Healthcare Promote Sports Science Progress: The Effect of Kinesio Taping on Athletic Performance in Elite Athletes

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Abstract: **Objective**: To explore the potential mechanism and effect of kinesio taping on the improvement of sports performance and performance of competitive athletes. **Methods**: The literatures were searched by PubMed, Web of Science, Sport discuss and other databases. **Results**: 1. The elasticity of kinesio taping® educed the relative area of skin folding, increased the subcutaneous space, and improved blood and lymphatic circulation. 2.The kinesio taping causes corresponding changes in proprioceptive perception by stimulating skin receptors and mechanical receptors, correcting the errors that may occur in the process of exercise or correcting the mode of action; 3. Kinesio taping® can significantly reduce the time of body fatigue recovery and increase local blood flow. 4. The kinesio taping® plays a fixed and protective role in the joint, which reduces the risk of joint injury and improves the balance ability of the body. **Conclusion**: Kinesio taping® positive role in improving the sports performance of competitive athletes, but the related physiological.

1 INTRODUCTION

In recent years, cross-border cooperation between sports and medicine and biotechnology has become more frequent, and more and more research and inventions are serving athletes to help them achieve good results and improve their sports performance in competition. Professional athletes use wearable technology to track on-court performance and monitor daily performance. In recent years, medical technology has also played an important role in the field of sports science, with the emergence of intramuscular patches that have contributed to injury prevention, post-performance recovery and improved athletic performance.

Kinesio Taping® (K T) is an elastic patch that can be used to treat sports injuries and some other diseases, and is now widely used in the field of sports medicine and rehabilitation medicine. In sports practice, it is also used as a means to improve human performance and athletic ability (Morris 2013). In the last decade, the use of KT, including the application of a specific type of elastic patch, has become an increasingly popular alternative to traditional sports patches. The potential mechanical and physiological effects of intramuscular patches can prevent joint injuries by improving sports performance in healthy individuals and reduce disability in individuals with joint disease by improving different physical parameters (e.g., muscle strength, lymphatic return and pain levels). In the field of sports science, intramuscular patches are mainly used for injury prevention and post-injury treatment in athletes, and can also have a positive effect on athletic performance and fatigue recovery, but there are still relatively inconsistent studies on the specific

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therapeutic effects and real value of intramuscular patches. This review focuses on the research of intramuscular patches on athletic performance of athletes to provide a theoretical basis for further research.

2 METHOD

Search formula: "Kinesio Taping" or "Kinesio Taping Technology" or "Kinesio Tape" and "balance" or "static balance" through PubMed, Web of Science, Sport discuss and other databases. " or "Kinesio Tape" and "balance" or "static balance" or "dynamic balance" or "performance", "lower limb strength" or "muscle strength" or "posture control" or "motor control" as search terms for relevant The literature search was conducted as a reference for relevant studies.

3 RESULT

3.1 Origin of the Intramuscular Patch Technique and Possible Potential Mechanisms

The intramuscular patch technique was invented in 1973 by Dr. Kase, a Japanese massage therapist, and is a medical treatment technique in which an intramuscular patch is applied to the skin surface of the human body according to certain technical requirements, and its elasticity is retracted to exert its effects.

Current research has shown that intramuscular patches have both preventive and therapeutic effects. It has been proposed as a therapeutic method to reduce pain, correct joint position, reduce swelling, increase proprioception, prevent injury, increase or inhibit muscle recruitment and increase range of motion (Rahlf 2019). Several studies have concluded that this intramuscular effect patch can have a positive effect on the prevention and treatment of sports injuries because it has a better effect on the recruitment of motor units. Due to the elasticity of the tape, the relative area of skin folding is reduced and the subcutaneous space is increased, thus allowing for improved blood and lymphatic circulation. This raised elasticity in turn activates neural inhibition, increases joint range of motion, improves muscle and fascia elasticity regulation and serves to reduce injury(Chen 2013).

