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Effectiveness of facilitatory an inhibitory kinesio taping technique in healthy collegiate sprint runners

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Abstract
Background: Sprint runners in track and field events must run a given distance with maximal effort. Running requires a progressively increasing speed with coordinated contraction of muscles, accelerating the body forward at an increasing velocity. Kinesio taping is widely accepted by professional sprint runners to improve performance during competitions and training.
Aim: To determine the effectiveness of facilitatory and inhibitory kinesio taping technique in healthy collegiate sprint runners.
Objective: To see the effect of kinesio taping on running time in healthy collegiate sprint runners.
Methodology: 30 male participants were recruited in the study. The age group of the participants was 18-24 years. The participants were told to run 100 meters without kinesio taping and the time was recorded. Then the participants were told to run 100 meters with kinesio taping on quadriceps and hamstrings which was applied 24 hours prior to the performance and then the time was recorded.
Results: Mean of pre intervention was 15.99 ±1.904 seconds and post intervention was 14.79±1.507 seconds. Conclusion: In this study, it was concluded that there is a significant improvement in sprint running time after applying kinesio taping on healthy collegiate sprint runners.
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Keywords: kinesio taping, sprint runners, time

1. Introduction

Rapid movement of the body from one place to another is required in sprint running**.** Sprint runners in track and field events must run a given distance with maximal effort [1]. running requires a progressively increasing speed with coordinated contraction of muscles, accelerating the body forward at an increasing velocity. The stride/step length, stride/step rate, ground contact time and joint angles are also the several factors involved in optimizing running performance [2].

An ideal position involves shoulders directly above the start line, the hips raised above the shoulder level and body weight distributed on the front foot with the leading knee of angle 90–110° and the rear knee angle 120–135°. Starting performance have concentrated not only on body positioning and associated start block settings but also on the development of angular velocity and maximal force by the sprinter during the start [3].

It is important to produce great force/ power and generate high velocity in the acceleration phase at the beginning of the sprint run. During the constant-speed phase, the events before and during the breaking phase are important for increasing explosive force or power and efficiency of movement [1].

The three main phases of a 100 m race mainly consists of the acceleration, maximal speed, and speed maintenance phase [4]. the acceleration phase can further be subdivided into an initial acceleration phase and transition phase. During the initial acceleration phase, a sprint runner aims to achieve maximal horizontal velocity to maximize overall acceleration. Until maximal speed is achieved, the runner attempts to be in a state of acceleration and speed development relying heavily on the powerful extension of the joints of the lower leg, and the swing back velocity of the support leg at touchdown. And the transition phase is defined by the raising of the trunk into a fully upright position [4].

The hamstrings and quadriceps are the two most powerful muscle groups involved in the mechanics of sprinting. The hamstring muscles function as a brake, contracting eccentrically to oppose the powerful concentric contraction of the quadriceps muscle group [2].

If these muscle groups are not balanced, then the functional performance will be limited and there will be high risk of injury [2].

Functional asymmetries may be different between the right and left sides of the body or between agonist (causing movement) and antagonist (opposing movement) muscle groups. For example, the quadriceps (agonist) and hamstrings (antagonist) muscles work in an opposing manner and an imbalance in these two muscle groups could result in overpowering or injury. The manner in which the quadriceps and hamstrings function during a sprint induces high intrinsic forces within the hamstring muscle and an imbalance in hamstring strength compared to quadriceps strength which could be an increased risk factor for injury.

Running (sprinting) performance is highly dependent on the ability to generate maximum speed in a short period of time through highly explosive force generating movements. During this force generation, the eccentric contraction of the hamstring generates high intrinsic forces within the muscle resulting in risk of injury for the hamstring muscles compared

to the quadriceps muscles [2].

