January 2023

Kinesio Tape Effect On Vertical Jump

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Kinesio Tape Effect on Vertical Jump

by

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Bachelor of Science in Kinesiology, the University of North Dakota, 2023

A Thesis

Submitted to the Graduate Faculty

of the

University of North Dakota

In partial fulfillment of the requirements

for the degree of

Master of Science

Grand Forks, North Dakota

August

2023

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Degree: Master of Science

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Department	Education and Human Behavior Studies
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Jalen Morrison
May 2023

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Acknowledgments

I wish to express my sincere appreciation to the members of my advisory Committee for their guidance and support during my time in the master's program at the flagship University of North Dakota. I would also like to thank the Athletics department at the University of North Dakota for their cooperation and allowing me to study their athletes.

Abstract

KinesioTape is used throughout sports at all levels of competition. This study aims at augmenting vertical jump performance with the use of KinesioTape. Vertical jumping ability is a crucial skill and advantage in various sports, as it impacts an individual's ability to achieve height, power, and efficiency during the jumping phase. Though training methods have proven to improve vertical jump, the potential of a Kinesiotape design remains somewhat unanswered in this context. This test aims to determine whether our tape design is significantly effective in countermovement and squat jumps. The research includes a comprehensive literature review to understand today's KinesioTape technology, biomechanics of the countermovement jump, and other vital factors that may influence the vertical jump. Based on the literature, a unique tape design will be created, including fundamental principles such as tension, support, muscle groups, and direction. The experimental phase involves athletes undergoing a series of jump tests with tape applied, a rest period, and then the same jump test phase with the tape off. The anticipated outcome of this experiment is to find how KinesioTape affects the vertical jump and how we can take advantage of this product in sports.

Introduction

Competitive edge is an essential aspect of athletics, especially at a high level of competition where milliseconds and millimeters often separate the top competitors. Thus, today's athletes will use whatever they can to give themselves an extra edge, continually pushing the boundary of rules. One such innovation has been using Kinesio tape, which has been studied as a helpful accessory for an athlete to improve performance (Reneker, J.C 2018). Kinesio Tape (KT), used as an ankle or foot brace, can make an athlete more elastic or act as a spring. KT elasticity can give a competitive edge (Kiseljak, D 2022). Comparing joint velocity and vertical jump height can demonstrate the impact KinesioTape technology has in a countermovement jump and squat jump.

With athletes getting bigger, faster, and more robust, giving them enough foot support could improve performance and help them stay healthy. Our KinesioTape design in theory, can aid the load in the tendons and joints for an athlete. This could give an athlete an edge during performance and benefit them in the long run with a longer career. KT can also make a shoe more comfortable, giving an athlete more confidence and trust in his or her footwear (Kiseljak, D 2022). Different designs could also lead to a longer career for professional athletes since it takes away some tension that could lead to injury.

The design of the KinesioTape is what really makes an impact. Having a good idea and vision of what you want from the tape is important to focus on. For this study, the tape will wrap around the ankle and foot, similar to a heel lock in an athletic ankle tape job. This is designed to add more plantar flexion to the foot, which will help push the ankle past its normal dorsiflexion giving the athlete more force through the ground, resulting in a higher vertical jump height. This design will pull on the foot without the participant being uncomfortable.

Purpose/Significance

Competitive advantage is a cornerstone of athletic competition. KT Tape may provide the edge that athletes are looking for. KT Tape is generally used to position stimulus throughout the skin, which aligns tissues to create space by lifting the soft tissue above the area of inflammation. Depending on the application technique, KT Tape assists and limits motion (Nakajima. 2013). However, the elastic component of KT Tape could be used to provide dynamic assistance to underlying musculature. This could assist an athlete in explosive movements, have a quicker response time, and increase stability. The differences in an athlete not using KT Tape and using the tape could make a game-changing difference; this is why it has become so popular throughout recent years. KT Tape and its multiple functions can help aid athletes by giving them better performance. Using the tape to move fascia in positions to boost performance for healthy athletes could provide a competitive advantage.

Hypotheses

H_1: Participants using KT Tape applied to the plantar fascia allow for a full range of motion; however, providing maximal elastic pressure within that range of motion will significantly increase their jump heights between taped and untaped conditions.

