

LETTER TO THE EDITOR

Clinical Research of Functional Training under Cold Environment in the Post-Operative Adhesion of the Extensor Device in Football Players with Fractures around Knee Joint

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Methods: A total of 160 patients definitely diagnosed as bone fractures around knee joint were enrolled. All patients were randomized into research group and control group, with 80 cases in each group. Of those, routine functional training was applied on the patients of control group, while those of research group was subjected to cold therapy and functional training. The therapeutic efficacy was compared between both groups. Results: Compared with the control group, the pain scores and the swelling circumference of the affected limb of the research group were significantly improved ($P < 0.05$). And the complete recovery rate of the knee range of motion was higher in the reference group, as compared with that of the control group ($P < 0.05$). Also, the patients of the research group had obviously superior life quality than the control group ($P < 0.05$). Conclusion: Application of cold therapy and functional training in the patients with post-operative adhesion of the extensor device after knee surgery significantly alleviate joint swelling and pain, improve flexion dysfunction as well as promote the recovery of joint function, which is worth popularization and application.

I Introduction

Xiantao Huang, Keqing Sheng, Yue Hu 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. In this study, a total of 420 questionnaires were distributed as research samples, and 325 valid questionnaires were collected, with a recovery rate of 77%. The results of the study: 1. In the second level of assessment, the most important facet is “site equipment”, followed by “management strategy” and “other factors”. 2. Among the 14 evaluation indicators, the top five indicators that are most important are: maintenance and repair, protection measures, replacement, natural environment, and risk.

With a relatively special occupation, football players usually have higher intensity of training, which can easily lead to fractures around the knee joint. It not only brings a large amount of inconvenience and pain to the athletes, but also gives normal training and life varying degrees of impacts. With in-time surgical treatment, we also need to

pay high value to the prevention of post-operative adhesion of the extensor device (Abdel 2016). This study was conducted to observe the effect of cold therapy combined with functional exercise on the post-operative adhesion of the extensor device in football players with fractures around the knee, with a main goal to provide valuable reference for clinical practice (Ghasemi et al. 2019). The report is listed as follows.

II Perspective

A total of 160 football players suffered from bone fractures around knee joint and treated at our hospital from June 2015 to October 2018 were enrolled. The inclusion criteria were as follows: injury around the knee joint (as shown in Fig 1. below), all treated with surgical methods; there was a smooth and complete articular surface, the joint space was not significantly narrowed, with no broken bone inside the joint cavity; Those with Raynaud's disease, sensitive to cold, locally unconscious, vascular disease, fractures of the knee extensor device, and severe knee fractures who are unable to strengthen internal fixation as well as those with mental disorders were excluded. There were 25 cases of mid-femoral fracture, 47 cases of lower femoral fracture, 40 cases of patella fracture, 48 cases of upper tibial fracture and 20 cases of tibial plateau fracture.



Fig 1. The X-ray measure image of a case

All patients and their families 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 80 patients in each group. Of those, there were 56 male patients and 24 female patients in the research group, with an average age of (27.9 ± 3.1) years, ranging from 20 to 30. Moreover, there were 60 male patients and 20 female patients in the control group, with an average age of (28.6 ± 3.9) years, ranging from 22 to 32. Data obtained from both groups was comparable ($P > 0.05$).

After the operation, ankle pump exercises were performed for 10 minutes when the patient was awake, including plantar flexion and dorsal extension. Meanwhile, the isometric contraction exercise of the quadriceps muscle was performed for 10 minutes, including the supine position, stationary of knee joint, and functional position of ankle, etc., four times a day (Hazra 2016). At the same time, the passive movement of the knee was conducted. Similar functional exercise program as well as cold therapy were performed in the patients of the research group. When the passive movement of the knee was completed, the AIR CAST Cryo/Cuff compression cold therapy system was used to apply ice compress onto the knee. A total of 600 ml cold water was added into the ice bucket,

and 600 g of crushed ice was added to keep the ice water at 0°C. The ring-type ice bag was completely attached to and covered around the entire knee joint, in between there was a dressing towel. The water inside the ice bag was controlled at 0-6°C while the skin temperature was about 15°C. Circular pressurization cold therapy was performed for 20 minutes each time (Wang 2017, Ghasemi et al. 2019).

