

## LETTER TO THE EDITOR

## Clinical Study on Isokinetic Muscle Strength Training and Surface Electromyography Change in Soccer Players Undergoing Total Hip Arthroplasty Based on Ecological Cognition

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To observe and analyze the effect of isokinetic muscle strength training on sEMG of patients after total hip arthroplasty, and to explore the effect on improving quadriceps femoris and hamstring muscle strength. The objects of this study were 160 soccer players who underwent total hip arthroplasty in our hospital. The two weeks after the operation, intermittent isokinetic strength training at multiple angles of the affected side was conducted once a day. At the same time, before the first training, 7 days and 14 days after the training, the surface electromyography signals of the affected limb and the quadriceps femoris and hamstrings of the healthy limb during the squat were measured. The electromyography integral value (iEMG value) of squat exercise was taken for analysis three times, and the changes of quadriceps femoris, hamstrings and hamstrings/quadriceps ratio (H/Q ratio) of the affected and healthy limbs were observed. Before the training, the iEMG values of patients' femoral quadriceps and hamstring of the affected limb were significantly lower than those of the healthy side,  $p < 0.05$ . At 7 and 14 days after the training, the iEMG values of the quadriceps femoris and hamstrings of the affected side showed a significant increase,  $p < 0.05$ . After the isokinetic muscle training, the iEMG values of the quadriceps femoris and hamstrings of the healthy side of the patient tended to decrease. For soccer players undergoing total hip arthroplasty, the isokinetic muscle strength training can promote the positive improvement of quadriceps femoris and hamstring muscle strength, and effectively enhance the stability of knee joint, which is worthy of being promoted and applied.

### I Introduction

Xiantao Huang, Keqing Sheng, Yue Hu. Buslaev published "Key Factors Influencing Ecological Operation Risk of Football Sports" on Issue: 107, Pages: 3715-3720, Article No: e107414, Year: 2019, in the article, eco football sports is one of the favorite subjects of many people, and it is also the best way for young students to vent their physical strength. The football sports ecological movement is full of risks. In view of the major student sports accidents in the country, risk management is bound to become an important issue in school sports management. Therefore, how to reduce the casualties caused by accidental injuries in sports ecological activities is really a subject worthy of my research.

Total hip joint is composed of artificial acetabulum and artificial femoral head. Traditional artificial acetabulum and artificial femoral head are both in the form of metal, but clinical treatment experience shows that the application of this material will cause more complications, so it is no longer used at present. Currently, the acetabulum made of ultra-high molecular polyethylene and the artificial femoral head made of low-strength modulus metal are used for both at home and abroad (Ma et al. 2016). There are many types and designs of artificial total hip joint, and the focus is mainly on the diameter of femoral head and the design of acetabular surface fixed with bone. The thick acetabulum and the artificial femoral head of relatively small diameter constitute the total hip. The acetabulum friction force is small, the artificial acetabulum is stable and the local reaction is small (Wu and Mei 2014). Complications of total hip arthroplasty include not only the complications of artificial femoral head replacement, but also the local reactions caused by loosening of the artificial acetabulum, dislocation and wear of ultrahigh molecular polyethylene surface in the weight-bearing area (Sonmez et al. 2018).

Total hip arthroplasty (as shown in figure 1 below) has been widely used in the clinical treatment of femoral neck fracture, hip osteoarthritis and other diseases, and has achieved a wide range of ideal results due to the mature surgical methods. In addition, postoperative rehabilitation therapy, such as muscle strength training, can better reduce patients' time in bed, promote their recovery as soon as possible, and enhance their quality of life (Zheng et al. 2017). In this study, BIODEx multi-joint functional test and training system was adopted to implement the isokinetic muscle strength training program for patients after total hip arthroplasty. The objective evaluation of the training results was carried out based on surface electromyography (sEMG). The main purpose of this study is to provide valuable guidance for clinical treatment.



**Figure 1. Total hip arthroplasty**

## **II Method**

Isokinetic muscle strength training was carried out using multi-joint functional testing and training system. The patient was guided take the seat position, with the hip flexion by 80, fixed belts were placed in the hips, thighs and chest to avoid additional movement. During the exercise, the axis of rotation was parallel to the outer condyle of the femur, and the soft pad of the lever arm was placed at the proximal end of the ankle (Xu 2017). 14 days after the operation, intermittent isokinetic strength training of affected knee was carried out, with the speed set to 60, 90,

120, 90 and 60 per second, the interval set to 30 per second. At the same time, patients were instructed to perform extension and bending of knee for 10 times, and 50 times of training (including five types of sports) as a training unit. The number of contractions was gradually increased according to the state of muscle function adaptation.

