

EFFICACY OF KINESIO TAPING ALONG WITH DROP SQUAT EXERCISES VERSUS KINESIO TAPING ALONG WITH LEG EXTENSION EXERCISES ON PAIN AND MUSCLE STRENGTH AMONG VOLLEYBALL PLAYERS WITH JUMPER'S KNEE

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ABSTRACT

Background

Jumper's knee is clinically diagnosed condition of activity related to the anterior knee pain associated with tenderness at the inferior pole of the patella where the patellar tendon attaches.

Objective

The study's primary objective was to find out the Efficacy of Kinesio taping along with Drop squat exercises and Kinesio taping along with Leg extension exercises on pain and muscle strength among volleyball players.

Subjects and Methods

A pre-test and post-test experimental study design was used. A criterion based random sampling method was used to recruit players (N=20) diagnosed with Jumper's knee, and they were randomized into two treatment groups. The experimental Group-A received Kinesio taping along with Drop squat exercises whereas those assigned to experimental Group-B received Kinesio taping along with Leg extension exercises for a period of 12 weeks with one session for 5 days in a week. The efficacy of the treatment was measured through the Numerical pain rating scale (NPRS) and Handheld dynamometer (HHD). Both paired and unpaired 't' tests were employed to study the treatment effectiveness. A p-value <0.05 were considered 'significant'.

Result

The Group, which was exposed to the treatment of receiving Kinesio taping along with Dro squat exercises showed a better reduction in pain intensity (mean difference 2.2) and a notable improvement in the muscle strength (mean difference 53.5) than the other Group, that was exposed to the treatment by receiving Kinesio taping along with Leg extension exercises at 0.05 levels of significance.

Conclusion

There is a significant reduction in pain intensity, improvement in muscle strength and overall function of the leg following the application of Kinesio taping along with the Drop squat exercises for a period of 3 months in Jumper's knee players.

Clinical Implications

Application of Kinesio taping is found to produce a significant effect when combined with Drop squat exercises to manage Jumper's knee players.

KEYWORDS: *Jumper's Knee, Kinesio Taping, NPRS Scale, Hand-Held Dynamometer, Drop Squat Exercises, Leg-Extension Exercises.*

Article History

Received: 15 May 2024 | Revised: 31 May 2024 | Accepted: 18 Jun 2024

INTRODUCTION

The term jumper's knee refers to a clinically diagnosed condition of activity related anterior knee pain associated with tenderness at the inferior pole of the patella where the patellar tendon attaches. Jumper's knee is also known as Patellar tendinitis and Patellar tendinopathy^[1]. It is a degenerative condition affecting the patellar tendon resulting in anterior knee pain associated with focal and palpable tenderness at the inferior pole of the patella^[2]. Typically, in jumper's knee the pain and tenderness is present at the lower part of the knee cap, though upper part is affected. Generally, no pain when the person is at rest. Complications may include patellar tendon rupture^[3]. Other conditions that can appear similar include infrapatellar bursitis, chondromalacia patella and patellofemoral syndrome.

Jumper's knee is relatively common with about 14 % of athletes affected; however, research reflects that more than half of athletes with this injury end their careers as a result^{[4][5]}. Numerous conservative and surgical treatments have been recommended for jumper's knee none has provided a highly effective confident cure for this condition^{[6][7]}.

Strengthening exercises have been recommended as a treatment for jumper's knee^{[6][8][9]}.

Repetitive microtrauma to the tendon-bone interface such as in jumper's is the causative factor for patellar tendinitis. Pain is experienced at the patellar tendon which increases with activities which load the quadriceps mechanisms. Jumper's knee is often caused by the overuse or strain on patellar ligament such as frequent jumping on hard surfaces.

Jumper's knee is primarily a condition of relatively young (15-30 years old) athletes especially men, who participates in sports such as basketball, volleyball, high jump, long jump, tennis, and football which require repetitive loading of the patellar tendon. It is an overuse injury from repetitive overloading of the extensor mechanism of the knee. It may be associated with stiff ankle movement and ankle sprains^{[10][11]}.

