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The effect of kinesiology taping on knee loading line

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Physiotherapy

Background: Knee loading line and the alterations to it are factors that might influence the risk for injuries. Single-leg mini squat is a test that can be performed to measure the loading line. Using kinesiotape while performing the test we can find out whether it has an effect on the control of movement and control of the loading line.

Method: 7 healthy physiotherapy students were recruited for the testing. All participants performed 5 single-leg mini squats with and without the kinesiotaping method being applied to the lower limb. The performances of all participants were recorded with a smart phone camera and the videos were analyzed afterwards with a goniometer app.

Results: The kinesiotape had small positive effect on the Q-angle indicating increased consistency and control of movement. The kinesiotape had larger positive effect on mechanical axis of the lower limb indicating increased control of the lower extremity and less movement towards valgus position.

Conclusion: Kinesiotape when applied to the lower extremity has a positive effect on the lower extremity loading line and control of movement.

Keywords

kinesiology taping, proprioception, knee, single leg mini squat, loading line

CONTENTS

LIST OF SYMBOLS AND TERMS (NOT COMPULSORY)

ACL = Anterior Cruciate Ligament

LCL = Lateral Collateral Ligament

MCL = Medial Collateral Ligament

PCL = Posterior Cruciate Ligament

Q-angle = Quadriceps Angle

1 INTRODUCTION

Kinesiotaping (KT) has become more popular and shown growth on public interest and scientific research during the last 10 years. KT has a variety of ways to be used as a modality in different rehabilitation specialists in variety of different programs. (Walsh, Joe, 2018.)

Knee joint is one of the largest and most complex joints in the human body and it is one of the main factors and joints in the function of the lower extremity in multiple directions. The muscles controlling the knee joint play an important role in controlling the lower limb loading line and mechanical axis. (Tortora & Derrickson, 2017.)

Limb loading line and the control of movement due to altered muscle function may influence the risk of knee injuries. The control of this movement is something people are performing on a daily basis in activities such as ascending the stairs for example. Due to this the limb loading line and mechanical axis can be measured by using the single-leg mini squat test as it is easy to set up and perform and it resembles the conditions of daily living. (Ageberg et al., 2010.)

This Thesis was made for a company called RockTape. In this Thesis we we performed tests for the physiotherapy students of the Satakunta's University of Applied Sciences. With the tests we are trying to find if applying kinesiotape has an effect on the client's knee loading line during single leg mini squat.

2 KINESIOTAPE

The kinesiotaping method and its claim as a therapeutic tool has been studied widely. The kinesiotape has been claimed to enhance performance and be used as a treatment method in a variety of different medical conditions varying from orthopedic conditions all the way to neurological conditions. (Kase et al., 2016.)

The RockTape KT is made from 97% cotton and 3% nylon. The glue that attaches the tape to the skin is acrylic based and allergy tested. It does not contain medical chemicals, latex, or zinc. It can be longitudinally stretched to 180% length from its resting length (RockTape, 2022)

2.1 History of kinesiotaping

Kinesiological taping and the Kinesio Taping Method was developed in the 1970's by Dr. Kenzo Kase to fill the void in the treatment options available at that time. Dr. Kenzo Kase was trying to find a way to facilitate the body's natural healing process and prolong the benefits of his treatment. In 1973 the goal was to design a tape and taping method that would support the joints and muscles without limiting the range of motion like the normal hard sports tape would. (Kinesio UK, 2022.)

It took Dr. Kenzo Kase two years of researching of muscle taping, tape elasticity and adhesiveness to come up with KinesioTape. Ever since the kinesiotape and kinesiotaping has gained more attraction in communities. It gained attraction for the first time at the Seoul Olympics in 1988 and from there it exploded into the world of athletes and health care professionals. (Kinesio UK, 2022.)

2.2 Properties and methods of kinesiotaping

Kinesiotapes can have different properties based on the person it is being applied to or the intended use of the tape. The basic properties of kinesiotape are that the tape is made from cotton, can be longitudinally stretched to 140+ % from its resting length, and uses an adhesive for contact. These properties can change a bit based on the type of tape for example, the adhesive can be a bit milder if the skin of the person the tape is being applied to is very thin, or it may be a bit stronger if the person is in contact with water a lot. (RockTape, 2022.)

Contraindications for kinesiotape method includes taping areas that have active open wounds or acute infections due to the properties of kinesiotape and the adhesive. Deep vein thrombosis and any malignancy are also considered as contraindications to kinesiotape. Severe allergy and allergy to the adhesive are also considered as contraindications. Taping a person with diabetes should be done with caution due to possible loss of sensory feedback. The possible allergic reactions for kinesiotape can be tested by applying a small piece of kinesiotape to the person's skin and letting it be there for 15 minutes. (Wu et al., 2015.)

