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**Clinical Study**

# Clinical observation of tendon-regulating manipulation plus core stability training for non-specific low back pain

## 理筋手法联合核心稳定训练治疗非特异性下背痛临床观察

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**Abstract**
**Objective:** To evaluate the clinical efficacy of tendon-regulating manipulation plus kinesiotherapy in treating low back pain.
**Methods:** Sixty patients were randomized into a treatment group and a control group by using the random number table, 30 cases in each group. The treatment group was intervened by tendon-regulating manipulation plus kinesiotherapy, while the control group was by the tendon-regulating manipulation alone. The lumbar lordosis was measured by X-ray (side view), the pain was evaluated by analgesy meter, the lumbar range of motion was by using goniometer, and the function was judged by Oswestry disability index (ODI) before and after treatment, and the therapeutic efficacy was also observed.
**Results:** After treatment, the pain level was significantly reduced, lumbar lordosis was significantly increased, the lumbar range of motion was markedly improved, and the ODI score significantly dropped (all $P<0.05$) in both groups; the improvement of each item in the treatment group was more significant than that in the control group (all $P<0.05$). The total effective rate was 90.0% in the treatment group versus 63.3% in the control group, and the difference was statistically significant ($P<0.05$).
**Conclusion:** In the treatment of low back pain, tendon-regulating manipulation plus kinesiotherapy can mitigate topical pain, improve the motion of low back, enhance the quality of life, and produce a more significant therapeutic efficacy compared to tendon-regulating manipulation alone.
**Keywords:** Tuina; Massage; Exercise Therapy; Low Back Pain; Pain Measurement
**【摘要】目的：**评价理筋手法联合运动疗法治疗下背痛的临床疗效。**方法：**将 60 例患者根据随机数字表随机分为治疗组和对照组，每组 30 例。治疗组予理筋手法联合运动疗法治疗，对照组予以与治疗组相同的理筋手法治疗。两组分别于治疗前后测量患者的侧位 X 线片腰椎前凸角度，同时采用压痛仪评估两组患者疼痛程度，量角器法测定患者的腰椎活动度，并通过 Oswestry 功能障碍指数问卷(Oswestry disability index, ODI)对患者功能变化进行评估，并进行疗效观察。**结果：**治疗后，与本组治疗前相比，两组患者的疼痛程度减轻，腰椎前凸角度增加，腰椎活动度增加，ODI 评分下降(均 $P<0.05$)；且治疗组各项目的改善情况均优于对照组，组间差异均有统计学意义(均 $P<0.05$)。治疗组总有效率为 90.0%，对照组为 63.3%，两组总有效率差异有统计学意义($P<0.05$)。**结论：**理筋手法联合运动疗法治疗下背痛可缓解患者局部疼痛，改善患者腰椎活动功能，提高患者生活质量，其疗效优于单纯理筋手法治疗。
**【关键词】**推拿；按摩；运动疗法；腰痛；疼痛评定
**【中图分类号】**R244.1　　**【文献标志码】**A

As a commonly encountered medical problem, non-specific low back pain (NLBP) is a general term for a type of low back pain manifested by pain or discomfort in lumbar, sacral and buttock regions, with or without complaint of lower limbs, while in absence of imaging support[1]. It's believed that NLBP is caused by multiple factors, including acute or chronic injuries of soft tissues in low back, and the degeneration of facet joints. So far, there are many treatments for this problem. Thus it's worthwhile to discuss about how to choose a method of stable efficacy. Over the recent years, numerous studies have discovered a close relationship between the development of low back pain and the instability of spine[2-4]. Hence, it's of important guiding significance to treat low back pain from the aspect of spine stability[5].

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This study observed the clinical efficacy of tendon-regulating manipulation plus core stability training in treating 30 cases of NLBP. The report is given as follows.

## 1 Clinical Materials

### 1.1 Diagnostic criteria

Pain between the 12th rib and the inferior gluteal folds, with or without leg pain, with limited range of motion (ROM) of low back and obvious tender points; X-ray examination unveils lumbar spine with straight physiological curvature, narrowing of facet joint space, detached or asymmetry facet joint; without obvious abnormal findings from the physical examination.