The prevalence of this condition in elite volleyball players and basketball players has been found to be over 40 percent. While certain intrinsic risk factors for patellar tendinopathy have been identified, such as gender, weight, and body mass index, most significant risk factor appears to be training load.

The overall prevalence of Jumper's knee was 14.2%, with a significant difference between the sports with different performances characteristics (RANGE 0%-45%). The overall prevalence of Jumper's knee was 14% among in elite athletes and that of 45% in volleyball and 32% in basketball players. The highest prevalence in recreational athletes was in volleyball players (14%) and lowest was in soccer players (2.5%). Male athlete had twice the prevalence as female athletes^{[12][13]}.

The patellar ligament joints the patella to shin bone. It is very strong and facilitates straightening the leg by the quadriceps muscles. Quadricep is the muscle which helps the knee to straighten in jumping, running and other movements in which the individual need to be propelled. These muscles stabilize body during landing.

The patellar ligament induces the great deal of the stress during these movements this is especially true when the individual frequently changes direction performs jumping movements or uses the ligaments repeatedly for long periods of time as in running. With the repeated overuse constant inflammation micro tears as well as collagen degeneration may occur ^[14].

The quadriceps muscles are connected to the inferior pole of the patella by the common quadriceps tendon through a sesamoid bone, the patella. The patella (kneecap) is the moveable bone in the front of the knee. This unique bone patella is wrapped inside a tendon that connects the large muscles in front of the thigh, quadriceps.

The patellar ligament then connects the bottom of the patella to the tuberosity. The force generated from the quadriceps muscles acts through the patella as a pulley, causing knee to extend. The large quadriceps muscle ends in a tendon that inserts into the tibia tubercle, a bony bump at the top of the tibia (shin bone) just below the patella. The tendon together with the patella is called the quadriceps mechanism. The quadriceps has two separate tendons, the quadriceps tendon on the top of the patella and infrapatellar tendon. Patellar Tendon is the one of the most powerful Tendon in human body. It is 4 or 5 centimetres long by a little under 3 centimetres wide, and approximately 1 cm thick ^[15]. It can be considered as the part of the extensor apparatus of the knee, made up of the quadriceps muscle, quadriceps tendon, the kneecap and the patellar tendon which goes into tibia. It is a fundamental structure to stand up with the weight of the gravity, to walk, to run and to jump ^{[16][17]}. The patella acts like a Fulcrum to increase the force of the quadriceps muscle.

Tightening of the quadriceps muscles places a pull on the tendon of the quadriceps mechanisms. This action causes the knee to straighten. Jumper's knee is believed to be an overuse injury that is caused by the repetitive stress placed on the patella or the quadriceps tendon during jumping. Pathophysiology of Jumpers knee is the repetitive overload on the knee. The extensor tendons will cause it to weaken progressively, eventually leading to failure. Extension of the knee is performed by the quadriceps. The power of quadriceps is increased by the interposition of the patella within the extensor mechanism. The patella pushes the moment arm of the extensor mechanism anterior to the axis of rotation of the knee ^[18]. Patho-mechanics of the jumper's knee is the tendon is overloaded in landing from a jump. High forces (up-to 14 times body weight) and joint velocities (500 degree/sec) occur in landing ^[19]. Sport involves both high landing forces and repetitive force application and repetition must also be a factor. Most common symptoms of Jumper's knee are pain, tenderness, and stiffness around the joint and pain is occurring with varying intensities. Most frequent site of pain is in proximal insertion of patellar tendon in the lower part of patella, and then at quadriceps tendon and at insertion of the patellar tendon at the tibial tuberosity ^[12].

METHODOLOGY

Study Design

A pre-test and post-test experimental study design was used with two intervention groups to assess the efficacy of Kinesio taping along with drop squat exercises versus Kinesio taping along with leg extension exercises on pain and muscle strength among volleyball players with jumper's knee.