Kinesiotape can be applied in many ways depending on purpose of the treatment. Basic and correctional techniques are techniques that affect different things. Basic techniques can be used for inhibition and stimulation of a muscle. Kinesiotape can be applied with a slight tension using approximately 15%-25% of the maximum tension on the painful area from the insertion of the muscle to the origin of the same muscle. When the goal is to try and stimulate a weakened muscle the tension of the tape is approximately 15%.35% out of the maximum tension from the origin of the muscle to it's insertion. Whichever the goal is the muscle should be positioned on its maximal length. (Pyšný et al., 2015.)

Neuromuscular taping works by passive stretching through the application of the tape. with eccentric techniques the tape encourages flexibility and coordination and increasing range of movement in patients who are suffering with lack of muscle coordination. The neuromuscular taping has been claimed that the effects of the taping might be due to the sensorimotor and proprioceptive feedback mechanisms being modified. (Galli, 2015.)

2.3 Effects of kinesiotaping

Kinesio Taping theory is based on the neurophysiological mechanisms and the effect of mechanical stimuli on various systems in the body. It has different effects on skin, fascia and lymphatic system depending on the stretch of the tape. When applied on low amount of stretch on the skin it changes the concentration and density of the tissue in dermis and epidermis. This produces pressure and stretch on the skin that may

stimulate mechanoreceptors. The tension of the tape and the stretch changes the tension elements in the tissue encouraging homeostasis. This tension releases the fascia from any movement limitations. (Wu et al., 2015).

In athletes the tape can be used as preventative or rehabilitative ways. This allows the athlete to keep on training and competing while their injuries are healing. This is because of kinesiotaping on pain reduction and also the increased and enhanced muscular and joint range of motions. Kinesiotape also assists in proprioception and provides anatomical support. The tape can be used in different degrees of stretch depending on the desired effect as already demonstrated earlier. (Kase et al., 2003.)

Kinesiotape has shown to be a good short-term option for pain relief, increasing knee joint flexion and lower extremity functions in patients with osteoarthritis (Baskurt et. al., 2017). A study was made to find out whether kinesiotape has an effect on balance, proprioception and functional performance by using the Biodex Balance System, and four hop tests. The study found no significant differences after the application of kinesiotape to the gastrocnemius muscle (Duris et al., 2016). Study done in 2016 found out that kinesiotape has an effect on maximum grip strength increase in healthy adults. The has been systematic reviews done regarding the effectiveness of kinesiotape when it comes to management and prevention of sports injuries. A systematic review was conducted that found out an immediate pain reduction when applied and another review had slight improvements in muscle activity and movements. (Wilson & Bialocerkowski, 2015.)

3 KNEE JOINT

The knee joint is constructed by four bones, multiple ligaments, and many muscles. It is the largest and one of the most complex joints of the human body. The knee joint is a modified hinge joint, that has three joints within a single synovial joint. The knee joint's main movements are flexion and extension. Even though the main movement

is flexion and extension, the knee joint allows a small degree of medial and lateral rotation. (Tortora & Derrickson, 2017.)

3.1 Bones of the knee

The knee joint is constructed by four bones which are the femur which is the thigh bone, tibia which is the shin bone, and patella which is the kneecap. The fourth bone is the fibula which runs alongside the tibia but is not directly involved in the knee joint. On the other hand, the fibula acts as an important attachment point to multiple important muscles and ligaments as seen in figure 1. (Tortora & Derrickson, 2017.)

Femur is the largest bone of the lower extremity and it's located superiorly to the knee joint. The tibia can be located inferiorly to the knee joint. These two bones provide the articular surfaces in the knee joint for the cruciate ligaments. The patella is located most superficially to the knee joint. The fibula runs laterally to the tibial bone and offers an attachment point for the lateral collateral ligament as seen in figure 1 and 2. (Tortora & Derrickson, 2017.)

Figure 1. Bones of the knee. (Shelbourne knee center, 2022.)

3.2 Knee ligaments and articular discs

Knee ligaments have several important functions on the knee joint. They work as a shock absorber, connects the femur to the fibula and tibia, stabilizes the knee and keeps it in the correct place by preventing twisting, and keeps the knee from moving in unnatural ways and directions. The main types of ligaments in the knee are collateral ligaments and cruciate ligaments. (Tortora & Derrickson, 2017.)

Collateral ligaments are located at the lateral (Lateral Collateral Ligament also known as the LCL) and medial (Medial Collateral Ligament also known as the MCL). The LCL connects the femur bone to the fibular bone and the MCL connects the femur bone to the tibial bone as seen in figure 2. (Tortora & Derrickson, 2017.)

