANALYSIS

All statistical analyses were performed using SPSS version 26.0 (IBM Corp, Armonk, NY, USA). Continuous variables were expressed as mean $\pm$ standard deviation (SD). Within-group comparisons were conducted using paired t-tests, and between-group comparisons using independent-sample t-tests, provided that data met assumptions of normality and homogeneity of variance. For non-normally distributed data, nonparametric rank-sum tests were applied. Repeated-measures ANOVA was used for longitudinal analyses. Categorical variables, including clinical efficacy outcomes, were compared using chi-square tests. A P value < 0.05 was considered statistically significant.

6 TREATMENT RESULTS

6.1 WOMAC Scores of the Knee Joint

6.1.1 Total WOMAC score

Table 2 Comparison of Total WOMAC Scores between the Two Groups

Time point	Combination group (n=37)	Traditional group (n=36)	Pbetween	Pwithina (Before vs 1st tuina)	Pwithinb (Before vs 4 weeks)
Before tuina	89.89 ± 10.11	89.68 ± 11.28	0.939	—	—
After first tuina	67.12 ± 10.01	66.18 ± 10.59	0.712	<0.01	—
After 4 weeks of tuina	58.86 ± 7.72	58.18 ± 10.15	0.726	—	<0.01

From the analysis of the above table 2: In the combined group, the total WOMAC scores before Tuina, after the first Tuina session, and after four weeks of Tuina were 89.89 ± 10.11, 67.12 ± 10.01, and 58.86 ± 7.72, respectively. In the traditional group, the corresponding total scores were 89.68 ± 11.28, 66.18 ± 10.59, and 58.18 ± 10.15, respectively.

Overall, after manipulation treatment, the total scores of both groups decreased with the extension of treatment time, indicating that manipulation can improve patient function and symptoms.Within-group comparisons: After the first Tuina session and after four weeks of treatment, the total WOMAC scores of both groups decreased significantly compared with those before treatment ($P < 0.05$).Between-group comparisons: Before treatment, there was no statistically significant difference in total WOMAC scores between the two groups ($P > 0.05$), indicating comparability. After the first Tuina session and after four weeks of treatment, there was no statistically significant difference in total WOMAC scores between the combined group and the traditional group ($P > 0.05$).

6.1.2 Stiffness score

Table 3 Comparison of Stiffness Scores between the Two Groups

Time point	Combination group (n=37)	Traditional group (n=36)	Pbetween	Pwithina (Before vs 1st tuina)	Pwithinb (Before vs 4 weeks)
Before tuina	6.91 ± 2.81	6.56 ± 2.73	0.667	—	—
After first tuina	6.44 ± 2.30	6.00 ± 2.41	0.525	0.604	—
After 4 weeks of tuina	5.52 ± 2.81	6.17 ± 2.33	0.303	—	<0.05

From the analysis of the above table 3: In the combined group, the WOMAC stiffness scores before Tuina, after the first Tuina session, and after four weeks of Tuina were 6.91 ± 2.81, 6.44 ± 2.30, and 5.52 ± 2.81, respectively. In the traditional group, the corresponding scores were 6.56 ± 2.73, 6.00 ± 2.41, and 6.17 ± 2.33, respectively.

Overall, after manipulation treatment, the stiffness scores of both groups showed a decreasing trend over time, suggesting that manipulation can improve patients' functional mobility.Within-group comparisons: After the first Tuina session and after four weeks of treatment, stiffness scores in both groups decreased compared with those before treatment. The reduction in the combined group after four weeks was statistically significant ($P < 0.05$).Between-group comparisons: Before treatment, there was no statistically significant difference in stiffness scores between the two groups ($P > 0.05$), indicating comparability. After the first Tuina session and after four weeks of treatment, there was no statistically significant difference in stiffness scores between the combined group and the traditional group ($P > 0.05$).

