

LETTER TO THE EDITOR

Accurate Assessment of Gymnast with Incomplete Spinal Cord Injury with Surface Electromyography and Isokinetic Testing from the Perspective of Ecological Environment

Xin Wang¹, Yebing Zou^{2*}

¹School of Physical Education and Education Science, Nanchang University, Nanchang 330031, China

²Physical Education Department, Jiangxi University of Traditional Chinese Medicine, Nanchang 330004, China

Email of corresponding author: xin5203344@163.com

To accurately assess the gymnast suffered from in complete lumbar spinal cord injury with surface electromyography and isokinetic testing. A total of 200 gymnasts suffered from incomplete lumbar spinal cord injury and treated at our hospital were enrolled. These patients were divided into control group that subjected to routine rehabilitation training and research group that underwent routine rehabilitation training and isokinetic testing. The therapeutic efficacy (manual muscle test (MMT) of the knee muscles, isokinetic testing, surface electromyography test) of both groups were observed and compared. After 12 weeks of treatment, the hamstring peak torque/body weight, quadricepspeak torque/body weight, biceps femoris in tegratedelectromyography (IEMG), rectus femoris IEMG and quadriceps endurance of both groups were significantly improved compared with those before therapy ($P < 0.05$). Also, the improvement of the research group was markedly better than that of the control group ($P < 0.05$). Moreover, there was significant decrease in the mean power frequency (MPF) of biceps femoris and rectus femoris in research group, as compared with that of the control group ($P < 0.05$). Application of surface electromyography and isokinetic testing in the assessment of lower extremities muscle strength and endurance in patients with incomplete lumbar spinal cord injury could produce more accurate results.

I Introduction

Pengtao Ma, published articles “The Way and Environment of Physical Training of Canadian Athletes and Inspiration” on Issue: 107, Pages: 4249-4256, Article No: e107474, year: 2019, the main content is we are often and times met with the popular ideas on the education and development of good athletes which have concluded that athletic excellence as primarily the result of innate abilities or extensive practice and experience. In this paper, We are often and times met with the popular ideas on the education and development of good athletes which have concluded that athletic excellence as primarily the result of innate abilities or extensive practice and experience. In this paper, we describe a framework for understanding how biases in athlete development emerge between advantaged and disadvantaged youth. And what this article discusses is to accurately assess the gymnast suffered from in complete lumbar spinal cord injury with surface electromyography and isokinetic testing from the Perspective of Ecological Environment.

With the development of global economic, the incidence of spinal cord injury has gain ascendancy. Spinal

cord injury is the most serious complication of spinal injury, which often leads to severe body dysfunction below the injured segment. It not only causes serious physical and psychological damage to the patient, but also imposes a huge economic burden on the whole society. Therefore, the prevention, treatment and rehabilitation of spinal cord injury have become a major topic in the medical field today (Attari 2016).

II Perspective

A total of 200 gymnasts definitely diagnosed as trauma spinal cord injury and treated at our hospital from June 2015 to August 2018 were enrolled. All patients met the following inclusion criteria: satisfy the Grade C-D injury according to the 2006 American Spinal Injury Association (ASIA) Classification of Spinal Cord Injury; pre-treatment or surgery was performed in clinical department; suffering from lower limbs dysfunction; the injured level was L1-3; with stable vitals.

All patients enjoyed the right to know, and formal consent forms were obtained. This study was approved by the ethic committee of our hospital. The patients were randomized into research group and control group, with 100 patients in each 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 of (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 ($P > 0.05$).

Routine rehabilitation training methods including lower limb manual muscle strength training and stretching exercise were applied on patients of both groups. On this basis, isokinetic strength training was applied on the patients of research group. First, the routine rehabilitation program is: apply progressive resistance training according to the Delorme method on the muscles with strength level above grade 3, half-hour each time, once a day and 5 times a week. All treatment was performed by two senior therapists, who were trained before the beginning of the project, in order to ensure uniformity. Second, the isokinetic training program was conducted: IsoMed2000 isokinetic training test system was adopted. The patient was told to bend their knees that bend coxa to 90° and sit on the isokinetic training chair. Then their body and training limb were fixed by belts. Finally, the muscle strength training and muscle endurance training were performed (Wroblewska 2015).

Statistical analysis was performed using SPSS21.0. All quantitative data were expressed in the form of mean ± 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

Comparison of the peak torque/body weight (PT/BW) and IEMG of both groups before and after treatment.

As shown in Table 1, compared with the control group, the improvement of peak torque/body weight and IEMG was significantly better in the research group ($P < 0.05$). The image of a patient after therapy was shown in Figure 1.