Eccentric contractions of muscles are common during many activities of daily living and sport performance (eg:-resisted exercise training, plyometric training and downhill running). Eccentric contraction of muscles gives a negative effect on muscle performance. A decline in muscle performance is associated with delayed-onset of muscle soreness (DOMS) and other problems like hamstring strain or fatigue, quadriceps over use, muscle cramps. Delayed-onset of muscle soreness can affect the performance of athletes during successive games or training sessions by causing a reduction in joint range of motion (ROM) [5]. DOMS is characterized by pain and stiffness and peaks typically 24 to 48 hours after running or strenuous exercise, especially with eccentric contraction and subsides within 96 hours [6].

Eccentric contraction controls the muscles during movement of the body by enabling the movement to decelerate and also accumulates the elastic recoil energy of the muscle. During the sprint eccentric contraction occurring in the muscles, muscular movement acts like shock absorbent structures, the length of the muscle extends and this extension causes a negative workload and causes damage in the skeletal muscle fibers. There are several theories that explain the running induced Delayed Onset Muscular Soreness (DOMS) mechanism. One theory states that lactic acid accumulation is responsible from muscle spasm as seen after eccentric contraction of muscle during sprint especially in weak muscles with perception of pain at delayed stage. Another theory suggests that connective tissue damage results in DOMS. Especially fast twitch fibers may demonstrate stretch-induced injury under high load tension and this will result in connective tissue damage and DOMS. These mechanisms may induce inflammatory cell infiltration and reaction in the tissue. There are many reports that explain the reason behind the strength reduction and delayed-onset muscular soreness which are related to acute inflammatory reaction in the muscles [7].

In addition to promote balance and functionality needed to achieve significant and visible improvements in strength and muscular performance, resistance exercise and different kinds of training (balance and coordination) are responsible which helps in improving velocity and movement coordination [5].

However, in recent years, Kinesio tape (KT) has become popular for rehabilitation of musculoskeletal injuries and neuromuscular re-education. 10–12 KT is a type of therapeutic tape which was developed by Dr Kenzo Kase. It can be stretched upto 130% to 140% of its original length and have approximately the same weight and thickness as the skin [6].

Kinesio taping is widely accepted by professional sprint runners to improve performance during competitions and training. Kinesio taping is a high-viscosity, adhesive elastic tape that allows the skin to breathe and is water resistant. Kinesio taping provides constant mechanical/elastic stimulation of the skin and its effects are transmitted to deeper tissues through mechanoreceptors found in the epidermis and dermis. This may modify the muscle activity and increase force. Kinesio taping is a method of taping which utilizes a specialized type of tape by the same name. Kinesio tape is different from traditional white athletic tape. It subsequently provides a constant pulling (shear) force to the skin when applied unlike traditional white athletic tape. The fabric of this specialized tape is air permeable and water resistant and can be worn for atleast 3 days. Kinesio Taping has two techniques: - Facilitatory and Inhibitory.

1. Facilitatory technique: - Kinesio Tape application from muscle origin to insertion produces a concentric pull on fascia which activates the muscle by increasing muscle contraction.
2. Inhibitory technique: -Kinesio Tape application from muscle insertion to origin produces a eccentric pull on fascia which inhibits overuse of muscle by decreasing muscle contraction. Muscle inhibition application averts the overuse of muscle [5].

Therefore, the purpose of the study is to determine the difference in run time between runners before and after applying kinesio tape. Analysis of running –time data could determine if Kinesio Taping has a significant impact in running speed [10].

2. Methodology

Source of Data

The source of data will be collected form the students having hamstring tightness from Dr. APJAK college of physiotherapy, loni, Maharashtra.

Method of collection of data

Type of Data: Data will be primary collected by the principal investigator

Study Design: Cross sectional trial type of study design was used.

Sample size: 30

Participants: Males between 18 to 25 years of age

Sampling Method: Convenient sampling.