6.1.3 Function score

Table 4 Comparison of WOMAC Function Scores between the Two Groups

Time point	Combination group (n=37)	Traditional group (n=36)	Pbetween	Pwithina (Before vs 1st tuina)	Pwithinb (Before vs 4 weeks)
Before tuina	65.32 ± 7.39	65.10 ± 7.34	0.617	—	—
After first tuina	47.89 ± 8.98	46.01 ± 9.24	0.199	<0.01	—
After 4 weeks of tuina	43.19 ± 6.47	41.54 ± 9.01	0.293	—	<0.01

From the analysis of the above table 4: In the combined group, the WOMAC function scores before Tuina, after the first Tuina session, and after four weeks of Tuina were 65.32 ± 7.39, 47.89 ± 8.98, and 43.19 ± 6.47, respectively. In the traditional group, the corresponding scores were 65.10 ± 7.34, 46.01 ± 9.24, and 41.54 ± 9.01, respectively.

Overall, after manipulation treatment, the function scores of both groups decreased over time, indicating that manipulation could improve patients' daily living ability.Within-group comparisons: After the first Tuina session and after four weeks of treatment, the function scores in both groups decreased significantly compared with those before treatment ($P < 0.05$). Between-group comparisons: Before treatment, there was no statistically significant difference in

function scores between the two groups (P > 0.05), indicating comparability. After the first Tuina session and after four weeks of treatment, there was no statistically significant difference in function scores between the combined group and the traditional group (P > 0.05).

6.1.4 VAS score

Table 5 Comparison of VAS Scores between the Two Groups

Time point	Combination group (n=37)	Traditional group (n=36)	Pbetween	Pwithina (Before vs 1st tuina)	Pwithinb (Before vs 4 weeks)
Before tuina	20.02 ± 5.03	19.31 ± 5.51	0.568	—	—
After first tuina	12.03 ± 2.72	14.41 ± 3.52	<0.05	<0.01	—
After 4 weeks of tuina	9.61 ± 2.98	9.93 ± 2.42	0.714	—	<0.01

From the analysis of the above table 5: In the combined group, the VAS scores before Tuina, after the first Tuina session, and after four weeks of Tuina were 20.02 ± 5.03, 12.03 ± 2.72, and 9.61 ± 2.98, respectively. In the traditional group, the corresponding scores were 19.31 ± 5.51, 14.41 ± 3.52, and 9.93 ± 2.42, respectively.

Overall, after manipulation treatment, the VAS scores of both groups decreased over time. After the first Tuina session, the reduction in VAS score in the combined group was significantly greater than that in the traditional group.Within-group comparisons: After the first Tuina session and after four weeks of treatment, VAS scores in both groups were significantly lower than those before treatment (P < 0.05).Between-group comparisons: Before treatment, there was no statistically significant difference in VAS scores between the two groups (P > 0.05), indicating comparability. After the first Tuina session, the combined group showed a significantly greater reduction in VAS scores compared with the traditional group (P < 0.05). After four weeks of treatment, however, there was no statistically significant difference in VAS scores between the two groups (P > 0.05).

6.2 Kinematic Parameters of the Knee Joint

6.2.1 Knee adduction moment (KAM)

Table 6 Comparison of hip Adduction torque (Nm/kg × 10^{-1}) between the Two Groups

Time point	Combination group (n=37)	Traditional group (n=36)	Pbetween	Pwithina (Before vs 1st tuina)	Pwithinb (Before vs 4 weeks)
Before tuina	2.41 ± 0.74	2.37 ± 0.70	0.849	—	—
After first tuina	2.50 ± 0.77	2.44 ± 0.72	0.898	0.714	—
After 4 weeks of tuina	2.65 ± 0.59	2.63 ± 0.63	0.803	—	0.049

From the analysis of the above table 6: In the combined group, the KAM values before Tuina, after the first Tuina session, and after four weeks of Tuina were 2.41 ± 0.74 Nm/kg × 10^{-1}, 2.50 ± 0.77 Nm/kg × 10^{-1}, and 2.65 ± 0.59 Nm/kg × 10^{-1}, respectively. In the traditional group, the corresponding values were 2.37 ± 0.70 Nm/kg × 10^{-1}, 2.44 ± 0.72 Nm/kg × 10^{-1}, and 2.63 ± 0.63 Nm/kg × 10^{-1}.