The pain score evaluation and the measurement of the limb circumference were conducted after each time of activity, at different post-operative time points (at Day 1, Day 3 and Day 5 after surgery). Of those, the pain degree was evaluated by the visual analog scale (VAS). With a scale between 0-10 points, the higher the score, the higher the pain degree. And the circumference of the swelling limb was measured at the affected area. When the area was marked, the swelling is calculated by (the circumference of the affected limb - the circumference of the healthy limb) / the circumference of the healthy limb × 100% (Wang 2017). In addition, the patient's range of joint motion was measured. Partial recovery refers to alleviation of the local swelling and pain, and the range of joint motion was 75°-120°. No recovery refers no change occurred. The life quality of patients was assessed using the Quality of Life Comprehensive Assessment Questionnaire (GOQL-74). Statistical analysis was performed using SPSS21.0. All quantitative data were expressed in the form of mean ± standard variance (±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 statistical significance.

III Personal View

As shown in Table 1, the VAS score and the increase of the affected limb circumference were lower in the research group, as compared with the control group (*P* < 0.05).

Table 1. Comparison of the VAS score and the increase of the affected limb circumference after therapy between both groups ($\bar{x} \pm s$)

Groups	VAS score (points)			The increase of the affected limb circumference (points)		
	Day 1 after surgery	Day 3 after surgery	Day 5 after surgery	Day 1 after surgery	Day 3 after surgery	Day 5 after surgery
Research group (n=80)	6.30±1.26	5.42±1.53	2.21±1.01	3.25±0.47	5.03±1.20	2.09±0.78
Control group (n=80)	7.89±1.02	6.88±1.36	4.69±1.55	3.90±0.25	5.98±1.27	3.68±0.60
t	6.90	11.93	9.35	6.78	8.05	8.36
p	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

As shown in Table 2, the patients of the research group had markedly higher recovery rate of the knee range of motion 14 days after treatment, as compared with that of the control group (*P* < 0.05). Moreover, the images of a patient before and after treatment were shown in Figure 2.

Table 2. Comparison of the knee range of motion after treatment between both groups [n (%)]

Groups	Complete recovery	Partial recovery	No recover y	Total recovery rate

Research group (n=80)	57	20	3	77 (96.25)
Control group (n=80)	40	25	15	65 (81.25)
X²				9.62
p				< 0.05

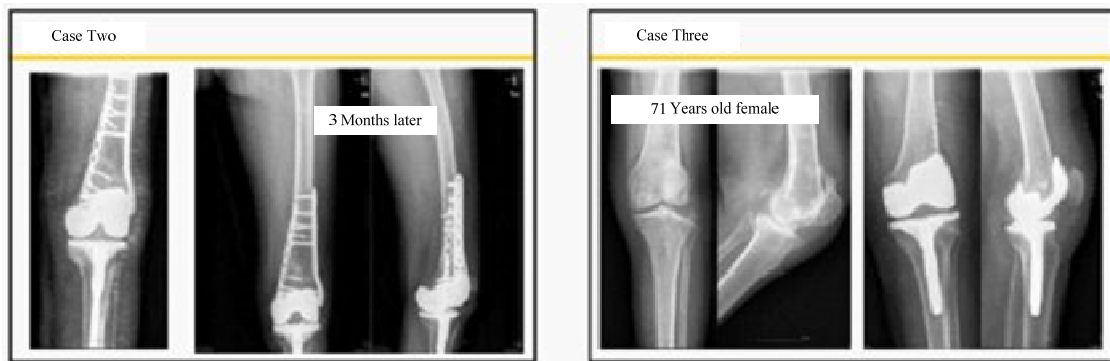


Fig 2. The images of a patient before and after treatment

As shown in Table 3, the patients of the research group had obviously superior life quality than the control group ($P < 0.05$).