### 1.2 Inclusion criteria

Conforming to the above diagnostic criteria; having signed the informed consent form and able to follow the instructions in the study.

### 1.3 Exclusion criteria

The initial attack of low back pain occurred in the age ＜20 or ＞55 years; a clear history of trauma, or osteoporosis plausibly complicated with mild trauma; with chest pain; unexplainable weight loss; numbness in saddle area, or discharge dysfunction; with progressive muscular dystrophy; positive neurological signs, such as straight leg raising test.

### 1.4 Statistical methods

The SPSS 17.0 statistical software was used for data analyses. After normal distribution analysis, the measurement data with normal distribution were expressed as mean ± standard deviation ( $\bar{x} \pm s$), and the intra-group and inter-group comparisons were examined by *t*-test or *F* test; otherwise, the data were examined by nonparametric test. The inter-group comparison of numeration data were performed by Chi-square test, and the standard was determined as $\alpha=0.05$.

### 1.5 General data

The 60 subjects diagnosed with NLBP were all enrolled from the Trauma Outpatient Department of the First Affiliated Hospital of Anhui University of Chinese Medicine from May 2010 to December 2013. They were randomized into a treatment group and a control group by using the random number table, 30 cases in each group. In the treatment group, the subjects were aged 22-54 years old and their disease duration ranged between 1-8 months. In the control group, the subjects were aged 24-55 years old, and their disease duration ranged between 1-9 months. There were no significant differences in comparing the general data between the two groups (all $P>0.05$), indicating the comparability.

**Table 1. Comparison of the general data before treatment**

| Group | *n* | Gender (case) | | Mean age ( $\bar{x} \pm s$, year) | Mean duration ( $\bar{x} \pm s$, month) |
|---|---|---|---|---|---|
| | | Male | Female | | |
| Treatment | 30 | 21 | 9 | 35.1±8.4 | 4.1±1.8 |
| Control | 30 | 19 | 11 | 36.1±7.7 | 4.4±1.9 |
| Statistical value | | 0.300[1)] | | 0.195 | 0.129 |
| *P*-value | | 0.584 | | 0.609 | 0.541 |

Note: $x^2$value; 2) *F* value

## 2 Methods

### 2.1 Treatment group

2.1.1 Tendon-regulating manipulation

The patient took a prone posture. Gun-rolling manipulation was first applied to the bilateral Bladder Meridian by lumbar spine for 5 min (Figure 1); An-pressed and Rou-kneaded the bilateral erector spinae and tender points in the same area for 5 min (Figure 2); the muscle insertion points such as the transverse processes of lumbar vertebrae, superior margin of the iliac crest, and lumbar triangle were then relaxed. The Gun-rolling and Rou-kneading manipulations were performed along the Bladder Meridian, targeting the gluteal muscles and posterior muscles of the calf, as well as nodules (Figure 3); Ashi points, Yaoyangguan (GV 3), Shenshu (BL 23), Dachangshu (BL 25), Weizhong (BL 40), and Chengshan (BL 57) were stimulated by digital An-pressing manipulation (Figure 4); finally, the lumbosacral region and Bladder Meridian were treated with palm Ca-rubbing manipulation (Figure 5), till the heat penetrated inside.

The above treatment was given once every other day, 7 sessions as a treatment course, for totally 2 courses.

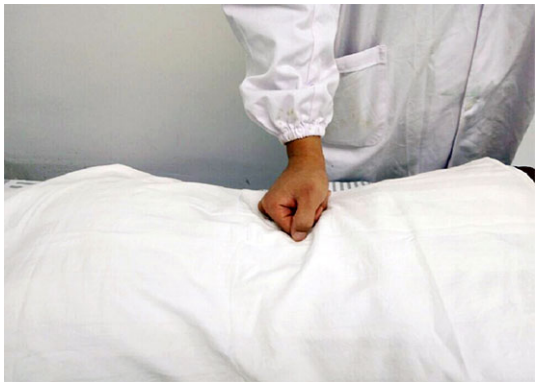

**Figure 1. Gun-rolling manipulation**

 

**Figure 2. Palm Rou-kneading manipulation**

**Figure 3. Tanbo-plucking manipulation**

**Figure 4. Digital An-pressing manipulation**

**Figure 5. Palm Ca-rubbing manipulation**

2.1.2 Core stability training

Reverse plank: Patient took a supine posture, bent the knees, meanwhile straitening the back and lifting the bottom above the bed by 5-10 cm, 10 s each time, 10 times as a group (Figure 6).