Overall, after manipulation treatment, the KAM of both groups showed an upward trend over time, suggesting that manipulation could enhance patients' KAM.Within-group comparisons: After the first Tuina session and after four weeks of treatment, KAM values in both groups increased compared with those before treatment, but the differences were not statistically significant (P > 0.05).Between-group comparisons: Before treatment, there was no statistically significant difference in KAM values between the two groups (P > 0.05), indicating comparability. After the first Tuina session and after four weeks of treatment, there were still no statistically significant differences in KAM values between the combined group and the traditional group (P > 0.05).

6.2.2 Knee flexion moment (KFM)

Table 7 Comparison of Knee Flexion Torque (Nm/kg × 10^{-1}) between the Two Groups

Time point	Combination group (n=37)	Traditional group (n=36)	Pbetween	Pwithina (Before vs 1st tuina)	Pwithinb (Before vs 4 weeks)
Before tuina	1.09 ± 0.59	1.05 ± 0.39	0.849	—	—
After first tuina	1.20 ± 0.58	1.18 ± 0.51	0.930	0.921	—
After 4 weeks of tuina	1.51 ± 0.77	1.54 ± 0.71	0.791	—	<0.05

From the analysis of the above table 7: In the combined group, the KFM values before Tuina, after the first Tuina session, and after four weeks of Tuina were 1.09 ± 0.59 Nm/kg × 10^{-1}, 1.20 ± 0.58 Nm/kg × 10^{-1}, and 1.51 ±

0.77 Nm/kg × 10^{-1}, respectively. In the traditional group, the corresponding values were 1.05 ± 0.39 Nm/kg × 10^{-1}, 1.18 ± 0.51 Nm/kg × 10^{-1}, and 1.54 ± 0.71 Nm/kg × 10^{-1}.

Overall, after manipulation treatment, the KFM of both groups increased over time, suggesting that manipulation could improve patients' KFM.Within-group comparisons: After the first Tuina session and after four weeks of treatment, the KFM values of both groups increased compared with those before treatment. At four weeks, KFM values in both groups were significantly higher than baseline ($P < 0.05$). However, after the first Tuina session, the increase was not statistically significant compared with baseline ($P > 0.05$).Between-group comparisons: Before treatment, there was no statistically significant difference in KFM values between the two groups ($P > 0.05$), indicating comparability. After the first Tuina session and after four weeks of treatment, there were no statistically significant differences in KFM values between the combined group and the traditional group ($P > 0.05$).

6.2.3 Knee adduction moment impulse (KAMI)

Table 8 Comparison of Hip Adduction Torque Impulse (Nm/kg × 10^{-1}) between the Two Groups

Time point	Combination group (n=37)	Traditional group (n=36)	Pbetween	Pwithina (Before vs 1st tuina)	Pwithinb (Before vs 4 weeks)
Before tuina	2.57 ± 0.59	2.61 ± 0.52	0.811	—	—
After first tuina	2.21 ± 0.61	2.30 ± 0.42	0.521	<0.05	—
After 4 weeks of tuina	2.30 ± 0.66	2.22 ± 0.51	0.729	—	<0.05

From the analysis of the above table 8: In the combined group, the KAMI values before Tuina, after the first Tuina session, and after four weeks of Tuina were 2.57 ± 0.59 Nm/kg × 10^{-1}, 2.21 ± 0.61 Nm/kg × 10^{-1}, and 2.30 ± 0.66 Nm/kg × 10^{-1}, respectively. In the traditional group, the corresponding values were 2.61 ± 0.52 Nm/kg × 10^{-1}, 2.30 ± 0.42 Nm/kg × 10^{-1}, and 2.22 ± 0.51 Nm/kg × 10^{-1}.