Subjects

All those patients complaining of knee pain visiting the outpatient department of PPG college of physiotherapy, Coimbatore, Tamil Nadu state formed the population for this study. Among them, those patients (N=20) whose job involves repetitive use of the knee movements and are diagnosed with Jumper's knee, were recruited using criterion-based sampling technique. Before the selection all the subjects were examined by the physiotherapist to exclude structural bony abnormalities and degenerative disorders around the lower extremity. The criteria adopted to include the subjects with jumper's knee in male volleyball players aged between 19- 25 years.

Methods

The subjects received a clear explanation in detail about the study procedure and treatment techniques, and then the written informed consent was obtained prior to the pre-test evaluation. All the subjects in each group undergone a patch test to know about the skin allergic reactions to Kinesio taping and Subjects who fulfill the Inclusion criteria were included in this study. After signing the informed consent forms, Subjects are allocated into two groups. After the allocation into the groups: GROUP A received Kinesio tape along with drop squat exercises.

GROUP B received Kinesio tape along with Leg-extension exercises. Both group A and group B were applied Kinesio tape. All the subjects filled the NPRS SCALE score before starting the intervention. 20 Athletes were selected based on the selection criteria by using simple randomized sample technique by slot method. For Group A consists of 10 athletic male subjects and they have received Kinesio tape along with Drop squat exercises. For Group B consists of 10 athletic male subjects was received Kinesio tape along with Leg-extension exercises. The pain intensity and muscle strength values were measured using Numerical pain rating scale and Hand-held dynamometer. After 4 weeks and 12 weeks, post-test values were noted in the two groups, the pre and post score values were documented for Group A and Group B. The demographic characteristics of the subjects are shown in Table 1. All the subjects (N=20) were identical before the application of the selected therapeutic interventions ($p>0.05$). Subjects assigned to the experimental group-I were exposed to Kinesio taping and drop squat exercises whereas those who assigned to group-II were given Kinesio taping and Leg extension exercises. Subjects in both groups were not given any medications during the period of the study. All the interventions were given 12 weeks excluding weekends. In-order to study the efficacy of the therapeutic interventions, 2 outcome parameters were chosen. These include pain intensity measured by the scale Numeric pain rating scale and muscle strength by Handheld dynamometer.

Description of Experimental Interventions KINESIO TAPING

The idea of using Kinesio tape was first presented by DrKenzokas in the 1970s. Kinesio tape is an alternative taping technique theorized to be an effective treatment to improve physiological problems based on functions of the tape. Kinesio tape helps in pain management, soft tissue injury, tissues and joints malalignment, oedema, activation of circulation, correcting of direction of movement, increasing stability, supports the function of joints by stimulating proprioceptors^[20]

Drop Squats Exercises

It is the dynamic movement. The squat movement pattern is arguably one of the most primal and critical fundamental movements necessary to improve sport performances, to reduce injury risk and to support life-long physical activity. Squats exercises improves balance and posture, prevent injuries, increase metabolism, strengthen core.

Leg Extension Exercises

It is a resistance weight training exercise that targets the quadriceps muscles. The exercise consists of bending the leg at the knee and extending the legs, then lowering them back to the original position

STATICAL ANALYSIS

Results

The demographic presentation of the subjects is shown in table 1. The experimental group 1 and group 2 consisted of 10 male volleyball players in each group. The mean age was of 19-25 years old. The mean duration of pain for experimental groups was for 12 weeks. The Group, which was exposed to the treatment of receiving Kinesio taping along with Dro squat exercises showed a better reduction in pain intensity (mean difference 2.2) and a notable improvement in the muscle strength (mean difference 53.5) than the other Group, that was exposed to the treatment by receiving Kinesio taping along with Leg extension exercises at 0.05 levels of significance.