**III Results**

As shown in table 1 below, the iEMG value of the quadriceps femoris of the affected side increased significantly after 7 days of training compared with that before treatment,  $p < 0.05$ . The iEMG value of patient's quadriceps femoris After 14 days of treatment was better than that after 7 days of treatment, which was very close to the iEMG value of the quadriceps femoris of the healthy side,  $p > 0.05$ . Three tests at the same time showed that the iEMG value of the quadriceps femoris had a decreasing trend,  $p < 0.05$ .

**Table 1. Comparison of iEMG values of quadriceps femoris in patients ( $\bar{x} \pm s$ )**

Time	Affected Side	Healthy Side	t	p
Before treatment	55.38±3.69	92.10±6.70	20.19	<0.05
7 days after treatment	65.68±4.52	82.11±8.05	18.73	<0.05
14 days after treatment	74.55±6.42	75.69±7.46	0.15	>0.05

According to the statistics in table 2 below, after 7 days of training, the iEMG value of the hamstring muscle of the affected side was significantly increased compared with that before treatment,  $p < 0.05$ . After 14 days of treatment, the iEMG value of patient's hamstring also increased, gradually approaching the iEMG value of hamstring of the healthy side,  $p > 0.05$ . Three tests at the same time showed that the iEMG value of patient's hamstring had a decreasing trend,  $p < 0.05$ . The postoperative image of 1 patient is shown in figure 2 below.

**Table 2. Comparison of iEMG values of hamstring in patients ( $\bar{x} \pm s$ )**

Time	Affected Side	Healthy Side	t	p
Before treatment	32.30±4.57	59.70±6.31	23.31	<0.05
7 days after treatment	38.93±4.23	52.16±7.68	20.78	<0.05
14 days after treatment	45.52±6.80	47.31±7.48	0.38	>0.05



**Figure 2. Postoperative examination showed that the patient recovered well**

As shown in table 3 below, after the training, the hamstring/quadriceps femoris muscle strength ratio of the patients was significantly different from that before the training,  $p < 0.05$ . However, there was no such difference for the healthy side,  $p > 0.05$ .

**Table 3. Patient's hamstring/quadriceps muscle strength ratio ( $\bar{x} \pm s$ )**

Time	Affected side	Healthy side	t	p
Before treatment	0.58±0.03	0.65±0.02	6.25	<0.05
7 days after treatment	0.55±0.02	0.65±0.02	8.78	<0.05
14 days after treatment	0.60±0.03	0.65±0.01	5.38	<0.05

#### IV Discussion

In recent years, isokinetic muscle strength training mode has been widely applied gradually, and achieved good results in clinical treatment (Zhang et al. 2015, Li et al. 2016). During the isokinetic muscle strength training, there is a relatively constant movement speed, and the resistance during the movement matches the actual muscle strength, so as to ensure that the muscle can always bear the maximum resistance and form the maximum muscle strength in the range of motion (Xiao and Li 2016), so the therapeutic effect of isokinetic muscle strength training is very significant in the rehabilitation treatment after knee joint replacement.

The results of this study showed that iEMG values of hamstrings and quadriceps femoris of the affected side were significantly lower than those of the healthy side before isokinetic strength training for patients undergoing total hip arthroplasty. This is mainly due to that the surgery caused the direct trauma of the affected limb and the involuntary braking protection of the affected limb was triggered due to postoperative pain. After 14 days of training, the iEMG value of quadriceps femoris and hamstring muscle of the affected side was basically close to that of the healthy side, indicating that the quadriceps femoris and hamstring muscle strength of the patient's affected side were significantly enhanced after isokinetic muscle strength training. In the study, H/Q of the affected side after training first declined and then increased, and the hamstring muscle increased faster after 14 days of training, indicating that the training effects of quadriceps femoris and hamstring muscle were not uniform. In the actual training, it is necessary to select targeted ways to improve the effectiveness of hamstring muscle strength training and enhance the stability of the knee joint.

#### V Conclusion

Currently, the isokinetic muscle strength training method has been widely used in the treatment of patients with total hip arthroplasty, with good results being achieved. Surface electromyography (EMG) can be used to measure the myoelectricity status of a muscle and thus evaluate the function of a single muscle. During the implementation of surface EMG test, it is easy to be affected by the interference of electromyographic signal crosstalk and collect the electromyographic signal generated by adjacent muscle contraction unrelated to the study, which is the key reason for the limitation of sEMG research. In this study, FexComp surface electromyography instrument was used in conjunction with a monopolar recording system. Only one electrode was attached to each muscle, and the spacing between collection points of each electrode was set to 1.5cm, so as to minimize crosstalk interference and significantly improve the accuracy of the effect of isokinetic force training system. In conclusion, this study shows that surface electromyography can be used as a quantitative index to evaluate muscle strength, and more studies are needed to evaluate the reliability and validity of function in the future.

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