Flying swallow movement: The patient took a prone posture with the hands behind the back, lifting the four limbs and chest above the bed, 10 s each time, 10 times as a group (Figure 7).

Side plank: With the ipsilateral forearm and foot as the support, the patient should keep the whole body straight, 10 s each time, and 10 times as a group (Figure 8).

Plank: With the feet separated to shoulder's width, the patient should keep the body in a straight line, taking toes and forearms as the support, holding the abdominal muscles, 10 s each time, 10 times as a group. Pay attention, don't hold the breath (Figure 9).

Unilateral plank: While looking straight ahead, the patient stretched an arm of one side and a leg of the other side horizontally, with the contralateral hand and knee as the support, 10 s each time, and 10 times as a group (Figure 10).

The above 5 movements were practiced by 2-3 groups a day. Slight sweating and in absence of fatigue sensation in the next day would be appropriate.

**Figure 6. Reverse plank**

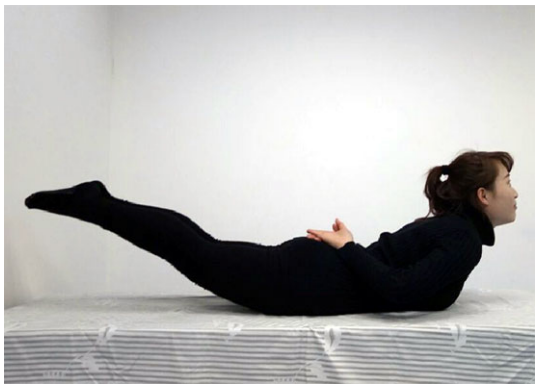

**Figure 7. Flying swallow movement**

**Figure 8. Side plank**

**Figure 9. Plank**

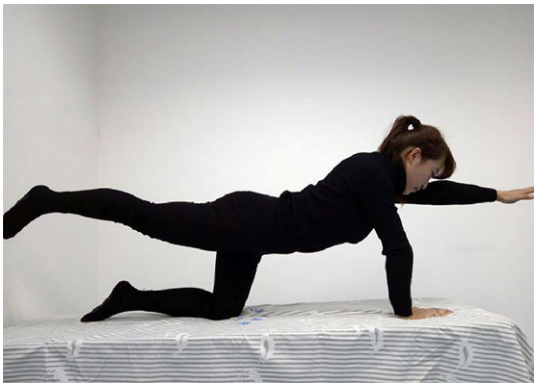

**Figure 10. Unilateral plank**

### 2.2 Control group

Patients in the control group only received the same tendon-regulating manipulation, with the same treated areas, operations, and treatment course.

## 3 Results

### 3.1 Observation parameters of therapeutic efficacy

3.1.1 Tender points

The pressing pain values of the most significant tender points were measured by using Wagner Force Ten™-Model FDX (Wagner Instruments, USA & Canada).

3.1.2 Lumbar lordosis

The lumbar lordotic curve was calculated according to the X-ray imaging of lumbar vertebrae (side view), and the value was recorded by computer.

3.1.3 Range of motion of lumbar vertebrae

The flexion, extension, and side flexion were all measured by goniometer. In a standing position, with the $L_5$ spinous process as the axis, the vertical line as the stationary arm, and the line between $C_7$ and $L_5$ spinous process as the moving arm, the ranges of motion of lumbar spine, including fexion, extension, left flextion, and right flexion were measured.