H_2: Participants using KT Tape applied to the plantar fascia allowing for a full range of motion; however, providing maximal elastic pressure within that range of motion will have significantly increased center of mass vertical velocity at toe-off during vertical jumping.

H_3: Participants using KT Tape applied to the plantar fascia allow for a full range of motion; however, providing maximal elastic pressure within that range of motion will significantly increase take-off leg angular velocity at toe-off.

Literature Review

The effectiveness of shoe insoles has been examined in hundreds of studies for athletic performance, but what insole will give you the most is still being determined. (Gregory, 2018) Carbon fiber plates have the most impact on energy consumption in an athlete (Fu, 2021). Shoes like the Nike Vapor Fly have been used by elite athletes in marathons and other long-distance events. The Vapor Fly shoe has been shown to help athletes dominate their opponents. There is still room for improvement with the shoe and tape. Energy consumption is one of the essential things in a shoe, but injury prevention, security, and comfortability are also essential to athletes. The Kinesio Tape design is made to replicate an elite shoe insole. All the benefits the athletes would gain from the Nike Vapor Fly is what the aim of Kinesio Tape will be.

While running, shock is absorbed by the ground, the shoe, and the musculoskeletal system, known as shock attenuation. (Derrick, 2004) Shock attenuation can affect an athlete's performance and influence pain throughout the lower extremity. Common injuries include tibial stress fractures, plantar fasciitis, metatarsalgia, and Achilles tendinitis. Giving the athlete more support around the foot will give them the edge to improve their sport. Reducing plantar pressure and loading rate and improving comfort is the vision of a custom insole and tape design.

Vertical Jump

The vertical jump is a basic motor pattern to jump as far in the vertical vector as an athlete can. The two primary factors in vertical jumps are projecting angle and velocity. The athlete crouches, swings their arms in a counter-movement to maximize projection velocity, and explosively extends their legs to their knees to their maximal displacement. The hip flexors and the plantar flexor muscles all flex their related joints at the highest velocity possible (Zhao, 2021). If a projection velocity of 90 degrees and the maximal possible velocity of CM is

achieved, an athlete is said to achieve maximal jump height. Often vertical jump is used as a measure of explosive athletic power. (Zhao, 2021)

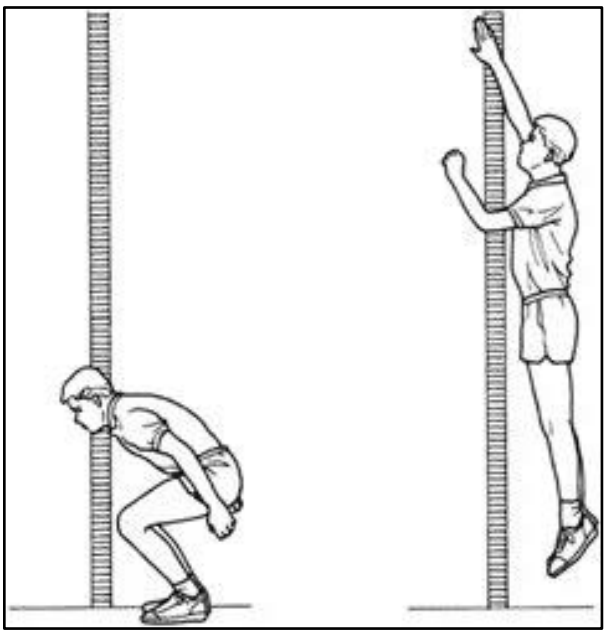

Figure 1

KT Tape

KT Tape is an elastic sports and fitness tape designed for muscle, ligament, and tendon pain relief and support. KT Tape Original and Gentle Tape are 100% cotton fibers with specialized elastic cores. KT Tape PRO, PRO Extreme, and PRO X are made using a highly engineered, ultra-durable synthetic fabric with 30% stronger elastic cores (Sarvestan, J 2020). The cotton and synthetic materials create unidirectional elasticity, allowing the athletic tape to stretch in length but not in width. As a result, the elastic fibers provide stable support without restricting the range of motion like a traditional rigid athletic tape. KT Tape PRO's fibers allow for moisture release, critical for comfort and wearability (Sarvestan, J 2020). As a result, the sports tape provides greater comfort over a more extended period. KT Tape is a specially formulated adhesive that is latex-free, hypo-allergenic, and designed to last through humidity, sweat, showers, and multiple days of wear.