Table 1. Comparison of the PT/BW and IEMG of both groups before and after treatment ($\bar{x} \pm s$)

Group	H-PT/BW (N×)	Q-PT/BW (N×)	BF-IEMG (μv)	RF-IEMG (μv)
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	M/kg)		M/kg)					
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Research group	0.45±0.19	1.08±0.26	0.53±0.23	1.08±0.21	58.70±22.18	175.60±43.25	87.66±26.70	246.77±54.38
Control group	0.42±0.20	0.82±0.29	0.52±0.31	0.88±0.35	58.62±20.19	134.29±43.20	79.08±35.68	179.83±50.25
t	0.28	10.92	0.11	8.36	0.36	11.35	0.12	14.73
p	> 0.05	< 0.05	> 0.05	< 0.05	> 0.05	< 0.05	> 0.05	< 0.05

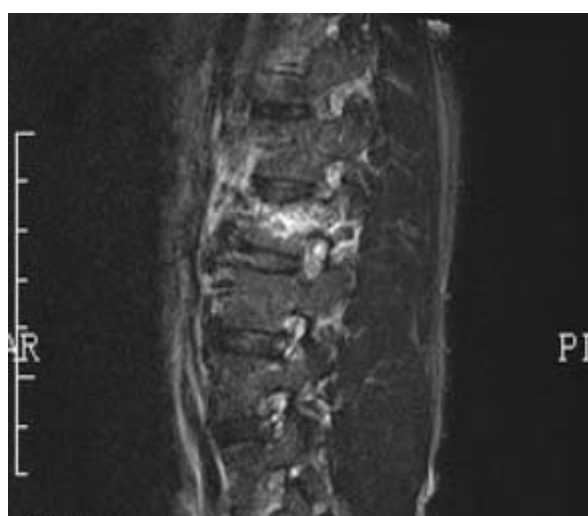


Figure 1. The image of a patient after therapy.

As shown in Table 2, improvement was observed in the RO and MPF of both groups after treatment. But the improvement was significantly better in the research group ($P < 0.05$).

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

Group	H-RO (%)		Q-RO (%)		BF-MPF (Hz)		RF-MPF (Hz)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Research group	66.79±17.20	86.73±13.60	66.79±10.88	88.10±10.07	75.70±11.90	56.34±12.28	75.08±13.89	57.70±10.35
Control group	68.42±15.42	76.37±16.28	65.38±12.31	75.88±12.13	75.72±12.56	50.21±10.95	75.78±13.05	50.73±12.06
t	0.50	15.22	0.12	17.56	0.08	14.69	1.02	10.84
p	> 0.05	< 0.05	> 0.05	< 0.05	> 0.05	< 0.05	> 0.05	< 0.05

IV Conclusion

Relevant data show that the annual incidence of spinal cord injury in China is about 23/1 million, and the number of quadriplegia patients or paraplegic patients is markedly higher. Accurate and reliable assessment can effectively help us in the diagnosis of rehabilitation functions, development of rehabilitation program and realization of the rehabilitation progress (Bi et al. 2015). There is no unified standards and conclusions regarding the application of accurate and quantitative assessment in spinal cord injury. Surface electromyography and isokinetic muscle strength testing have been widely applied in exercise injury and assessment of chronic pain rehabilitation (Chen et al. 2018, Dai et al. 2015). Also, they have been reported in the assessment of neurological diseases like stroke and polio. This study investigated the assessment value of surface electromyography and isokinetic testing on patients with incomplete lumbar spinal cord injury.

The results of this study demonstrated a certain degree of improvement in the surface electromyography and isokinetic testing after treatment in both groups, as compared with those before treatment. Meanwhile, the improvement was better in the research group. Also, patients of the research group presented with better outcome in MMT. However, it was not statistically significant. After 12 weeks of treatment, the strength of the major muscle groups such as the knee flexors and extensors in the lower extremities had reached Grade 4 and above, which significantly improved the quadriceps and hamstring PT/BW and IEMG. The above results fully demonstrate the value of surface electromyography and isokinetic test in the assessment of muscle strength changes after rehabilitation training. The results of this study are in line with the results of relevant scholars.

In addition, this study showed that the hamstring and quadriceps PT/BW and the IEMG of both groups were significantly improved compared with those before therapy. Also, the improvement of the research group was markedly better than that of the control group. Isokinetic strength training was performed on the basis of routine rehabilitation therapy, which produced more significant advantages as compared with the control group that underwent manual muscle training only (Gao et al. 2017). Accurately quantified spinal cord injury assessment methods help us better understand the patient's function and develop more targeted rehabilitation programs (Yuan et al. 2018).

To sum up, combination of isokinetic testing and surface electromyography test respond well to changes in muscle strength and endurance after rehabilitation therapy, which improve the ceiling effect and poor reflection ability of traditional manual muscle test. The problem of endurance defects is positively improved. Moreover, combination of isokinetic testing and surface electromyography could accurately quantify and reflect the muscle state as an important guidance for rehabilitation programs. Other than the indicators listed in this study,

In addition to the corresponding evaluation item indicators in this study, isokinetic testing could measure the torque ratio, present the balance of the active muscle and the antagonist muscle strength, and then understand the joint stability. Given the limited sample size and the relatively short time of observation in this study, a large sample size study should be conducted in the future to fully utilize the surface electromyography and better observe the lower extremity motor function in patients with incomplete lumbar spinal cord injury during rehabilitation.

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