

Influence of Kinesio Taping on the Level of Inflammatory Factors in the Joint Fluid of Athletes with Early Meniscus Injury

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ABSTRACT. *Purpose: observe the influence of kinesio taping on interleukin-1 β (IL-1 β), tumor necrosis factor- α (TNF- α) and matrix metalloproteinase-3 (MMP-3). Method: select 60 eligible athletes with early meniscus injury and then divide them into a control group and a test group by random number table. The test group was treated by kinesio tape, while the control group was treated by non-elastic placebo tape that had the same appearance. These two groups were replaced with the tapes once every two days and one course of treatment was 15 times. Joint fluid was respectively extracted from all the patients one week before and after the treatment to carry out the enzyme linked immunosorbent assay (ELISA) and thus detect the content of IL-1 β , TNF- α and MMP-3 in the joint fluid. Then the content was evaluated by Visual Analogue Scale (VAS) one week after the treatment. Results: after the patients in the test group received treatment, the content of IL-1 β , TNF- α and MMP-3 in the joint fluid was lower than the level before the treatment, and the difference was statistically significant ($P < 0.05$); after the patients in the test group received treatment, the content of IL-1 β , TNF- α and MMP-3 in the joint fluid was lower than that of the control group, and the difference was statistically significant ($P < 0.05$); and after the patients in the test group received treatment, the score of VAS was higher than that of the test group before the treatment and than that of the control group after the treatment, and the difference was statistically significant ($P < 0.05$). Conclusion: the treatment by kinesio tape can obviously reduce the content of IL-1 β , TNF- α and MMP-3 in the joint fluid of athlete with early meniscus injury, restrain the inflammation inside the athlete's joint cavity and facilitate the restoration of knee joint function.*

Keywords: *Knee joint injury; kinesio tape; inflammatory factor*

1. Introduction

The athlete's early meniscus injury is more common^[1]. After the light injury

undergoes early treatment like arthroereisis and ice compress, the symptoms can be relieved. In recent years, the kinesio taping is widely applied in the field of sports injury rehabilitation pain and has certain value for the treatment of athlete's early meniscus injury, but its treatment mechanism is unclear^[2]. By observing the influence of kinesio tape on interleukin -1 β (IL-1 β), tumor necrosis factor- α (TNF- α) and matrix metalloproteinase-3 (MMP-3) in the joint fluid of athlete with early meniscus injury, this research is to discuss the functional mechanism of kinesio taping for the treatment of athlete's early meniscus injury and provide reliable basis for intervening the athlete's early meniscus injury in the early stage and promoting the restoration of athlete's knee joint function.

2. Object and Methodology

2.1 Object

The athletes suffering from the sports injury of knee joint from Xi'an Petroleum University and Xi'an Physical Education University were selected from June 2018 to January 2019. All the athletes received the MRI examination on knee joint in the local top three hospitals after the injury and the persons with medial and lateral meniscus injuries were researched (excluding the persons with anterior and posterior cruciate ligament injuries, medial and lateral collateral ligament injuries and fractures around the knee). The investigated objects are (37.28 \pm 5.56) years old on average. They are divided into a test group and a control group by random number table and each group contains 30 cases. The control group contains 21 male cases and 9 female cases or 14 left cases and 16 right cases; and the test group contains 20 male cases and 10 female cases or 19 left cases and 11 right cases; through the comparison of two groups in age of patients, sex composition and left and right knees, etc., the difference is not statistically significant ($P > 0.05$).

2.2 Methodology

2.2.1 Treatment method: the patients in two groups were treated by such methods as injured limb bracing and cold compress. All the patients received health education and were prohibited from bearing load on the ground with the injured

limb and then carried out the long-time exercise and ankle pump training for quadriceps femoris, tibialis anterior muscle, gastrocnemius muscle and soleus. The test group was treated by kinesio tape (Changzhou Dele, S.C.X.B. No.20150408), while the control group was treated by non-elastic placebo tape that had the same appearance. The taping method is: after the patients in two groups sit down, their knee joints are in semi-flexion position to take the following taping methods. (1) Y-shaped taping: the anchoring end is located above the knee joint and then two claws wrap the patella downward along both sides of the patella. (2) Claw-shaped taping: after the anchoring end of one tape is placed inside the knee joint, the upper two claws extend outward along the upper edge of patella and then the lower two claws extend outward along the lower edge of patella; then after the anchoring end of another tape is placed outside the knee joint, the upper two claws extend inward along the upper edge of patella and then the lower two claws extend inward along the lower edge of patella. These two claw-shaped tapes wrap the patella in a mutually staggered way. (3) I-shaped taping: the anchoring end is in the middle of the tape, which is placed below the patella and then extends to the two sides to be fixed. The tape is replaced once every two days and one course of treatment is 15 times.