KT Tape Design

KT Tape became popular due to athletes using the product during the 2008 Olympic games. KT Tape claims to increase blood flow, help with recovery, increase range of motion, strength, and many other measures that improve athletic performance. (Reneker, 2018) This study aims to increase the range of motion in the foot/ankle with the use of KT Tape. The style of taping will add tension throughout the foot to help push through plantar flexion during a vertical jump, improving jump height. (Tamura, K. 2020) The tension in the tape is crucial to affect performance; also, the amount of tape used makes an impact. Other brands, such as RockTape, claim to have a similar effect to KT Tape; those other brands will not be used in this study.

KT Tape Benefits

KT tape is a water-resistant elastic tape that can be stretched longitudinally to 90-140% of the initial length. (Liu, L 2021) It has been tested to prevent and treat chronic ankle instability at a reasonable price. Studies have assumed its mechanics create reduced pain and improved proprioception through stimulation of sensory afferents. (Liu, K 2020) KT Tape has improved balance, range of motion, recovery, and other vital factors that can improve athletics. During exercise, the ankle shows fatigue in static and dynamic balance abilities. KT Tape improves these areas of depletion through its technology. KT Tape helps with long-term recovery and short-term, which can lead to more success in sports and injury prevention. (Sarvestan, J. 2020)

KT Tape and Vertical Jump

Due to the elastic nature of KT tape, this tape placed along the longitudinal axis of the plantar fascia may slightly increase the angular velocity of the foot during plantar flexion. While this benefit may be slight, it may prove valuable to athletes where small performance differences

mean the difference between victory and defeat. Several studies have examined KT Tape effects on a vertical jump; however, these studies concentrated on the extensors at the knee instead of the ankle's plantar flexors. The amplification of plantarflexion may have significant effects on jump height or mechanics by adding additional support for the athlete during the jumping movement. In addition, Kinesio Tape is utilized to prevent hyper supination in the ankle joints providing more comfort than traditional tape (Sarvestan, J 2020). It is possible that improving mechanical stability from the Kinesio Tape design could improve an athlete's ankle strategy to correct posture and limit unnecessary movement from other joint locations (Sarvestan, J 2020).

Vicon Motion Capture

Vicon is a device used to capture the motion of objects and people through infrared optical tracking. This device was the first commercially developed motion capture system and was made in the 1980s, making significant improvements ever since. Vicon NEXUS has been used in life sciences, biomechanics, sports science, object tracking, and entertainment. Vicon's official website says that the software and systems have won an Academy Award for developing accessible motion capture technology that delivers the most accurate data in any movement analysis application. Live and inanimate objects can be recorded and analyzed for various motion capture applications. This easy-to-use platform gives users an advantage in gait analysis and rehabilitation; biomechanical research; posture, balance, and motor control; sports performance; and animal science (Vicon Motion Systems LTD., 2017). This platform collects optical, digital, and analog data. Plug-in Gait is the Vicon implementation of the Conventional Gait Model widely used in the gait analysis community. Plug-in Gait has been validated through criterion testing with representative anthropomorphic models. This software enables users to produce gait analysis reports that conform to established clinical practices.

Vicon uses non-wearable sensors (NWS) and wearable sensors (WS) that can study human gait. NWS uses image processing and floor sensors, while WS uses sensors placed on several body parts. Different sensors capture the signals that characterize human gait.