Table 3. Comparison of the life quality scores between both group ($\bar{x} \pm s$)

Group	Mental function	Social function	Body function	Emotional life	Total scores
Research group (n=80)	79.80±6.45	80.19±9.04	80.25±7.23	78.05±8.38	80.25±7.03
Control group (n=80)	64.33±7.03	70.26±8.26	65.98±9.26	62.46±9.50	65.48±8.31
t	10.29	8.93	11.22	9.03	8.59
P	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Cold therapy can markedly reduce the swelling, of which the underlying mechanism is that cold therapy can shrink local blood vessels, slow down the blood flow, reduce capillary permeability and extravasation of tissue fluid, and then control local bleeding and reduce tissue swelling. Meanwhile, cold therapy also positively alleviates the pain by weakening the pain signaling (Wang et al. 2017).

Compared with the control group, the pain scores and the swelling circumference of the affected limb of the research group were significantly improved ($P < 0.05$). And the complete recovery rate of the knee range of motion was higher in the reference group, as compared with that of the control group ($P < 0.05$). These findings fully demonstrated that application of cold therapy and functional training in the patients could significantly prevent the post-operative adhesion of the extensor device after knee surgery, which is in line with other researches (Oforikwakye et al. 2016).

IV Conclusion

Patients are often stay still after injury around the knee or internal fixation surgery due to fear of pain and internal fixation loosening, thus resulting in adhesion of the knee extensor device. Once adhesion occurs, it would affect the patient's work and life seriously, even cause permanent disability in severe cases. The application of cold therapy and functional training in the patients could significantly prevent the post-operative adhesion of the extensor device after knee surgery. However, the problem to be noted is that the skin temperature should be controlled at 10-15°C during ice compression, which can effectively reduce edema and pain. Ice cold therapy combined with functional exercise can reduce pain and swelling in patients with fractures around the knee, actively improve the joint range of motion of knee and actively promote the recovery of knee function, which has important application value. In this study, a comparative analysis was conducted to observe the effect of cold therapy combined with functional exercise on the adhesion of the knee extensor device after knee fracture, and the ideal results were obtained. However, given the limited sample size in this study, a larger sample research should be developed in the future to fully support the results of this study.

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References

- Abdel MS (2016) Design and synthesis of some substituted thiazolo [3,2-a] pyrimidine derivatives of potential biological activities. *Saudi Pharmaceutical Journal* 24 (2): 119-32.
- Ghasemi S, Emadi-Baygi M, Nikpour P (2019) Down-regulation of circular RNA ITCH and circHIPK3 in gastric cancer tissues. *Turkish Journal of Medical Sciences* 49 (2): 687-695.
- Hazra M (2016) Designing polymeric microparticulate drug delivery system for hydrophobic drug quercetin. *Saudi Pharmaceutical Journal*, 23 (4): 429-36.
- Liu Z, Zhu Z, Zhao J, Ren W, Cai Y, Wang Q, Luan X, Zhao K, He J (2017) Malondialdehyde: A novel predictive biomarker for post-stroke depression. *Journal of Affective Disorders* 220: 95-101.
- Oforikwakye K (2016) Development and evaluation of natural gum-based extended release matrix tablets of two model drugs of different water solubilities by direct compression. *Saudi Pharmaceutical Journal* 24 (1): 82-91.
- Wang H, Tan X, Xu J, Li H, Wang M, Chen S, Yang X, Liu Y, Wang F (2017) Negative correlation between CSF lactate levels and MoCA scores in male Chinese subjects. *Psychiatry Research* 255: 49-51.
- Wang XX (2017) Effect of local compression and cold therapy combined with CPM functional exercise on early joint function recovery after total knee arthroplasty. *China Tissue Engineering Research* 21 (07): 998-1003.
- Wang Y, Chen Y, Jiang HT, Lu CH, Wang JN (2017) Effect of cold therapy combined with sputum pumping exercise on early rehabilitation of patients with tibiofibular fracture. *Zhejiang Medical Education* 16 (01): 27-29.