Study Duration: 5 months

3. Procedure

The ethical clearance form registration no. BPT/INT/2018/26 Randomly 30 individuals from college between 18 to 24 years of age group participated in this study. The participants were told to run 100 meters without kinesio taping (PRE) and the time was recorded. Then the participants were told to run 100 meters with kinesio taping on quadriceps and hamstrings which was applied 24 hours prior to the performance and then the time was recorded. (POST)

Combination of both facilitation and inhibition kinesio taping techniques were used.

For quadriceps facilitation

The skin was cleaned with alcohol before KT application. KT was applied from origin to insertion of the muscle (proximal to distal) in I shape. The participants were made to lie in supine position on the bed. Bilateral quadriceps femoris and vastus lateralis of the participants was taped.

For rectus femoris, the origin of the rectus femoris on the anteroinferior iliac spine to the common patellar-tendon insertion of the quadriceps femoris on the tibial tuberosity. The base of the tape was attached to the anteroinferior iliac spine without any stretch on tape. Then the kinesio tape was stretched 15 to 35% and applied towards insertion and the end was applied without any stretch. For Vastus Lateralis, the origin of the vastus lateralis on greater trochanter of the femur to the quadriceps tendon to base of patella and tibial tuberosity via patellar tendon. The base of the tape was attached to greater trochanter without any stretch on tape. Then the kinesio tape was stretched 15 to 35% and applied

toward insertion and the end was applied without any stretch. (The middle portion of the tape should be applied with 15 to 35% of tension)

Fig 1: Kinesio taping for quadriceps facilitation

For hamstrings inhibition

By following the same procedure as above Kinesio tape will be applied from insertion to origin of the muscle (distal to proximal) in prone position on bed or examination table. Bilateral hamstring muscles of the participants was taped from insertion (fibia and tibia) to origin (tuberosity of ischium and linea aspera). The base of the tape was at both middle for and lateral side of the posterior part of the knee and the end was at origin. The base was applied without any stretch on tape than the tape was applied with 15 of 25% stretch toward the origin and the end was applied without any stretch.

Fig 2: Kinesio taping for hamstrings inhibition.

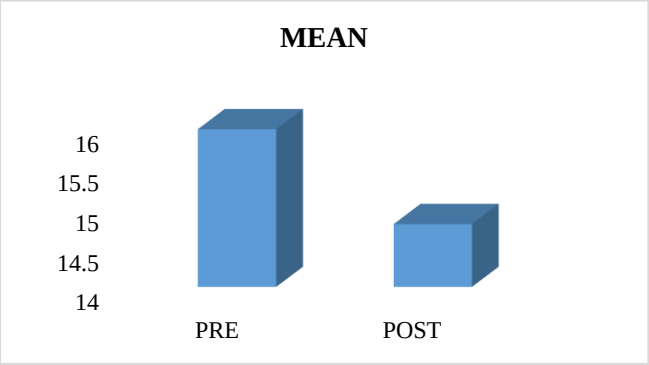
Fig 3: Sprint running with application of kinesio taping

4. Results

The objective of the study was to determine the effectiveness of facilitatory and inhibitory kinesio taping technique in healthy collegiate sprint runners. The data was collected and used to analyze the results. The result for the study was obtained from the run time of the participants. All the patients were screened and evaluated for baseline measurements of dependent variable and all the values were recorded. Participants were evaluated and pre and post run data was recorded. Statistical analysis was carried out utilizing the trial version of Graph Pad Instat software. The data was entered into an excel spread sheet, tabulated and subjected to statistical analysis. Various statistical measures such as mean, standard deviation (S.D.) and test of significance such as Paired 't' test was utilized to analyzed the data.

Table 1: Data representation of run time, pre and post kinesio taping

Participants	Intervention	Mean in sec	SD	p value	t value	Result
30	Pre (Without Tapping)	15.99	1.907	<0.0001	8.889	Considered extremely significant
	Post(With Tapping)	14.79	1.507			



Graph 1: Mean time (in sec) of sprint running

Table 1: The results were concluded to be statistically significant with Mean of pre intervention was 15.99 ±1.904 seconds and post intervention was 14.79±1.507 seconds, $p<0.0001$ very significant. Paired't' test was used to compare the difference between the pre-intervention and post-intervention values within the group.