Vicon Accuracy

The Vicon performance gets evaluated with three scenarios. The static measurement precision, dynamic behavior, and precision test. Dynamic experiments have highlighted interesting aspects. Faster displacements of the marker lead to lower errors. Error can be reduced by 40% for the same object if it moves at higher speeds. (Windolf, 2008) Vicon motion capture has been proven to be very accurate but expensive. “This study revealed a significant influence of the system environment on the performance of video-based motion capturing systems.” It is crucial to have proper calibrations and maintain a healthy environment for the motion capture testing to do its work. Researchers must stay up to date with any changes that need to occur to the system to obtain accurate and precise data. A paper compared OptiTrack camera systems to that of Vicon systems. They found that OptiTrack fell short of valuable information and noted that they need to confirm in writing that there is missing information that other Vicon systems would pick up. “These shortcomings prevent the sharing of valuable information on system accuracy and measurement repeatability, and these should be subsequently included in scientific papers to improve the repeatability and reproducibility of the studies.” (Nagymáté, 2018)

Methods

Data Collection

This section will outline the basic procedures of data collection in this study. Two forms of data will be collected; one will be motion capture data allowing for the quantification of

movement during vertical jump trials. The second data type will be vertex vertical jump displacement data.

Participants

Thirty male and female participants were recruited from the available student athletes at The University of North Dakota. The athletes included football, women's basketball, women's golf, and volleyball. Participants will complete a Physical Activity Readiness Questionnaire (PAR-Q). If the Par-Q clears the participants, they will continue and be cleared to participate in the study.

Procedures

This study employed a randomized within-participant design. Participants were fitted with reflective markers to the lower extremity (see fig 2 & fig 3). These markers allow tracking and quantification of movement during vertical jump testing. Participants were asked to avoid exercise for 24 hours before taking the vertical jump test.