3.1.4 Symptoms scores

By referring to the Oswestry disability index (ODI), the relevant symptoms including pain (pain intensity and influence of pain on sleep), single functions (lifting, ability to walk, ability to sit, and ability to stand) and comprehensive functions (activities of daily living, sexual function, social life, and ability to traval), totally 10 items, were scored before and after treatment[6]. Each item was divided into 6 degrees, respectively scored 0-5: 0 for no pain or normal function, and 5 for extreme pain or the severest dysfunction. The percentage of the total score of the 10 items in the highest score (50 points) would be calculated afterwards, the higher the percentage, the severer the dysfunction.

### 3.2 Criteria of the therapeutic efficacy

The criteria of the therapeutic efficacy adopted in this study were made by referring the *Criteria of Diagnosis and Therapeutic Effects of Diseases and Syndromes in Traditional Chinese Medicine*[7].

Recovery: The pain in low back and leg was gone; able to squat, stand up, bow, and walk normally.

Improved: The pain in low back and leg was substantially gone; lumbar function was basically improved, while pain still occurred after fatigue.

Invalid: No improvement in the symptoms and body signs.

### 3.3 Results

3.3.1 Comparison of the pressing pain intensity and lumbar lordotic curve

Prior to the treatment, there were no significant differences in comparing the scores between the two groups ($P>0.05$). The pressing pain intensities and lumbar lordotic curves were significantly improved in both groups after treatment ($P<0.05$), and there were also significant inter-group differences ($P<0.05$), (Table 2).

3.3.2 Comparison of the ROM of lumbar spine

After treatment, the ROM of lumbar spine was significantly improved in both groups ($P<0.05$); the ranges of flexion, extension, and side flexion in the treatment group were significantly better than that in the control group ($P<0.05$), (Table 3).

 

**Table 2. Comparison of the pain degree and lumbar lordosis**

| Group | *n* | Pressing pain value ( $\bar{x}$ ±*s*, kg) | | Lumbar lordosis ( $\bar{x}$ ±*s*, °) | |
|---|---|---|---|---|---|
| | | Pre-treatment | Post-treatment | Pre-treatment | Post-treatment |
| Treatment | 30 | 3.89±0.78 | 4.57±0.82[1)2)] | 30.07±5.44 | 32.77±4.69[1)] |
| Control | 30 | 4.10±0.87 | 5.11±0.87[1)] | 29.47±5.23 | 36.63±5.62[1)] |

Note: Intra-group comparison, 1) $P<0.05$; compared with the control group after treatment, $P<0.05$

**Table 3. Comparison of lumbar motion of range before and after treatment ( $\bar{x}$ ±*s*, °)**

| Group | *n* | Time | Forward flexion | Forward stretch | Left flexion | Right flexion |
|---|---|---|---|---|---|---|
| Treatment | 30 | Pre-treatment | 51.53±10.99 | 14.63±3.42 | 17.43±4.05 | 18.23±3.18 |
| | | Post-treatment | 63.53±11.13[1)2)] | 21.07±2.45[1)2)] | 24.53±4.18[1)2)] | 25.17±3.57[1)2)] |
| Control | 30 | Pre-treatment | 47.20±9.15 | 15.03±3.25 | 18.47±3.22 | 17.57±2.96 |
| | | Post-treatment | 57.50±9.83[1)] | 19.67±2.83[1)] | 22.40±3.30[1)] | 23.47±1.87[1)] |

Note: Intra-group comparison, 1) $P<0.05$; compared with the control group, 2) $P<0.05$

### 3.3.3 Comparison of ODI score

The ODI scores significantly dropped in both groups after treatment, and the inter-group difference was also statistically significant ($P < 0.05$). It indicates that tendon-regulating manipulation plus exercises can significantly improve the lumbar function (Table 4).

**Table 4. Comparison of ODI score ( $\bar{x}$ ±*s*, %)**

| Group | *n* | Pre-treatment | Post-treatment |
|---|---|---|---|
| Treatment | 30 | 43.87±8.22 | 25.73±4.92[1)2)] |
| Control | 30 | 48.00±9.64 | 30.07±7.47[1)] |

Note: Intra-group comparison, 1) $P<0.05$; compared with the control group after treatment, 2) $P<0.05$

### 3.3.4 Comparison of the therapeutic efficacy

After treatment, the total effective rate was 90.0% in the treatment group versus 63.3% in the control group, and the rate of the treatment group was significantly higher than that of the control group ($P < 0.05$), (Table 5).