Each knee has two cruciate ligaments, the ACL (Anterior Cruciate Ligament) and the PCL (Posterior Cruciate Ligament). These ligaments control the knee's movements in posterior and anterior directions. The PCL is located behind the ACL and they make a X-shaped cross between the femur bone and the fibula and tibia. The ligaments also connect the thigh – and calf bones into each other. (Tortora & Derrickson, 2017.)

Articular discs also known as menisci are two fibrocartilage discs inside the joint space between the tibial and femoral condyles that help compensate for the irregular shapes of the condyles. They work as a shock absorber and help circulate synovial fluid. (Tortora & Derrickson, 2017.)

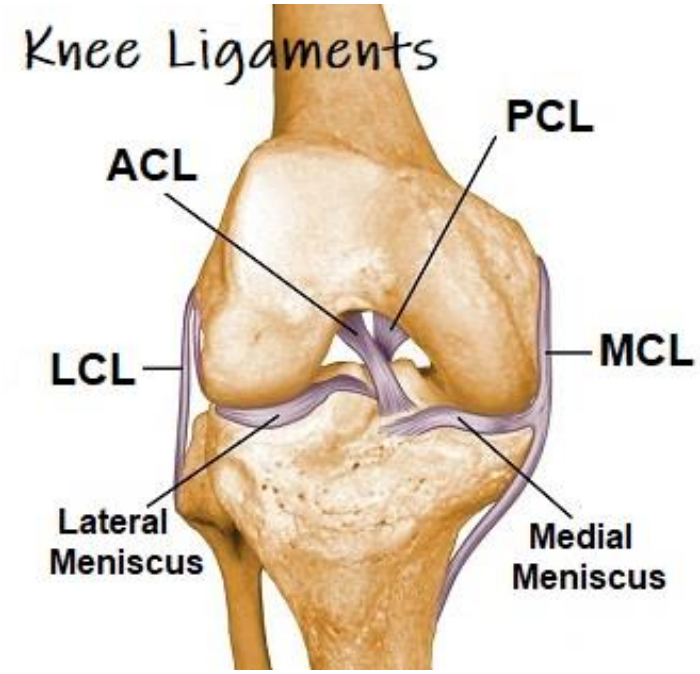


Figure 2. Ligaments of the knee. (Wilson, 2022)

3.3 Muscles associated with knee joint

There are multiple important muscles involved in the movements of the knee joint that can be found from table 1 and 2. The main muscles can be divided into regions based on their location.

The posterior compartment involves the hamstring muscles, which are mainly working on flexion direction movements. The anterior compartment of the knee has muscles that mainly works in extension direction of the knee joint, these are also known as the quadriceps muscles. There are a few muscles that are weakly involved in the movements of the knee joint such as the gracilis muscle and the sartorius muscle. (Tortora & Derrickson, 2017.)

Table.1 Anterior compartment of the knee muscles. (Tortora & Derrickson, 2017.)

Anterior compartment	Origin	Insertion	Action
Rectus femoris	Anterior inferior iliac spine	Patella through quadriceps tendon and then tibial tuberosity through patellar ligament.	Extension of the knee joint, also works in flexing the hip joint.
Vastus lateralis	Greater trochanter and linea aspera of femur.	Patella through quadriceps tendon and then tibial tuberosity through patellar ligament.	Extension of the knee joint.
Vastus medialis	Linea aspera of femur.	Patella through quadriceps tendon and then tibial tuberosity through patellar ligament.	Extension of the knee joint.
Vastus intermedius	Anterior and lateral surfaces of body of femur.	Patella through quadriceps tendon and then tibial tuberosity through patellar ligament.	Extension of the knee joint.
Sartorius	Anterior superior iliac spine.	Medial surface of body of tibia	Weakly flexes the knee joint, works in movements of the hip joint.

Table 2. Posterior compartment of the knee. (Tortora & Derrickson, 2017.)

Posterior compartment	Origin	Insertion	Action

Biceps femoris	Long head arises from ischial tuberosity; short head arises from linea aspera of femur.	Head of fibula and lateral condyle of tibia.	Flexes leg at knee joint and extends thigh at hip joint
Semitendinosus	Ischial tuberosity	Proximal part of medial surface of shaft of tibia.	Flexes leg at knee joint and extends thigh at hip joint
Semimembranosus	Ischial tuberosity	Medial condyle of tibia	Flexes leg at knee joint and extends thigh at hip joint

4 LOWER EXTREMITY LOADING LINE

Limb loading in this test is characterized by the control of movement, medio-lateral motion of the knee, and the quadriceps angle of the lower limb during the performance of the single-leg mini squat. The load bearing axis of the lower limb can be presented by a line extending from the femoral head center to ankle joint center. Varus and valgus are types of knee alignments where in varus knee the line passes medial to the center of the knee thus increasing force across the medial tibiofemoral compartment of the knee. In valgus knee the line passes lateral to the knee center thus increasing force across the lateral compartment of the knee. (Sharma et al., 2010.)