In addition, there are relatively few physiological explanations behind the application of KT. Some researchers have hypothesized that applying KT to the starting to ending points of muscles can have a stimulating and facilitating effect on muscle function (Kase 2003). This suggests that this form of patching can have a stimulating and activating effect on the muscle due to the elasticity and other properties that KT have. The elastic fibers of the intramuscular effect patch can stimulate muscle contraction in the direction of movement and improve motor performance (Vithoulka 2010). In addition, KT can improve proprioception and increase the recruitment of motor units in the body (Supik 2007). Another proposed hypothesis is that KT stimulate the fascia and provide higher tension to the muscle, thus promoting muscle contraction (Vithoulka 2010). If the direction of muscle firing and the direction of tension of the intramuscular effect patch are the same, then tension can assist muscle contraction. Conversely, if the direction of tension is opposite to the direction of muscle contraction, the tension may diminish muscle traction. During the application of the intramuscular effect patch, skin receptors and mechanoreceptors are stimulated, and this stimulation leads to a corresponding improvement in proprioception, correcting possible errors or correcting movement patterns during exercise (Magalhaes 2006) .

3.2 Kinesio Tape Effect Patch Type and Function

The main proprietary terms of the intramuscular patch are the concepts of "anchor", "tail", extension direction and contraction. The term "anchor" refers to the starting point of the patch; "tail" refers to the end of the patch that continues to extend outward away from the stop point after the stop point has been determined; extension direction: the direction in which the tail end continues to extend after the anchor of the patch has been fixed; retraction direction: the direction in which the tail end continues to extend after the anchor has been fixed with the tail facing the anchor. Contraction force.

Clinically, the patch can be cut in various ways such as I-shaped, Y-shaped, X-shaped, O-shaped, claw-shaped (also called fan-shaped) and lantern-shaped to fit the shape of the corresponding regional muscle joint ((Rahlf 2019)) (see Figure 1, Table 1).

Figure 1: Cutting effect of different shapes of KT.

Table 1: I Y X shapes and functions of KT.

Ligature shape	Function
I shape	Reduces/increases muscle tone and improves athletic performance
Y shape	Supports, immobilizes and protects soft tissues such as muscles and ligaments
X shape	Relieves pain at "anchor" points

Table 2: O Claw Lantern shapes and functions of KT.

Ligature shape	Function
O shape	Immobilization and protection, mostly for fractures and soft tissue injuries
Claw shape	Promotes lymphatic circulation and eliminates swelling at the site of ligation
Lantern shape	For immobilization

3.3 Effect of Intramuscular Effect Patch on Exercise Performance

3.3.1 Effect of Intramuscular Patches on Muscle Strength

The effects of intramuscular patches on muscle function are more likely to be on muscle strength, and a study by Csapo R involving surface EMG recordings showed that intramuscular patches may stimulate greater levels of EMG in different muscle groups, thus providing a relevant basis for intramuscular activation of muscles (Csapo 2012). In his study, Sun Zhang also found that intramuscular patches did not immediately affect the force and explosive power of isometric and isokinetic contractions of the wrist extensors and flexors, but still improved to some extent the fatigue of repetitive work and the decay of torque in the wrist flexors, which may have a positive effect on muscle fatigue induced by prolonged work (Nunes 2015).

Muscle activity of the anterior tibialis and posterior tibialis muscles can reveal a dynamic stabilizing effect on the foot arch during weight-bearing activities. In athletes with low arches, it was found that the EMG signals in all phases of the tibialis anterior muscle were generally higher in the group with and without the intramuscular patch than in the group without the intramuscular patch, but not all EMG signals were statistically significant (Siu 2019). This may be because the purpose of the intramuscular effect patch is to promote the contraction of the posterior tibial muscle and also the contraction of the anterior tibial muscle. To some extent, intramuscular effect patching of the wrist flexors may improve climbing ability and rock-hugging performance in rock climbers. This is because climbing ability performance is largely dependent on the strength and endurance of the finger flexors. There is also evidence that intramuscular effect patching on the finger flexors reduces muscle fatigue during repetitive and prolonged grip tasks and that intramuscular effect patching of the finger flexors leads to an increase in parameters related to muscular endurance and athletic climbing performance (España 2009, Williams 2012).

3.3.2 Effects of Intramuscular Patches on Fatigue and Blood Flow

Centrifugal and isometric exercise can cause muscle damage and pain, and the extent of delayed muscle soreness can be effectively alleviated through the use of KT. By comparing the biochemical index test analysis of rowers in the patching and non-patching groups, Zhou Zhenghong et al. found that intramuscular effect patching had positive effects in improving muscle fatigue and eliminating serum creatine kinase in athletes' muscles, and the effects of longer patching were more pronounced (Tekin 2018). In a comparative test of KT in aerobic athletes, it was found that intramuscular effect patch intervention reduced creatine kinase concentrations in athletes during different periods of delayed muscle soreness, indicating that KT reduce microdamage in athletes' skeletal muscles (Rahlf 2019).

