

LETTER TO THE EDITOR

Application of Isokinetic Testing and Surface Electromyography Based on Environmental Science in the Clinical Research of Tuina in Treating Lumbar Disk Hernia in Ping-Pong Player

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Method: A total of 200 ping-pong players definitely diagnosed as lumbar disk hernia were enrolled. All patients were randomized into research group and control group. Of those, 100 patients of the control group were subjected to traction therapy while the other 100 of the research group underwent Tuina treatment. US Biodex System III Multi-joint Isokinetic Speed Test System and TeleMyo2400T Surface EMG were applied to detect the biomechanical characteristics of lumbar extensor before and after therapy, thus comparing the therapeutic efficacy between both groups. Results: Results showed that the total therapeutic efficacy of the research group (96.00%) was significantly higher than that of the control group (81.00%) ($P < 0.05$). And the peak torque of the patients in research group was markedly superior than that of the control group ($P < 0.05$). Conclusion: Application of Tuina therapy on the patients with lumbar disk hernia could yield significant results.

I Introduction

Lumbar disc hernia has the highest incidence in lumbar 4-5 and lumbar 5-sacrum 1, accounting for more than 90% of the total incidence (Guo 2017). Because of the special career of ping-pong players, the corresponding regulations of technical movement during exercise or competition, and the rather high training intensity, there are numerous movements that can easily lead to lumbar disc hernia. Also, ping-pong players are at high-risk of lumbar disc hernia. Applying Tuina treatment to patients with lumbar disc hernia can directly affect the soft tissue in the lower back area and positively improve local neuromuscular function, exerting remarkable effects (Wroblewska 2015). In this study, the effects of isokinetic testing and surface electromyography on the clinical study of lumbar disc hernia in table tennis athletes were observed and analyzed. The contents of the report are as follows.

II Perspective

A total of 200 ping-pong players definitely diagnosed as lumbar disk hernia and treated at our hospital from June 2015 to August 2018 were enrolled. All patients met the diagnostic criteria. All patients were randomized into

research group and control group. Of those, there were 60 male patients and 40 female patients in the research group, with an average age of (26.9 ± 3.1) years, ranging from 20 to 34. And the average course of the research group was (43.8 ± 0.9) days. Moreover, there were 68 male patients and 32 female patients in the control group, with an average age (28.4 ± 3.6) years, ranging from 22 to 32. And the average course of the research group was (45.2 ± 1.1) days. Data obtained from both groups was comparable ($P > 0.05$).

The patients in the control group were subjected to routine traction therapy. The TF-5 computer traction bed (developed and produced by Shanghai Jiaotong University) was employed, with the first traction weight of 26%-36% of the patient's body weight. And the weight was gradually increased by 3 kg to 40%-50% of the patient's weight. The patient was placed at supine position, with an intermittent traction for 60 s. The duration of each treatment was half an hour, with an interval of one day, for 8 consecutive times.

The patients of the research group underwent Tuina treatment. That is: The patient was maintained at a comfortable and correct prone position, and each acupuncture point was rubbed, namely the Qi Haishu, Dachangshu, Weizhong and Huantiao, Chengshan, Shenshu, Ganshu, Zusanli, Ashi, etc. Each acupuncture point was rubbed for 30 s. After that, the rolling method was used on both sides of erector spinae, multifidus muscle and the affected lower limb, with a time of 5 minutes. Then the plucking method was applied to both sides of erector spinae and multifidus muscle, with a time of 3 minutes. In addition, 3 minutes of lumbar vertebrae modified oblique-pulling treatment was performed, and both sides of the bladder meridian and lumbosacral position were rubbed until it was warm, with a duration of 1 minute (Gu and Fang 2010). The patients were treated once a day with the above plan. When five consecutive treatments are recognized as a course, a total of two courses of treatment were performed.

Before and after treatment, the surface electromyography of bilateral lumbar paraspinal muscles (lumbar erector spinae and multifidus muscles) was performed under isokinetic testing. First, the maximum torsion force during muscle movement at peak torque (PT) was measured under isokinetic testing, reflecting the muscle strength status. Secondly, the medium frequency (MF) of the surface electromyogram and the myoelectric signal of the muscle contraction frequency were measured to reflect the fatigue degree of muscle. At the same time, the Ag/AgCl surface electrode was used to record the sEMG signal (Wei 2014). The data acquisition frequency of the EMG signal is 1500 Hz. The original data is stored in the electronic computer via the wireless receiver, and the corresponding analysis processing is carried out by the signal processing software My Research (Noraxon, USA). The total therapeutic efficacy and the peak torque before and after treatment were observed and compared between both groups. Meanwhile, the electromyography status before and after treatment were recorded.

Statistical analysis was performed using SPSS21.0. All quantitative data were expressed in the form of mean \pm standard variance ($\bar{x} \pm s$), and comparisons were made with t-test. Enumeration data were expressed in the form of natural number (n) + percentage (%), and comparisons were made with chi-square test. $P < 0.05$ represents the intergroup difference was of statistically significance.

III Personal View

As shown in Table 1, the total efficacy of clinical treatment of the research group was significantly higher than that of the control group ($P < 0.05$). The images of a case after treatment was shown in Figure 1.