4.1 Frontal plane knee alignment and mechanical axis

Frontal plane knee alignment is an important knee motion when it comes to injuries and experiencing pain such as patellofemoral pain. Altered frontal plane knee alignment during activities such as single-leg squats, hop landings or running is often expressed as “dynamic knee valgus”. Dynamic knee valgus is characterized by the

knee being excessively abducted and it is usually combined with femoral adduction and internal rotation. (Gwynne et al., 2014.)

The mechanical axis of the lower extremity is drawn by using a line from the center of the femoral head to the center of the ankle. This line's physiological position runs to the center of the knee as seen in figure 3. The line runs on average from 2 to 6mm from the to the center of the knee and any possible measured deviation from this physiological range is an indication of a varus or a valgus knee alignment; valgus if the line runs laterally to the center of the knee or valgus if the line runs medially to the knee. (Marques Luís & Varatojo, 2021.)

Figure 3. Mechanical axis of the lower limb. (Marques Luís & Varatojo, 2021.)

4.2 Quadriceps angle

The Q-angle (Quadriceps angle) is formed between the patellar tendon and the quadriceps muscles as seen in figure 4. The Q-angle is considered to be clinically important measurement that shows the effect of the quadriceps muscles on the knee from a biomechanical perspective. The Q-angle can is used as one assessment parameter to many knee-related problems. (Khasawneh et al., 2019.)

When assessed, correctly the Q-angle can provide good information about the alignment and angles of the hip, knee, and foot. The normal Q-angle should fall somewhere between 12-20 degrees while the males are usually on the lower end of the number and females at the higher end of the number. (Khasawneh et al., 2019.)

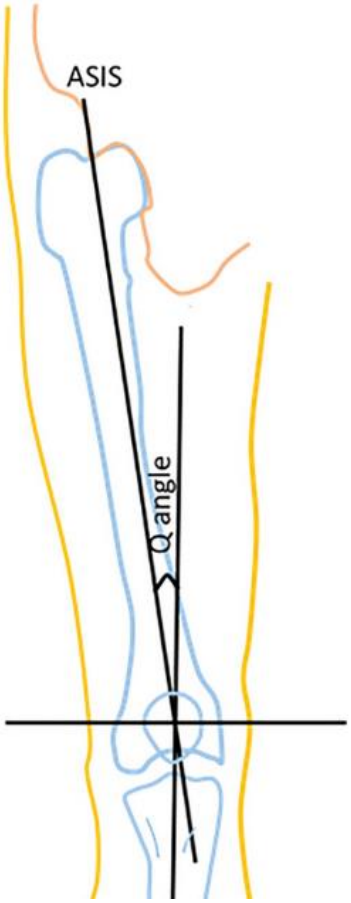


Figure 4. Q-angle. (Khasawneh et al., 2019)

5 SINGLE LEG MINI SQUAT AS A TEST

Single leg mini squat is a clinical test that is used to measure lower limb function on individuals. It resembles conditions of daily life in many ways and can be used to assess quality of movement. The movement is performed by standing on one leg and performing a small single leg squat. The participant should not bend from the hips and

flexing the knee by squatting to approximately 50 degrees of flexion. (Ageberg et al., 2010.)

There is some evidence that the kinematic patterns for example in the single leg squat especially related to the knee function and movement in weight bearing activities, are characteristic of some musculoskeletal conditions and can be related to increased risk on lower extremity injuries. Increases in knee valgus in a functional task like the single leg squat is an important risk factor in an ACL injury without contact. The single leg squat is known as a simple method to identify clinically abnormal movement patterns in the lower extremity. (Weeks et al., 2012.)

A study was conducted to find out about the validity and reliability of single leg squat test among females. They study found out that the validity depends on the squat depth, stance and the presence of dynamic knee valgus. However, the test provides the clinician an useful tool that is not expensive and readily available and it can be used to asses knee motions during the single leg squat. The test is a very common tool used by clinicians, but more studies need to be made to assess the reliability and validity of the test. (Jamaludin et al., 2022.)

6 AIM AND OBJECTIVES OF THE THESIS

The aim of the thesis is to find out if kinesiotape affects knee loading line while performing single leg mini squat when applied. To achieve this aim, I will conduct a testing session for physiotherapy students, analyze the data gathered from the testing sessions and writing the results to this thesis.