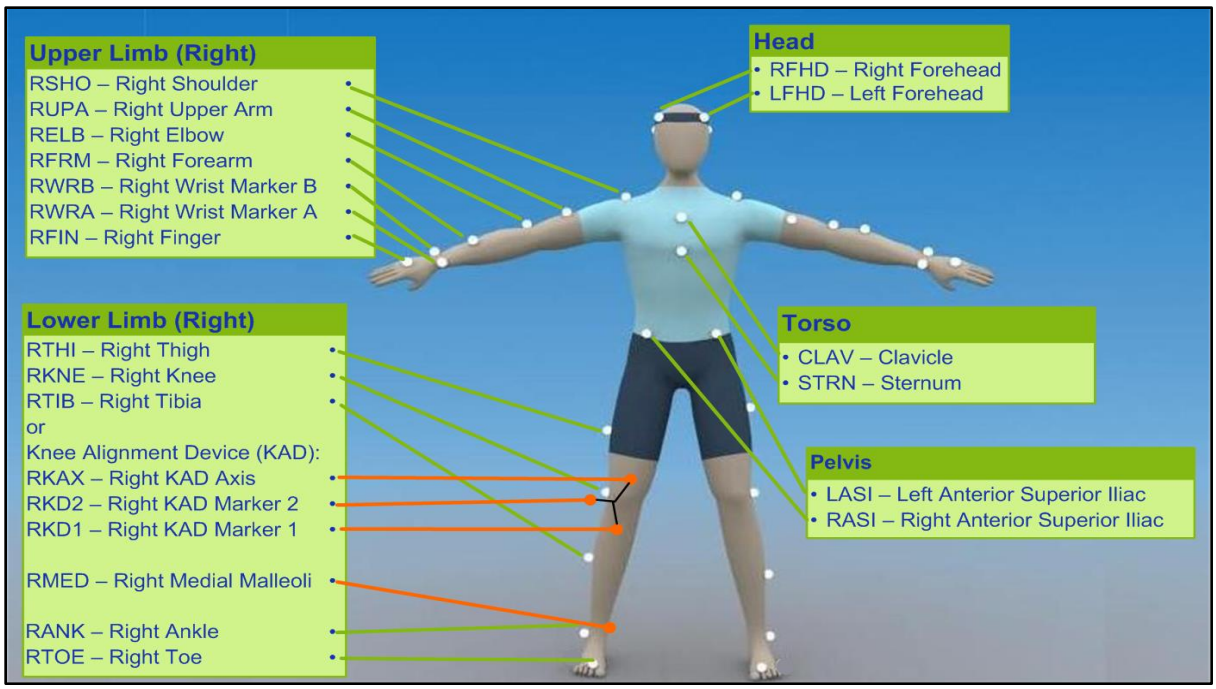

Figure 2

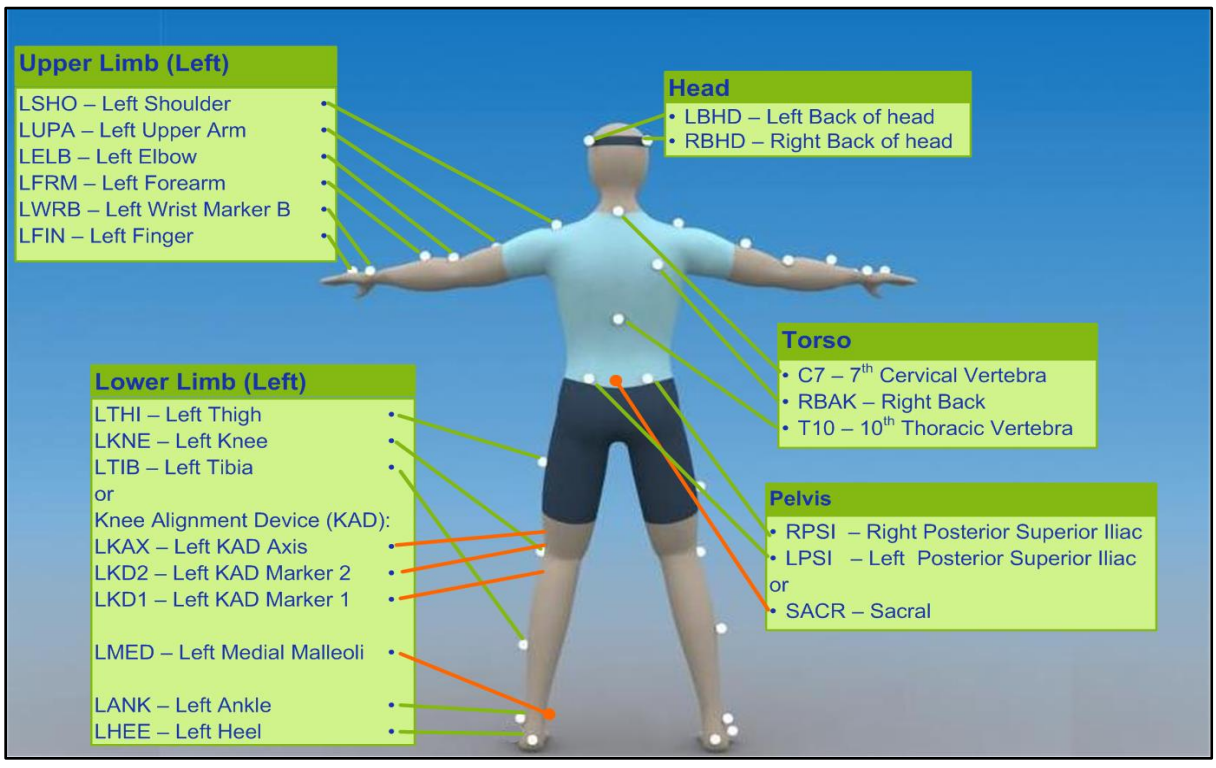

Figure 3

Participants completed two sessions of maximal jump testing. During each session, participants were asked to go through a warm-up before the test. Warming up is strongly recommended before vertical jump activities to avoid injury and help enhance performance. Dynamic warm-ups have been proven more useful in vertical jump protocol than static stretching since static stretching could decrease muscle force production. (Holt, B. W., & Lambourne, K. 2008). The subjects then perform ten walking lunges, ten reverse lunges, ten single-leg RDLs, and ten straight-leg kicks. The participants also went through high knees and reverse high knees over a distance of 10 meters. These movements are similar to the movements the athletes do in their sport, so they should be comfortable with this warm-up. These maximal jump tests were taken with rest in between. During one of the sessions of jump testing, the participants completed maximal jump testing with no KT Tape applied. During the next session of testing, participants had KT Tape applied along the length of their plantar fascia. The KT Tape was placed in such a way as to place pressure on the foot along the long axis of the foot.