Table 1. Comparison of the total therapeutic efficacy between both groups [n (%)]

Groups	Cases	Excellent	Valid	Invalid	Total efficacy
Research group	100	81	15	4	96 (96.00)

Control group	100	52	29	19	81 (81.00)
X²					8.52
p					< 0.05



Fig 1. The images of a case after treatment

As shown in Table 2, there was no significant difference in the peak torque between both groups ($P > 0.05$). After treatment, the peak torque of the patients in research group was markedly superior than that of the control group ($P < 0.05$).

Table 2. Comparison of the peak torque before and after treatment between both groups ($\bar{x} \pm s$)

Groups	Cases	Before treatment	After treatment
Research group	100	53.20±12.19	115.66±20.30
Control group	100	48.05±12.68	70.89±21.50
t		0.23	15.63
p		> 0.05	< 0.05

The electromyogram (median frequency of the affected side) before and after treatment of both groups was as shown in Table 3 and Figure 2. Results showed that the median frequency (MF) of the affected multifidus muscle of the research group was significantly improved after Tuina therapy ($P < 0.05$). Meanwhile, there was difference in the median frequency (MF) of the affected multifidus muscle between both groups ($P < 0.05$).

Table 3. Comparison of the electromyography(the median frequency of the affected side) before and after treatment between both groups ($\bar{x} \pm s$)

Indicators	Research group (n=100)	Control group (n=100)
Erector spinae before treatment	24.89±3.29	33.20±15.28
Erector spinae after treatment	28.94±3.56	24.82±11.29
Multifidus muscle before treatment	28.96±5.01	37.94±12.30
Multifidus muscle after treatment	71.22±24.50	23.58±19.06

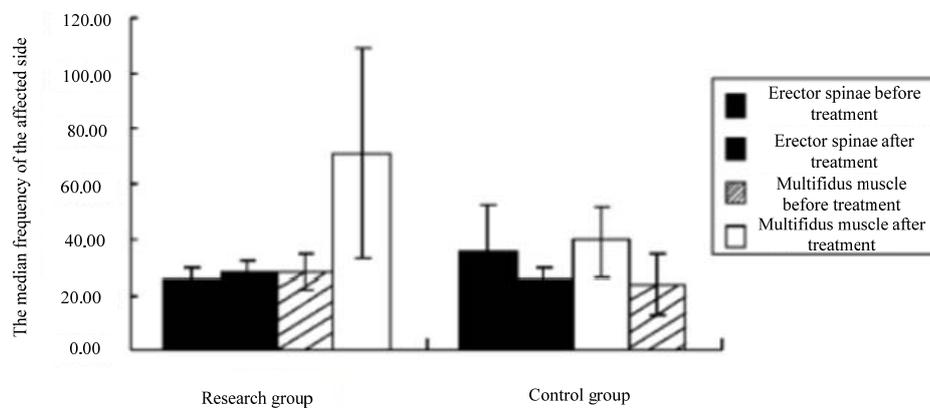


Fig 2. Comparison of the electromyography (the median frequency of the affected side) before and after treatment between both groups

The imbalance of the biomechanical structure of lumbar spine serves as an important factor leading to lumbar disc hernia. The stability of lumbar vertebra depends on the structure of the spine itself and the muscle tissue associated with it. The motion stability of lumbar spine rests upon the strength of lumbar flexor and extensor. Surface electromyography (sEMG) is a quantitative method used during the evaluation of neuromuscular function status, which enables a good observation of the improvement of the neuromuscular function of the affected side before and after treatment (Fu et al. 2017). By attaching the electrode onto the surface of the muscle and skin, the myoelectric activity of the whole muscle could be obtained. It is capable of detecting changes in cell excitability caused by changes in potentials inside and outside the cell, and thus can evaluate muscle function (Attari 2016). Meanwhile, it is an ideal biofeedback treatment technique for sustained static and dynamic observation of changes in muscle activity. It has the advantages of real-time, intuitive and accurate positioning, etc., which is a mature dynamic inspection technology (Tao et al. 2017).

In the perspective of Chinese medicine, lumbar disc hernia falls into the category of “lumbago-leg pain”. Applying Tuina treatment to patients with lumbar disc hernia can directly affect the soft tissue in the lower back area and positively improve local neuromuscular function, exerting remarkable effects. Tuina therapy plays a role in specific parts of the human body, thus producing positive effects and realize the goals of dredging meridians, promoting qi and activating blood circulation, lubricating joints, and relieving muscle strain. The results of this study showed that Tuina treatment can produce ideal results in patients, which was consistent with the relevant researches (Oforikwakye 2016).

IV Conclusion

In summary, application of Tuina treatment on patients with lumbar disc hernia can achieve significant results, positively improve the contraction of lumbar extensors in patients with lumbar spinal nerve pain, alleviate the muscle fatigue of the waist, and effectively promote recovery of the biomechanical properties of lumbar extensors. With the use of isokinetic testing and surface electromyogram, we can observe the lumbar muscle tissue before and after treatment. And it was found that correction of the muscle imbalance on both sides of the lower back plays an important role in improving the treatment of lumbar disc herniation. Therefore, during the treatment of lumbar spondylosis, doctors should pay attention to the “anatomical reduction” of the lumbar spine on the one hand, as

well as focus on the key role of the Tuina method in the onset and treatment of lumbar spondylosis. In addition, this study has certain limitations. For example, due to the limited course of Tuina therapy, substantial improvement in soft tissue is not easily obtained in a short period of time, thus it may require longer time for the therapy to work. Therefore, long-term observational studies are required in the future to fully support our results.

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