The research question is: How does kinesiotaping affect the loading line of a knee while single leg mini squatting on a healthy physiotherapy student?

7 THESIS PROCESS

The research permit was applied to and signed by all parties. The testing session, invitations and data collection was planned beforehand, and the theory part of the thesis was ongoing. The date for the testing session was decided to be the 2nd of November and the location was set to be in a school classroom.

7.1 Schedule

The thesis process was started at the end of 2021, and the thesis plan was presented at the same time. Theory part was written throughout then end of 2021 and throughout 2022. Research permit for the testing session was applied and granted during the autumn of 2022. Invitations were sent to the participants at the end of October. The tests were conducted at the beginning of November.

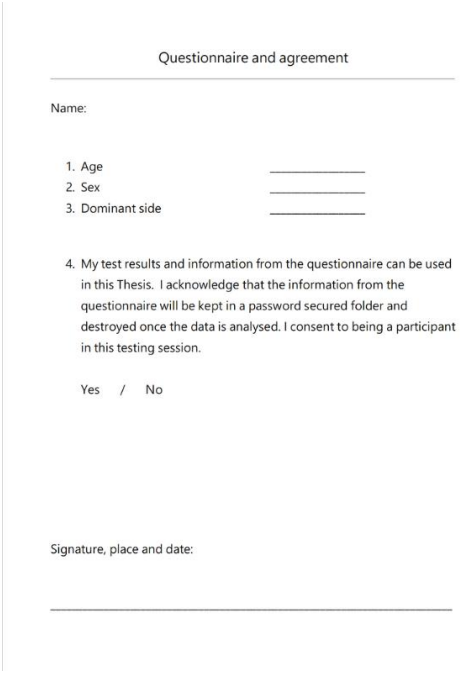
Thesis was finished during November and presented on the 22nd of November. The schedule was hectic at the end of the year, but it was manageable.

7.2 Invitations

The invitation was made in the Autumn. The invitations were sent to the class PH2022 which is the first-year physiotherapy class. The invitations were for a testing session that included measurements of knee loading line with and without kinesiotape. I got 7 responses to the invitations, from which all 7 were eligible for the testing session by having no acute injuries, allergies for tape and they were healthy physiotherapy students.

The participants were told about the test and procedures very vaguely. They participants were told to prepare by having appropriate clothing. Before the test the participants answered a pre-test questionnaire seen in figure 5, that found out the sex, dominant side, age and an agreement of usage of the data material gathered from the

testing session in the thesis. All 7 participants filled out the forms and agreed for the data usage. The participants were told that the data will only be seen by me and it will be kept in a password protected folder and terminated once the data is analyzed.



Questionnaire and agreement

Name:

1. Age _____
2. Sex _____
3. Dominant side _____

4. My test results and information from the questionnaire can be used in this Thesis. I acknowledge that the information from the questionnaire will be kept in a password secured folder and destroyed once the data is analysed. I consent to being a participant in this testing session.

   Yes / No

Signature, place and date:

_____

Figure 5. Pre-testing questionnaire.

7.3 Practical implementation of the testing

The testing sessions were held 2nd of November at school in a classroom. The room was set up by adding a tape 1 meter away from a white wall and having a camera stand 1,5 meters from the tape and the mobile phone was held by the stand at 80cm from the ground. This allowed for a good view on the lower extremity from hip down and the markers were visible during the whole movement.

The participants came in one by one. The test session started with a questionnaire to find out the age, sex, dominant side and the approval of using and analyzing the data for the thesis. All 7 participants filled the questionnaire. From the 7 participants 1 was male and 6 were females. All 7 participants reported right side to be the dominant side. The participants were asked to be in either underwear or shorts to be able to put the markers visibly. The participants were asked to remove the sock from the dominant lower extremity that was performing the single leg mini squat. Instructions were given

on how to perform the single leg mini squat and the participants were able to practice it 5 times before the test was started.

The first 5 repetitions of the actual test were recorded by a camera. The markers were set on the head of femur, middle point of the knee and middle point of the ankle. The repetitions were made without the kinesiotape applied on the lower extremity. The participants made the 5 repetitions on their own speed and after that the video was stopped.

After the first part of the testing the kinesiotape would be applied to the dominant lower extremity. After the tape was applied the participants were asked to go in front of the camera again and behind the tape marked on the floor. The participants were asked to perform 5 single leg mini squats with the same instructions as in the first part of the test. After the repetitions the video was stopped, and the test was officially done.