**Table 5. Comparison of therapeutic efficacy (case)**

| Group | *n* | Recovery | Improved | Invalid | Total effective rate (%) |
|---|---|---|---|---|---|
| Treatment | 30 | 10 | 17 | 3 | 90.0[1)] |
| Control | 30 | 6 | 13 | 11 | 63.3 |

Note: Compared with the control group, $P<0.05$

## 4 Discussion

Spine, especially the lumbar spine, bears heavy loads, while the back muscles protect the stability of the lumbar spine through contraction. Under increased load and repeated postures, the inertial load that lumbar spine bears rises, and the antagonistic muscles produce tensions of different directions because of the over-tense or over-loose muscles, subsequently causing imbalance in lumbar muscles and risk of low back pain. Numerous studies have found the close relationship between the imbalance of lumbar muscles and low back pain[8-9].

The core muscle group around spine can be divided into two categories: general motor muscles and topical stabilizer muscles. Located superficially, the motor muscles, including erector spinae and rectus abdominis, own a comparatively longer force arm and enable the body to move. Low back pain is often manifested by symptoms due to superficial myofasical injuries, such as muscle spasm, strains, myofascial inflammation, and shortening of muscles and fascia. In this case, patients will feel heaviness, stiffness, and pain in the back[10]. Located deeply in the trunk, local stabilizer muscles, majorly including multifidus and transversus abdominis, usually distribute inside single joint or vertebra, working to control the movement of the vertebra and maintain the stability of lumbar spine. The weakening and dysfunction of local stabilizer muscles are the main factors leading to lumbar instability and the above symptoms. Modern research has found that the pathogenesis of low back pain is much related to the function state of lumbar multifidus and transversus abdominis which are in charge of the lumbar stability[11-12].

Low back pain belongs to the range of tendon damages or Bi-impediment syndrome, along the running course of the Bladder Meridian of Foot Taiyang. The treatment for low back pain should be focused on relaxing muscle origins and insertions, the relevant fascia, adjacent muscles, and nodules. Meanwhile, whether there is anatomical displacement should also be taken into consideration[13-14]. According to the above pathogenesis of low back pain, this study

adopted tendon-regulating manipulations to regulate the tendons, fascia, and muscles, for relaxing the back muscles and restore the balance, and finally releasing pain and improving the function of low back. The core stability exercises adopted in this study are based upon the Guidelines for Low Back Pain stipulated by the European Union in 2004 targeting the NLBP patients[15]. The exercises can recover the control ability of the stabilizer muscles, improve the co-contraction of the stabilizer and motor muscles, enlarge the ROM of lumbar spine, and release pain. The reverse plank and flying swallow movement extend the lumbar spine and make the intervertebral joints to move in a totally opposite direction compared to that in the daily life, avoiding stretching strains to the back extensors and lumbar ligaments; the plank, unilateral plank, and side plank can increase the intra-abdominal pressure and the stability of lumbar spine through the contraction of transversus abdominis. Besides, through isometric contraction and closed kinetic chain, these movements also stimulate the motoceptors to activate and summon the stabilizer muscles to inhibit the compensatory mechanism of the general motor muscles, and finally enhance the control and coordination abilities of central nervous system over the core of the body[16-17]. After treatment, the ROM of lumbar spine and ODI scores of the two groups improve significantly, and the results of the treatment group were significantly better than that of the control group ($P<0.05$).

This study shows that tendon-regulating manipulation plus exercises can increase the strength of the core muscles, reduce or eliminate the stimulation from pathological factors, restore the normal anatomical structures. But, we still expect more evidences to prove the clinical efficacy of this treatment method because of the small sample size and short follow-up duration in this study, though this method is easy-to-operate for the patients.

**Conflict of Interest**

There was no conflict of interest in this article.

**Statement of Informed Consent**

Informed consent was obtained from all individual participants included in this study.

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