This test included six total jumps per session. The first three jumps were countermovement jumps. The subjects were informed on how to perform the jump. The vertical jump starts with the participants in a neutral static position with their hands-free on their sides. Then, the subject will bend at the knees and hips to achieve a countermovement of acceleration below the center of gravity. Keeping their chest up, the participant will be asked to jump as high as possible. (Campos Jr, 2019) The next group of jumps will be a squat jump. In the squat jump, the athlete descends into a semi-squat position and holds this position for approximately 1.5 seconds before takeoff. The squat jump numbers will be significantly lower than the countermovement jump.(Van Hooren, B & Zolotarjova. 2017)

Data Processing

Jump mat data will be written down as the participants complete their maximal jump testing. These written down data will then be transcribed into an Excel format. All motion capture data in this study will be processed with Vicon Nexus 2.0 Software. Motion capture data will be digitized, auto-labeled, gap filled, and filtered using a Woltring filtering routine (Gomez, D 2021). Data variables data will be exported into a .csv file format for analysis.

Data Analysis

Several variables were extracted from the Vicon and junp kat data. Variables to be extracted will be

1. Maximal vertical jump from vertex calculation
2. Calculated Center of Mass Vertical Displacement
3. Maximal Ankle Angular Velocity.
4. Maximal Ankle Angular Acceleration.
5. Maximal Knee Angular Velocity.
6. Maximal Knee Angular Acceleration.

Countermovement projection velocity, projection acceleration, and projection angle will be recorded. These variables will give us a good idea of the participant's speed during their jump, which can give us an idea of how much the KT Tape impacts these numbers. (Paz, Gabriel 2016) The take-off angle will give us a good look at whether the tape can increase or decrease forward/backward lean. Another primary variable being recorded is hip rotation. Hip rotation can impact a vertical jump severely. Looking at the alignment of the hips and plane through the Vicon technology will allow us to decipher if the KT Tape positively or negatively impacts hip rotation.

Statistical Analysis

Statistical differences will be determined using paired sample t-tests. These comparisons will be made using SPSS 21. The alpha level for statistical significance will be set at .05.

RESULTS

Using the SPSS software, we calculated the averages of each jump. From the averages of the jumps, we compared the vertical jump squat jump taped (VJSJT), left ankle velocity taped (LAVT), right ankle velocity taped (RAVT), left knee velocity taped (LKVT), and right knee velocity taped (RKVT). Data collection on the countermovement jump and squat jump did not show any significant difference between those with KinesioTape applied to those without KinesioTape applied. Looking at the tables below including correlation and t-test data, you notice that the numbers are very close and show the numbers of .435 (One-Sided p) and .870 (Two-Sided p) for Squat jump comparisons. Counter movement comparisons showed .290 (One-Sided p) and .581 (Two-Sided p); this tells us that there is not a strong case for the tape impacting vertical jumps or joint velocity changes in the knees and ankles. The tables below show squat jump results and counter-movement jump results.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	CMJNTVJ	539.5444	27	124.14652	23.89201
	CMJTVJ	544.4000	27	121.71529	23.42412
Pair 2	CMJNTLAV	794.5407	27	141.53794	27.23899
	CMJLAV	777.6593	27	142.71664	27.46583
Pair 3	CMJNTRAV	784.4370	27	146.06651	28.11051
	CMJRAV	760.8222	27	134.09083	25.80579
Pair 4	CMJNTLKV	674.6148	27	111.40685	21.44026
	CMJLKV	680.7778	27	104.77567	20.16409
Pair 5	CMJNTRKV	683.2111	27	108.67151	20.91384
	CMJRKV	680.3556	27	98.89005	19.03140

Table 1

Paired Samples Correlations

		N	Correlation	One-Sided p	Two-Sided p
Pair 1	CMJNTVJ & CMJTVJ	27	.933	<.001	<.001
Pair 2	CMJNTLAV & CMJLAV	27	.795	<.001	<.001
Pair 3	CMJNTRAV & CMJRAV	27	.810	<.001	<.001
Pair 4	CMJNTLKV & CMJLKV	27	.926	<.001	<.001
Pair 5	CMJNTRKV & CMJRKV	27	.907	<.001	<.001