5. Discussion

Kinesio tape is a high-viscosity, adhesive elastic tape that allows the skin to breathe and is water resistant. Kinesio taping provides constant mechanical/elastic stimulation of the skin, and its effects are transmitted to deeper tissues through mechanoreceptors found in the epidermis and dermis. Kinesio taping may modify the muscle activity and increase force. Kinesio taping is a method of taping utilizing a specialized type of tape by the same name. Kinesio tape is different from traditional white athletic tape, it is elastic and can be stretched to 140% of its original length before being applied to the skin. It subsequently provides a constant pulling (shear) force to the skin which it is applied unlike traditional white athletic tape. The fabric of this specialized tape is air permeable and water resistant and can be worn for at least 3 days. According to Dr Kenzo Kase, the creator of Kinesio tape, these proposed mechanisms may include: - (1) correcting muscle function by strengthening weakened muscles, (2) improving circulation of blood and lymph by eliminating the fluid in tissues or bleeding under the skin by moving the muscle, (3) decreasing pain through neurological suppression and (4) repositioning subluxed joints by relieving abnormal tension in muscle, helping to return the function of fascia and muscles (5) mechanism has been suggested by Murray, which describes Kinesio tape causing an increase in proprioception through increased stimulation to cutaneous mechanoreceptors [8]. Kinesio taping has two techniques: - Facilitatory and Inhibitory.

1. **Facilitatory technique:** Kinesio tape application from muscle origin to insertion produces the stretch response which activates the muscle spindle situated in belly of muscle in perimysium which triggers sensory afferent 1a to spinal cord to activate extra fusal fiber via alpha and gamma motor neuron to cause contraction [9]. A concentric pull on fascia which activates the muscle by increasing muscle contraction. Proprioception is the ability of mechanoreceptors in the body to detect information regarding joint movement position and the perception of these movements by the central nervous system. Studies have reported that taping over the skin stimulates cutaneous mechanoreceptors, therefore it allows more sensory signals to be carried to the central nervous system for integration [9]. This concept underlies our hypotheses stating that proprioception will be enhanced through increased cutaneous feedback supplied from the kinesio tape. Applying pressure and stretching to the skin can stimulate cutaneous mechanoreceptors.
2. **Inhibitory technique:** Kinesio tape application from muscle insertion to origin produces facilitate Golgi tendon organ which is located at musculotendinous junction and eccentric pull on fascia which inhibits overuse of muscle by decreasing muscle contraction. Muscle inhibition applications rest the overuse of muscle [5].

The aim of this study was to see the effect of kinesio taping on run time by facilitating quadriceps and inhibiting hamstrings muscles in college students. The study was done to find out the time difference of runners without kinesio taping and with kinesio taping. Initially the participants were asked to run 100meter sprint without tape and the time was recorded then the kinesio tape was applied. As combination of both the kinesio taping techniques, facilitation and inhibition are used. Kinesio tape was applied 24 hour prior to the study for better effect.

Gerda Strutzenberger1, Joseph Moore2 *et al*. studied on effects of kinesio-taping on performance with respect to fatigue in rugby players which states that Kinesio taping the gluteal muscles could influence performance outcome in tasks requiring high gluteal muscle activities. Even if performance outcome is not affected by the KT, relative hip, knee and ankle joint power production patterns can already change in rested situation but show higher effects after fatigue. The change in power production pattern might be beneficial for the knee in slow SSC, but could impose a higher injury risk for the ankle in tasks requiring fast SSC due to higher relative power contribution [12].

6. Conclusion

In this study, it was concluded that there is a significant improvement in sprint running time after applying kinesio taping on healthy collegiate sprint runners.

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