Demographic Data

Table 1: Demographic Data

VARIABLES	GROUP A	GROUP B
AGE	19 – 25 years	19 – 25 years
GENDER	10 males	10 males
DURATION	3 months	3 months

Table 2: Between Group Analysis of NPRS Scale

TEST	GROUP	MEAN	SD
PRETEST	GROUP A	5	0.48
	GROUP B	5	0.48
POSTTEST	GROUP A	2.2	0.36
	GROUP B	3.4	0.1

The mean and standard deviation of pre-test score in Group-A were 5 and 0.48. The mean and standard deviation values of pre-test score in Group-B were 5 and 0.48. The calculated t value and table t value were 0 and 2.101. The obtained t value is lesser than the table t value at the significant level of $p > 0.05$. Hence the statistical report states that there was no significant difference in pre-pre comparison. The mean and standard deviation of post-test scores in Group-A were 2.2 and 0.36. The mean and standard deviation values of post-test score in Group-B were 3.4 and 0.1. The calculated t value and table t value were 4.68 and 2.101. The obtained t value is greater than the table t value at the significant level of $p < 0.05$. Hence the statistical report states that there were significant differences in post-post comparison.

Table 3: Between Group Analysis of Hand-Held Dynamometer

TEST	GROUP	MEAN	SD
PRE-TEST	GROUP A	40.9	0.42
	GROUP B	41.5	1.18
POST-TEST	GROUP A	53.5	0.48
	GROUP B	49.1	0.42

The mean and standard deviation of pre-test scores in Group-A were 40.9 and 0.42. The mean and standard deviation values of pre-test score in Group-B were 41.5 and 1.18. The calculated t value and table t value were 0.93 and 2.101. The obtained t value is lesser than the table t value at the significant level of $p > 0.05$. Hence the statistical report states that there was no significant difference in pre-pre comparison.

The mean and standard deviation of post-test scores in Group-A were 53.5 and 0.48. The mean and standard deviation values of post-test score in Group-B were 49.1 and 0.42. The calculated t value and table t value were 9.07 and 2.101. The obtained t value is greater than the table t value at the significant level of $p < 0.05$. Hence the statistical report states that there were significant differences in post-post comparison.

DISCUSSION

Jumper's knee is an injury to the tissue that connects the kneecap to the shin bone (patellar tendon). It is a condition characterised by the inflammation of the patellar tendon.

It is caused due to repetitive jumping or running. The present study has demonstrated the Effectiveness of Kinesio taping along with Drop squat exercise versus Kinesio taping along with Leg extension exercise on pain and muscle strength among players with

Jumper's knee. 20 subjects with jumper's knee were selected based on selection criteria. The subjects received interventions for 12 weeks. The outcome measures were evaluated by NPRS scale and Hand-held dynamometer. The following articles also support the result of the present study. Jason Brummett, et al (2019) conducted study on "Prevalence of jumper's knee and patellar tendon abnormality in male collegiate basketball players: cross sectional study. 95 male collegiate basketball players aged 20 years. Out of these 95 participants 53 participants that is 55.8% did not present pain during palpation or ultrasonographic evidence of PTA. 32 basketball players that is 33.7% displayed ultrasonographic evidence of PTA in at least 1 knee; 20 of those athletes that 21.1% had pain and tendon abnormality. And they concluded that the prevalence of jumper's knee has been reported to be as high as 32% in elite male basketball players and has high 50% in high level male volleyball players. p g kumar, et al.,

(2020) conducted a study on "comparison between the effectiveness of decline squat exercise and forward lunges in athletes with patellar tendinopathy". The study was a randomized clinical trial consisting of 30 basketball players with clinically diagnosed and imaging confirmed with patellar tendinopathy. They were randomly assigned into two groups consisting of 15 in each group. And they concluded that Both exercise protocols alleviate pain and sporting functions in basketball players over 4 weeks. This study shows that the decline squat exercise protocol shows higher clinical gains during the rehabilitation of patellar tendinopathy in athletes. Michaelmassei, et al., (2015) conducted a study on "The effect of Therapeutic taping on Pain, range of motion, power, balance, and strength in athletes and nonathletes with and without acute jumper's knee". Three females with acute jumper's knee and five non-athletes (3 male and 2 females) without participated in this preliminary study. Five dependent variables were examined including pain, Range of motion, power, balance, and strength. Overall, non-parametric statistics revealed no significant differences during the assessment of pain, ROM, power, balance, and strength. Therapeutic taping has minimal effect on varsity athletes and non-athletes with and without acute patellar. They have concluded that the application of therapeutic tape and its effect on pain. Vithoulkas, et al., (2010) conducted a study on the "Effects of Kinesio taping on quadriceps strength during isokinetic exercises in healthy nonathletic women", Purpose of the study was to investigate the effect of Kinesio taping on quadriceps strength at