Overall, after manipulation treatment, the KAMI of both groups showed a downward trend over time, suggesting that manipulation could reduce KAMI.Within-group comparisons: After the first Tuina session and after four weeks of treatment, KAMI values in both groups decreased compared with those before treatment. In the traditional group, the reduction at four weeks compared with baseline was statistically significant ($P < 0.05$). In the combined group, the reduction after the first Tuina session compared with baseline was statistically significant ($P < 0.05$). However, in the combined group at four weeks, and in the traditional group after the first session, the reductions were not statistically significant ($P > 0.05$). Between-group comparisons: Before treatment, there was no statistically significant difference in KAMI values between the two groups ($P > 0.05$), indicating comparability. After the first Tuina session and after four weeks of treatment, there were still no statistically significant differences in KAMI values between the combined group and the traditional group ($P > 0.05$).

6.3 Clinical Efficacy Evaluation after Tuina in Both Groups

6.3.1 Comparison of clinical efficacy after the first Tuina session

Table 9 Comparison of Clinical Efficacy after the First Tuina Session between the Two Groups (%)

Group	n	Symptom controlled	Markedly effective	Improved	Ineffective	Effective rate (%)	P value
Combination group	37	5	6	20	6	83.78	0.598
Traditional group	36	3	7	19	7	80.56	

After the first Tuina session, in the combined group, 5 cases achieved symptom control, 6 cases were markedly effective, 31 cases effective, and 6 cases ineffective, with a total effective rate of 83.78%. In the traditional group, 3 cases achieved symptom control, 7 cases were markedly effective, 28 cases effective, and 7 cases ineffective, with a total effective rate of 80.56%. Chi-square test analysis showed no statistically significant difference in efficacy between the two groups ($P > 0.05$) (Table 9).

6.3.2 Comparison of clinical efficacy after four weeks of Tuina

Table 10 Comparison of Clinical Efficacy after 4 Weeks of Tuina Treatment between the Two Groups (%)

	n	Symptom controlled	Markedly effective	Improved	Ineffective	Effective rate (%)	P value
Combination group	37	8	14	12	3	91.89	0.634
Traditional group	36	7	14	12	3	91.67	

After four weeks of Tuina, in the combined group, 8 cases achieved symptom control, 14 cases were markedly effective, 34 cases effective, and 6 cases ineffective, with a total effective rate of 91.89%. In the traditional group, 7 cases achieved symptom control, 14 cases were markedly effective, 33 cases effective, and 3 cases ineffective, with a total effective rate of 91.67%. Chi-square test analysis showed no statistically significant difference in efficacy between the two groups ($P > 0.05$) (Table 10).

7 DISCUSSION

Knee osteoarthritis (KOA) is a degenerative disease caused by multiple factors, characterized by fibrosis, fissures, ulcers, and loss of articular cartilage, with joint pain as the main symptom. The primary clinical manifestations are pain and functional limitation[10]. The prevalence of KOA in China is 18%, with 11% in men and 19% in women, predominantly in middle-aged and elderly women. Due to the unique structural characteristics of the knee joint, the varus type of KOA is commonly seen in clinical practice[11]. Therefore, this study selected middle-aged and elderly women as the study population.In stepwise treatment protocols, non-surgical interventions are the main focus of research[12]. Evidence-based medicine has demonstrated that Tuina therapy is effective in the treatment of KOA. A systematic review published in 2021 found that Tuina manipulations were superior to non-steroidal anti-inflammatory drugs in improving knee pain, stiffness, and daily function in KOA patients[13]. This disease is also part of chronic disease management in community health practice, and TCM Tuina accounts for a certain proportion in community treatment of KOA. Therefore, related research on Tuina therapy for KOA has been continuously explored in depth.In traditional Chinese medicine theory, KOA falls under the category of “Bi syndrome” caused by the invasion of pathogenic wind, cold, and dampness, which may further transform into heat. The main symptoms include soreness, numbness, heaviness of the limbs and joints, difficulty in flexion and extension, joint swelling, and burning sensation. The etiology and pathogenesis are related both to external invasion of wind, cold, dampness, or heat pathogens, and to insufficiency of the body’s vital qi. Clinically, Bi syndrome is generally classified into pain Bi, wandering Bi, fixed Bi, and heat Bi.