7.4 Spiral tape

Spiral tape was applied by having the participant sit on a chair and having the sock removed from the dominant leg. The first end of the tape was first attached to the lateral side of the foot and from there wrapped around the sole as seen in figure 6. The participant would then stand up kinesiotape was applied to the lower extremity by using a spiral taping technique from the sole of the foot all the way up to the lateral aspect of the hip of the dominant side. During this part the participant would have their dominant lower extremity to be internally rotated from the hip and the rest of the tape was applied by the spiral taping technique by using two laps around the lower extremity from the sole to the lateral aspect of the hip.

Figure 6. Spiral tape.

Using this method, we are tried to see whether the style has an effect on the dominant lower extremity while we tried to guide the dominant lower extremity to more internal rotation from the hip due to sensory and mechanical output of the tape to help the knee from moving to a valgus position during the single leg mini squat. This style was chosen due to valgus position being the more common direction in lack of movement control during the squat as already discussed.

8 RESULTS

The test was conducted by performing the single leg mini squat 5 times with and without the kinesiotape being applied to the lower extremity. The results were put into an Excel file from which they were analyzed by median difference in degrees in Q-angle and loading line as well as peak values in highest and lowest degree values from the single leg squats performed.

8.1 Results in Q-angle

The Q-angles were measured on the bottom end of the range of movement in the single leg squat. Out of 7 participants the median value of the difference in highest and lowest value of degree in the Q-angle without the kinesiotape being applied to the lower extremity while performing the squat was 1,9 degrees of difference in the angle. as seen in table 2.

Table 2. Median difference in Q-angle with no kinesiotape.

Highest	Lowest	Difference	Median
12,50	10,70	1,80	
13,90	11,00	2,90	
13,20	11,30	1,90	
12,00	10,20	1,80	
13,60	11,10	2,50	
12,00	11,10	0,90	
15,40	13,20	2,20	1,90

The Q-angle measured at the bottom of the range of movement in a single leg squat with kinesiotape applied was measured the same way and the same values were introduced into a table. The median difference in the highest and lowest Q-angle was 1,2 degrees as seen in table 3. The reduction in the median variance of the Q-angle through 5 repetitions of the single leg mini squat came down to be 1,9 degrees with the kinesiotape added and 1,2 degrees with the kinesiotape indicating more control and less variance in movement in Q-angle while performing the movement by, on median, 0,7 degrees. The number is not very significant but indicates some improvement and effect got from the kinesiotape.

Table 3. Median difference in Q-angle with kinesiotape applied.

Highest	Lowest	Difference	Median
11,80	10,10	1,70	
15,00	13,00	2,00	
12,30	11,70	0,60	
13,20	12,00	1,20	
12,90	11,70	1,20	
13,10	12,00	1,10	
15,50	13,60	1,90	1,20

8.2 Results in mechanical axis and loading line.

The loading line and mechanical axis was measured by using three markers on the participants lower extremity on the center of ankle, center area of the knee and the head of femur. This line represents the loading line. The line was measured once before the movement started when the participant was on a single leg weight bearing position. The loading line was measured at the bottom part of the movement and the values of the pre-squat line, and the bottom of the arch line were measured with each other to find the highest and lowest degree of values and the median value of the differences.

Without the kinesiotape added to the lower extremity the median of the highest degree of value in a single leg mini squat was 3,8 degrees. The median value of the lowest degree was 0,6 degrees. The median value of the difference between the highest and the lowest value of degree in during the 5 repetitions was 3 degrees as seen in table 4.

Table 4. Values of the loading line without kinesiotape.

	Highest	Lowest	Difference
	5,80	2,70	3,10
	2,60	0,30	2,30
	3,80	1,90	1,90
	3,20	0,20	3,00
	5,60	0,60	5,00
	0,50	0,20	0,30
	10,50	1,70	8,80
Mediaani	**3,80**	**0,60**	**3,00**

With the kinesiotape added to the lower extremity the median of the highest number of degrees in the single leg mini squat in the bottom of the range of motion was 1,9 degrees. The median value of the lowest number of degrees in the same situation was 0,3 degrees. The median value of the difference between the highest and the lowest number of degrees in loading line while performing the movement was 1,3 degrees as seen in table 5.

Table 5. Values of the loading line with the kinesiotape.

	Highest	Lowest	Difference
	4,80	0,20	3,60
	2,00	0,10	1,90
	1,90	0,70	1,20
	0,70	0,30	0,40
	1,90	0,60	1,30
	0,50	0,10	0,40
	8,20	2,30	5,90
Mediaani	**1,90**	**0,30**	**1,30**

The differences in the values of the mechanical axis and the loading line the differences were a bit more significant even though the values are fairly small. The median values of the highest number of degrees the loading line was changing in were shown to be twice as less in the highest number and the lowest number of degrees in the bottom position of the single leg mini squat by the number without kinesiotape being 3,8 degrees of movement internally compared to the 1,9 degrees of movement internally with the kinesiotape being applied to the lower extremity as seen in tables 4 and 5.