maximum concentric and eccentric isokinetic exercises mode in healthy non-athletic women in order to examine the Kinesio taping effect in increasing or decreasing the muscular quadriceps strength. They concluded the results suggest that the application of Kinesio taping on the anterior surface of thigh, in the direction vastusmedialis, lateralis and rectus femoris fascia, could increase the eccentric muscle strength in healthy adults. The result of the study showed that Kinesio taping along Drop squat exercise was more beneficial in reducing pain and improving the muscle strength among volleyball players with jumper's knee. Statistical analysis is also an Evidence for the significant improvement, there by the alternative hypothesis is accepted. The positive outcome of this study is due to the following mentioned mechanism. KT has physiological effects such as reducing pain or abnormal sensation, promoting drainage of the blood and lymphatic fluid under the skin and correcting the joint arrangement. Leg extension exercises strengthen quadriceps muscles. The primary function of the patella is to increase the lever arm of the extensor mechanism around the knee, improving the efficiency of the quadriceps contractions. Drop squat exercises helps to improve the strength of quadriceps muscle, hamstring muscles and gluteal muscles and strengthens the knee. It helps to improve body balance and prevent injuries. It is a close chain movement, requiring simultaneous extension patterns of the ankle, knee, and hip joints. This study was a comparative study, 20 athletes aged between 19 -25 years with jumper's knee were selected for this study using slot method. Subjects were divided to two groups, Group A and B with 10 subjects in each group. Subjects in group A received Kinesio taping along with drop squat exercises and group B subjects received Kinesio taping along with leg extension exercises. Treatment duration for both groups were of 12 weeks with one session for 5 days in a week. The pre-test and post-test values of pain and muscle strength were measured with Numerical Pain Rating scale (NPRS) and Hand-held dynamometer.

The statistical analysis showed that the calculated 't' value using the paired 't' test in Group A and B for pain were 21.56 and 7.31, respectively which was greater than the table t value of 2.262 with $p>0.05$. When comparing between the group using unpaired 't' test, the calculated 't' value of post-post comparison of the pain was 4.68, which was greater than the table 't' value of 2.101 with $p<0.05$.

The statistical analysis showed that the calculated 't' value using the paired 't' test in Group A and B for muscle strength were 26.19 and 10.81, respectively which was greater than the table t value of 2.262 with $p>0.05$. When comparing between the group using unpaired 't' test, the calculated 't' value of post-post comparison of muscle strength was 9.07, which was greater than the table 't' value of 2.101 with $p<0.05$. Thus, the resultant of this study shows that there were improvements in muscle strength and reduction in pain both Groups eventually, but Group A (Kinesio taping along with Drop squat exercises) showed more statistically significant improvements in muscle strength and reduction in pain when compared to Group B (Kinesio taping along with Leg extension exercises).

LIMITATIONS

- The participants selected for this study were only male athletes.
- This study was limited to a particular age group.
- The study has been conducted with small sample size.
- This study was limited to particular players.

CONCLUSION

Thus, the study concluded that, both the Groups showed statistically significant improvement in muscle strength and reduction in pain after the application of Kinesio taping along with Drop squat exercises for Group A Kinesio taping along Leg extension exercises for Group B for a period of 3 months. But Group A (Kinesio taping along with Drop squat exercises) showed more significant improvements in muscle strength and reduction in pain than Group B (Kinesio taping along with Leg extension exercises).

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