Intramuscular patches were superior to other methods and techniques in improving local blood circulation in the knee during the 7-day application period after total knee arthroplasty (Windisch 2017). Aguilar-Ferrandiz et al. reported that the use of intramuscular patches for one month significantly improved venous reperfusion time and venous pump function in postmenopausal women with chronic venous insufficiency by comparison with the use of placebo patches (Aguilar 2014). Souza et al. found that delayed muscle soreness contributed to a reduction in vascular diameter and impaired blood flow response at the corresponding site in the body, promoting nociceptive hyperalgesia. In addition, the "fold hypothesis" of the intramuscular patch explains to some extent the findings of this study, as the fold lifts the skin of the local tissues to which it is attached, and the tissue gap under it increases, which increases the blood and lymphatic circulation to the local tissues (creatine kinase in the tissue fluid enters the body circulation more quickly with the lymphatic circulation, increasing the rate of metabolism in the body). metabolic rate) is accelerated, allowing more anti-inflammatory factors to penetrate the lesion to accelerate the inflammatory response. In contrast, Yang and Lee reported no increase in local blood circulation in the lower back over 15 minutes in a non-disabled group with KT (Yang 2018). These contradictory results may be due to differences in the application period and population characteristics of these studies. KT may be beneficial in populations with muscle fatigue and chronic musculoskeletal disorders, as the increased circulation helps to promote recovery through increased nutrient and metabolic waste exchange.

However, Stedge et al. evaluated the effect of intramuscular patches on blood circulation and found no effect of intramuscular patches on blood circulation capacity by measuring blood flow. In addition to this, no evidence-based studies have been reported to confirm the effect of intramuscular patches on aerobic exercise capacity.

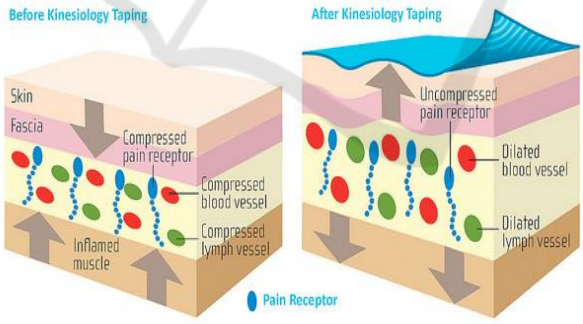

Figure2: Potential mechanisms inherent in KT (Nicole,2020).

3.3.3 Effect of Intramuscular Effect Patch on Balance

The intramuscular effect patch technique includes the facilitation and inhibition of fascial correction and the correction of bone and joint function. In particular, intramuscular patches have been shown to prevent injury by providing sensory stimulation to control proper movement and prevent excessive stretching of tissues or joints beyond normal range of motion （ROM）.

Intramuscular patches can improve postural control by increasing sensory input, thereby reducing delay in postural reflexes. Intramuscular patches have a significant beneficial effect on dynamic and static balance, but no significant effect on flexibility. As an external support, intramuscular patches remain one of the most popular clinical treatment strategies, and the

available literature suggests that intramuscular patches not only reduce the risk of recurrent ankle sprains, but also improve patients' sensorimotor function because they increase joint stability and are protective by limiting ligaments for a short period of time.A study by Cortesi et al. found that that intramuscular patches may have a beneficial effect on balance in patients with multiple sclerosis. The anterior-posterior displacement towards the center of pressure was reduced by applying the intramuscular effect patch to the patient's Achilles tendon. The intramuscular patch may have a more significant effect on non-athletes with weaker balance and strength or at least on athletes who do not train regularly (Cortesi 2011). Future studies should focus on the effects of the tape on the sensorimotor system by detecting electromyographic activity, motion analysis or fatigue, and postural control.

4 CONCLUSIONS

Intramuscular patches can indeed contribute to athletic improvement by immobilizing joints, increasing muscle tone and local blood flow circulation, and improving balance. However, further research is needed on the physiological mechanisms associated with the effects of intramuscular patches on athletic performance. The improvement of balance and postural control is also worth further exploration and research, which will help to support and improve the new techniques and methods of sports performance.

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