The median difference in the difference of the highest and lowest number of degrees of movement in performing the single leg mini squat was shown to be 1,7 degrees less with kinesiotape applied being 1,3 degrees in median and without kinesiotape the median difference was 3 degrees. This number was the most significant when it comes to all the data gathered from the testing period.

9 CONCLUSION

Based on the results and numbers from the testing session there is a slight increase in control of the movement when it comes to performing a single leg mini squat while having a spiral tape added to the lower extremity. The difference in values were small in an overall picture considering the participants were healthy physiotherapy students.

However, the results show that there are improvements in control throughout the repetitions as seen from comparing tables 2 and 3 as well as tables 4 and 5.

The original research question of my thesis was: “How does kinesiotaping affect the loading line of a knee while single leg mini squatting on a healthy physiotherapy student?” and the answer to that question based on the testing and results is that kinesiotape when added to lower limb has a positive effect on improving the control of the mechanical axis and the loading line when applied to a healthy physiotherapy student.

10 DISCUSSION

The testing session provided some information on the possible effects the spiral style kinesiotape might have on the loading line while added to a healthy physiotherapy student.

10.1 Limitations of the study.

In this study and thesis there are some limitations when it comes to the implementation and conducting the testing. As I was working alone on this everything done data wise was done by me. Analyzing statistics and the material I gathered is always better done with someone else as it provides a better quality and reliability. Although the markers in the videos are visible and thus helped with the analysis it’s always a bit prone to error when done alone and carefully. The results came through a careful and specific analysis, so the margin of error is quite small.

This study had 7 participants and the requirements were quite specific in a sense that it was a healthy physiotherapy student. The number of participants and the state of the participants does not directly correlate to populations with musculoskeletal and neurological diseases and limitations for example thus the subject needs more studies

to be done. In this case it had good outcomes even if the number of participants was quite low. The expectations of physiotherapy students usually being the more active population could also have an effect if compared to possibly choosing a different field of study in the same building and using those students to conduct the same study.

10.2 Further implementation

The design and topic of this thesis can be researched further by using different populations to find out better how the kinesiotape affects the loading line in a single leg mini squat. Using different age groups, different conditions such as musculoskeletal or neurologic conditions could provide good information about the reliability and effectiveness of kinesiotape as a supportive treatment tool for clinicians to use. The method can be tried out by the company to see whether it can be implemented into a tool for them to use with their clients.

As said the study can be done multiple different ways to multiple different populations to find out the effect. This alone provides a lot of opportunities for further students, researchers, or clinicians to gather more evidence on the subject.

10.3 My thesis process

My thesis process was filled with ups and downs. The subject was suggested to me by a supervising teacher and the topic was mine to choose from a multiple different option. I felt like I had a lot of room to come up with a topic that I was interested in. The heading of the thesis has changed multiple times throughout the writing period, which has also been a challenge because I was too stuck on one heading sometimes making my research and writing harder. At the end I ended up with a topic that I was interested in, and it helped me to carry the thesis out.

Biggest difficulties for me have been scheduling especially due to the ongoing clinical practices and the summer job that took out most of my time for 6 months. This resulted in a tighter schedule at the end of the year, but it was proven to be manageable. Being

very stressed about the thesis and schoolwork combined resulted in time periods where it was very hard to stay motivated and write the thesis out. These were my biggest obstacles in my thesis.

In the end I feel supported throughout the writing process and the opportunity to make a thesis for RockTape ended up being a great experience and a challenge. It was a great learning process of scheduling, handling stress and finding evidence-based information and learning about kinesiotaping which will prove to be useful in future as a clinician.

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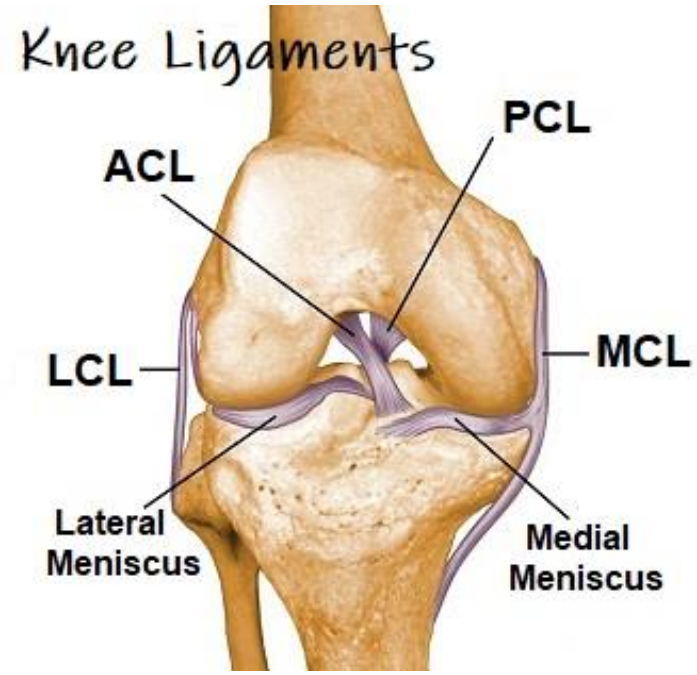
APPENDIX 1