2.2.2 Observational index: joint fluid was respectively extracted from all the patients one week before the treatment and after the last treatment for testing. The specific method is that: if there is joint effusion, 2 ml joint fluid is extracted from the injured limb directly by sterile syringe. The content of IL-1 β , TNF- α and MMP-3 in the joint fluid is detected by enzyme linked immunosorbent assay (ELISA) and determined in strict accordance with the operation instructions for IL-1 β , TNF- α and MMP-3 kits. The absorbance value of each pore is determined by microplate reader.

2.2.3 Therapeutic evaluation: the pain situation of the patients in two groups was evaluated by using the score of VAS after they received treatment for one week.

2.3 Statistical Method

The SPSS 19.0 statistical software is used for conducting analysis and all the data are expressed by $\bar{x}\pm S$. The T test is used for the statistical processing of data, and the difference is statistically significant ($P<0.05$).

3. Results

3.1 Changes in each inflammatory factor before and after the treatment

After the patients in test group received treatment, the content of IL-1 β , TNF- α and MMP-3 in the joint fluid is lower than the level before the treatment and is lower than that of the control group, which is shown in Table 1.

3.2 Comparison of knee function scores before and after the treatment

After the test group received treatment, the score of VAS is lower than that before the treatment and than that of the control group after the treatment, which is shown in Table 1.

Table 1 Comparison of the patients in two groups before and after the treatment ($\bar{x}\pm S$)

Group type	Case number	IL-1 β (ng/L)		TNF- α (ng/L)		MMP-3 (ug/L)		Score of VAS	
		Before the treatment	After the treatment						
Control group	30	35.79 \pm 2.56	33.90 \pm 1.06	58.62 \pm 4.12	52.82 \pm 3.72	15.11 \pm 2.06	13.55 \pm 1.08	8.12 \pm 0.11	5.10 \pm 0.22
	30	34.88 \pm 3.74	27.12 \pm 3.86	59.20 \pm 3.80	41.06 \pm 5.51	14.92 \pm 1.87	10.10 \pm 2.99	7.90 \pm 0.32	3.21 \pm 0.51
Test Group									
t		1.56	11.89	0.56	8.85	1.80	8.59	1.98	27.50
P		0.06	<0.05	0.45	<0.05	0.22	<0.05	0.34	<0.05

4. Discussion

The kinesio tape is widely applied in sports and injury protection^[3]. The kinesion tape does not contain any pharmaceutical ingredient and it plays a therapeutic role through the following several points: (1) the tape can increase the proprioceptive sensation through continuous skin stimulus; (2) the tape can adjust the fascia function by adjusting the muscle tension; (3) the subcutaneous space is increased due to elastic recoil so as to absorb more subcutaneous interstitial fluid and promote

the lymph and blood circulation; (4) the strength of weak muscle is enhanced. The kinesio tape is comprised of waterproof elastic cloth and wavy acrylate low sensitive adhesive. It can be cut into X shape, Y shape, I shape and claw shape, etc. as required. The I-shaped tape can fix the soft tissue according to different tension; the X-shaped tape can relax the tension area of pain point; the Y-shaped tape can adjust the muscle; and the claw-shaped tape plays an active role in eliminating edema and improving circulation. In this research, after the treatment group was provided with various shapes of tapes and the patients' knee joints were taped according to certain technology, the functions like relieving swelling and pain and improving circulation and joint function were realized, but the knee function score was not obviously improved after the control group was treated by placebo tape. It was once reported in some researches that the kinesio tape had good short-term effect for treating the knee osteoarthritis^[4], but there was no report on treating the acute knee injury and changing the inflammatory factors in joints. It is found in this research that the level of IL-1 β , TNF- α and MMP-3 decreased sharply after the test group received treatment, indicating that the kinesio tape can reduce the level of inflammatory factors in the patients' knee joint fluid and the knee joint pain is relieved by changing the score of VAS after the treatment. As the tape does not contain any pharmaceutical ingredient, it cannot directly reduce the level of IL-1 β , TNF- α and MMP-3. It is speculated that its functional mechanism is to correct the force line of knee joint unbalance to a certain extent, reduce the pessimal stimulation of joint synovium and then take away the inflammatory factors through the patients' autophagy. In addition, due to the elastic recoil of tape, the patients' subcutaneous space is increased and the local circulation is also improved, so the decrease of inflammatory factors may be related to it. To sum up, the kinesio tape can reduce the level of inflammatory factors in the joint fluid of athletes with early meniscus injury and the short-term efficacy is definite. However, due to short follow-up period and restricted number of cases, the long-term efficacy and the definite mechanism need to be further researched.

References

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