The knee micro-adjustment manipulation is developed on the basis of the characteristic techniques of Ding’s Tuina school, combined with the concept of joint mobilization from modern medicine. It mainly targets the adjustment of lower-limb mechanical alignment. During treatment, the ankle and knee joints are fixed in relatively normal anatomical positions. The practitioner places both thumbs on the medial and lateral “knee eyes” (the areas at the lower edge of the patella), with the other four fingers encircling the posterior knee, applying internal and external rotational mobilization to the tibia. Meanwhile, the patient is guided to perform active knee extension and standing movements within the physiological range of the knee joint, with the knee kept as straight as possible.In the Shanghai school of Tuina, traditional manipulations such as One-Finger Meditation and Tui Fa are the core methods. The “knee micro-adjustment manipulation” has been proven to produce good immediate effects[14]. In this study, we adopted a KOA treatment strategy that combined micro-adjustment with traditional manipulations under the principle of “treating both muscles and bones,” and compared it with traditional manipulations alone.The efficacy was assessed objectively using gait analysis, which includes motion analysis, force platform analysis, stride analysis, surface electromyography, and energy expenditure. Among these, spatiotemporal parameters and kinematic parameters have been the main focus in previous Tuina efficacy studies for KOA, while kinetic parameters have been rarely investigated. Kinetic parameters are divided into knee and hip joint moments. Knee joint moments include the knee adduction moment (KAM), knee flexion moment (KFM), and knee adduction moment impulse (KAMI). Therefore, in this study, the primary observation indicators were kinetic parameters, while the secondary indicators were the WOMAC index and clinical efficacy.

The results showed:Kinetic parameters: After four weeks of Tuina, KFM increased in both groups compared with baseline ($P < 0.05$). After the first Tuina session, KAMI in the combined group was significantly lower than before treatment ($P < 0.05$).Osteoarthritis scales: After the first Tuina session and at four weeks, WOMAC scores, function scores, and VAS scores all significantly decreased in both groups compared with baseline ($P < 0.05$). After the first session, pain scores decreased significantly more in the combined group compared with the traditional group ($P < 0.05$). After four weeks, stiffness scores in the combined group were also significantly reduced compared with baseline ($P < 0.05$).Clinical efficacy: The effective rates in the combined group after the first session and after four weeks were 83.78% and 91.89%, respectively; in the traditional group, they were 80.56% and 91.67%, respectively.

These findings suggest that both the combined therapy and traditional manipulations are effective for KOA. However, the micro-adjustment manipulation showed superior immediate analgesic effects, and the combined therapy was superior in improving stiffness after one course of treatment. Moreover, the significant reduction of KAMI after the first micro-adjustment treatment may indicate a decrease in knee joint loading.

We believe that Tuina may treat KOA primarily by reducing pain and improving joint function. Pain relief may result from promoting blood circulation, thereby lowering the concentration of local algogenic substances such as prostaglandin II, and alleviating aseptic inflammation. Functional improvement is mainly achieved by enhancing knee flexion‑extension, tibial internal‑external rotation, and restoring quadriceps muscle strength and tone.According to the TCM theory of “tendons and bones,” malalignment of the tibiofemoral and patellofemoral joints is considered a “bone displacement,” while dysfunction in the coordinated activity of the quadriceps femoris and tibialis anterior is regarded as “tendon displacement.” The knee micro-adjustment manipulation, through a combination of active and passive patient movements, allows the practitioner to adjust the tibiofemoral joint space, thereby altering lower-limb mechanical alignment and intra-articular dynamic loading of the knee joint. At the same time, incorporating the modern

rehabilitation concept of joint mobilization, this manipulation may release adhesions in periarticular soft tissues, reduce local muscle tension, and improve joint function.In summary, the therapeutic mechanism of combining micro-adjustment with traditional manipulations (One-Finger Meditation and Tui Fa) for KOA may lie in the following: micro-adjustment improves tibial platform rotational function and sagittal sliding function of the patellofemoral and tibiofemoral joints, while traditional manipulations restore coordination and balance of the corresponding lower-limb muscle groups. Together, these effects produce analgesia and relieve stiffness, thereby treating KOA. Although this approach merely involves a modification that integrates active and passive motion, it optimizes Tuina treatment outcomes for varus-type KOA and represents a breakthrough in Tuina clinical practice. Moreover, Tuina therapy has the advantages of minimal side effects and low medical costs, not only reducing the adverse effects of pharmacological treatment and overall treatment expenses for patients but also lessening the burden on health insurance systems.