Bones of the knee

Ligaments of the knee



APPENDIX 2

Anterior compartment of the knee

Anterior compartment	Origin	Insertion	Action
Rectus femoris	Anterior inferior iliac spine	Patella through quadriceps tendon and then tibial tuberosity through patellar ligament.	Extension of the knee joint, also works in flexing the hip joint.
Vastus lateralis	Greater trochanter and linea aspera of femur.	Patella through quadriceps tendon and then tibial tuberosity through patellar ligament.	Extension of the knee joint.
Vastus medialis	Linea aspera of femur.	Patella through quadriceps tendon and then tibial tuberosity through patellar ligament.	Extension of the knee joint.
Vastus intermedius	Anterior and lateral surfaces of body of femur.	Patella through quadriceps tendon and then tibial tuberosity through patellar ligament.	Extension of the knee joint.
Sartorius	Anterior superior iliac spine.	Medial surface of body of tibia	Weakly flexes the knee joint, works in movements of the hip joint.

APPENDIX 3

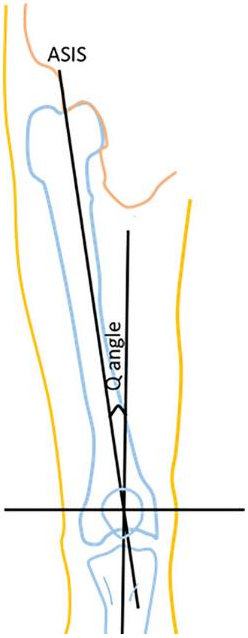
Posterior compartment of the knee

Posterior compartment	Origin	Insertion	Action
Biceps femoris	Long head arises from ischial tuberosity; short head arises from linea aspera of femur.	Head of fibula and lateral condyle of tibia.	Flexes leg at knee joint and extends thigh at hip joint
Semitendinosus	Ischial tuberosity	Proximal part of medial surface of shaft of tibia.	Flexes leg at knee joint and extends thigh at hip joint
Semimembranosus	Ischial tuberosity	Medial condyle of tibia	Flexes leg at knee joint and extends thigh at hip joint

Mechanical axis of the knee

APPENDIX 4

Q-angle



Pre-testing questionnaire

Questionnaire and agreement

Name:

1. Age _____
2. Sex _____
3. Dominant side _____

4. My test results and information from the questionnaire can be used in this Thesis. I acknowledge that the information from the questionnaire will be kept in a password secured folder and destroyed once the data is analysed. I consent to being a participant in this testing session.

   Yes / No

Signature, place and date:

_____

APPENDIX 5

Median difference in Q-angle with no kinesiotape

Highest	Lowest	Difference	Median
12,50	10,70	1,80	
13,90	11,00	2,90	
13,20	11,30	1,90	
12,00	10,20	1,80	
13,60	11,10	2,50	
12,00	11,10	0,90	
15,40	13,20	2,20	1,90

Median difference in Q-angle with kinesiotape

Highest	Lowest	Difference	Median
11,80	10,10	1,70	
15,00	13,00	2,00	
12,30	11,70	0,60	
13,20	12,00	1,20	
12,90	11,70	1,20	
13,10	12,00	1,10	
15,50	13,60	1,90	1,20

Values of loading line without kinesiotape

	Highest	Lowest	Difference
	5,80	2,70	3,10
	2,60	0,30	2,30
	3,80	1,90	1,90
	3,20	0,20	3,00
	5,60	0,60	5,00
	0,50	0,20	0,30
	10,50	1,70	8,80
Mediaani	**3,80**	**0,60**	**3,00**

APPENDIX 6

Values of loading line with kinesiotape

	Highest	Lowest	Difference
	4,80	0,20	3,60
	2,00	0,10	1,90
	1,90	0,70	1,20
	0,70	0,30	0,40
	1,90	0,60	1,30
	0,50	0,10	0,40
	8,20	2,30	5,90
Mediaani	**1,90**	**0,30**	**1,30**

Spiral tape