However, this clinical study did not classify the gait parameters of varus knee osteoarthritis, such as walking speed, stride length, and swing phase. Future studies could incorporate subgroup analyses based on different gait parameters to more objectively observe changes in kinetic parameters before and after Tuina treatment.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

REFERENCES

[1] Zeng QY, Huang SB, Xiao ZY, et al. Clinical and epidemiological study of symptomatic osteoarthritis. Chinese Journal of Internal Medicine, 1995, 34(2): 88–90.

[2] Fu YY, Gong L, Shao S, et al. Progress in tuina manipulation therapy for knee osteoarthritis. Massage and Rehabilitation Medicine, 2017, 8(14): 36–37.

[3] Li YH, Chen YF, Qin WK, et al. Anatomical essence of “tendon” in traditional Chinese medicine. Shaanxi Journal of Traditional Chinese Medicine, 2019, 40(3): 374–377.

[4] Liang HG, Jiang SY, Li JH, et al. Efficacy and gait analysis of the sitting knee-adjusting manipulation for knee osteoarthritis. Beijing Journal of Traditional Chinese Medicine, 2018, 37(2): 135–138.

[5] Xie ZQ, Cui LM, Wang YS, et al. Anatomical analysis of lesion points in “Jiejin disease”. Global Traditional Chinese Medicine, 2019, 12(10): 1569–1570.

[6] Liang HG, Jiang SY, Li JH, et al. Efficacy and gait analysis of the sitting knee-adjusting manipulation for knee osteoarthritis. Beijing Journal of Traditional Chinese Medicine, 2018, 37(2): 135–138.

[7] Chinese Orthopaedic Association (COA) Joint Surgery Group, Chinese Medical Doctor Association Orthopaedic Branch Osteoarthritis Group, National Clinical Research Center for Geriatric Diseases (Xiangya Hospital), et al. Chinese guideline for the diagnosis and treatment of osteoarthritis (2021 edition). Chinese Journal of Orthopaedics, 2021, 41(18): 1291–1314.

[8] Wang B, Yu NS. Expert consensus on the stepwise treatment of knee osteoarthritis (2018 edition). Chinese Journal of Joint Surgery (Electronic Edition), 2019, 13(1): 124–130.

[9] Kang ZR, Gong L, Xing H, et al. Preliminary exploration on the concept and principle of the sitting knee-adjusting manipulation for knee osteoarthritis. Journal of Shanghai University of Traditional Chinese Medicine, 2020, 34(4): 98–102.

[10] Gu F. Professor Cao Renfa’s Manipulative Techniques and Clinical Experience. Shanghai: Shanghai Scientific and Technical Literature Publishing House, 2016.

[11] Chinese Orthopaedic Association (COA) Joint Surgery Group, et al. Chinese guideline for the diagnosis and treatment of osteoarthritis (2021 edition). Chinese Journal of Orthopaedics, 2021, 41(18): 1291–1314.

[12] Wang B, Xing D, Dong SJ, et al. Consensus on the epidemiology and disease burden of knee osteoarthritis in China (2018 edition). Chinese Journal of Joint Surgery (Electronic Edition), 2019, 13(1): 124–130.

[13] Hua X, Sun JY, Li G, et al. Therapeutic massage for knee osteoarthritis: a systematic review and meta-analysis of randomized controlled trials. Journal of Acupuncture and Tuina Science, 2021, 19(5): 354–363.

[14] Xie ZQ, Cui LM, Wang YS, et al. Anatomical analysis of lesion points in “Jiejin disease”. Global Traditional Chinese Medicine, 2019, 12(10): 1569–1570.