Table 2

Paired Samples Test

		Paired Differences							Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	One-Sided p	Two-Sided p
Pair 1	CMJNTVJ - CMJTVJ	-4.85556	45.09492	8.67852	-22.69451	12.98340	-.559	26	.290	.581
Pair 2	CMJNTLAV - CMJLAV	16.88148	90.92777	17.49906	-19.08835	52.85131	.965	26	.172	.344
Pair 3	CMJNTRAV - CMJRAV	23.61481	87.12140	16.76652	-10.84926	58.07889	1.408	26	.085	.171
Pair 4	CMJNTLKV - CMJLKV	-6.16296	42.02717	8.08813	-22.78836	10.46243	-.762	26	.226	.453
Pair 5	CMJNTRKV - CMJRKV	2.85556	45.79208	8.81269	-15.25919	20.97030	.324	26	.374	.749

Table 3

Paired Samples Correlations

		N	Correlation	One-Sided p	Two-Sided p
Pair 1	SJNTVJ & SJTVJ	27	.753	<.001	<.001
Pair 2	SJNTLAV & SJTLAV	27	.901	<.001	<.001
Pair 3	SJNTRAV & SJTRAV	27	.786	<.001	<.001
Pair 4	SJNTLKV & SJTLKV	27	.963	<.001	<.001
Pair 5	SJNTRKV & SJTRKV	27	.944	<.001	<.001

Table 4

Paired Samples Test

		Paired Differences							Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	One-Sided p	Two-Sided p
Pair 1	SJNTVJ - SJTVJ	2.07037	65.28712	12.56451	-23.75635	27.89709	.165	26	.435	.870
Pair 2	SJNTLAV - SJTLAV	14.71481	53.26834	10.25150	-6.35744	35.78707	1.435	26	.082	.163
Pair 3	SJNTRAV - SJTRAV	33.91111	76.96492	14.81191	3.46480	64.35742	2.289	26	.015	.030
Pair 4	SJNTLKV - SJTLKV	5.40370	28.15074	5.41761	-5.73236	16.53977	.997	26	.164	.328
Pair 5	SJNTRKV - SJTRKV	4.65926	34.36425	6.61340	-8.93479	18.25330	.705	26	.244	.487

Table 5

Discussion

The significance of this study of finding if KinesioTape can impact an athlete's performance by improving vertical jump height can add to a major advantage in sport. Our participants came from the available athletes; since the study is taking place in the summer, there are limited programs on campus. Football, women's golf, women's basketball, and volleyball are the teams we were able to test. This population could make great use of this study had it been significant. This study may have impacted different athletes from different sports, though it is unlikely.

The tape design was designed to aid the foot while being flexed, creating more range of motion that would, in theory, create a faster velocity in the ankle and boost the athlete's vertical jump (Tamura, K. 2020). There are numerous reasons why this study did not show significance (<.001). Poor quality, insufficient tape, taping of the knee, and comfortability may have influenced results. KinesioTape has been around for a long time (Huang, C 2011); though it has succeeded in athletes' recovery and performance, more may have been needed for the athletes in our pool (Nakajima, M 2013.)

The tape design applied two strips to each ankle to aid dorsiflexion. The tape was wrapped from the foot to the tibia and on top of the foot to the tibia. The KinesioTape is not the most robust material, and it may have needed more for the athletes to feel a change (Liu, K 2020). If we had used more layers of tape, it may have had an impact on the result. Also, taping the knee and the ankle could have made an impact (Huang, C 2011). Using a more robust tape, such as rock tape, may have influenced a significant change. While KinesioTape is a popular choice in athletics, it is essential to consider other brands that may be more beneficial in the vertical jump. The adhesive quality of the tape plays a crucial role in its effectiveness, and other

brands may utilize adhesives that offer firmer grip and elasticity. The tape's elasticity offers more dynamic support, promoting joint mobility and muscle activation. Flexibility may lead to higher power output and range of motion, resulting in higher jump heights. The KinesioTape started to wear as athletes became sweaty. Moisture-wicking material from other brands may avoid this issue, creating a stronger bond to the skin. This bond will help the tape do what it is designed to do. While KinesioTape has gained recognition in sports, it is essential to note that the market offers many options that provide benefits for vertical jump performance (Nakajima, M 2013). . Researching which tape is designed more for vertical jump than all-around performance and recovery may play a crucial role in this testing style. Athletes should explore options to decide which material benefits their needs the most.

Numerous studies have been designed and conducted to investigate the impact of KinesioTape on jump height (Tamura, K 2020). Some anecdotal evidence and experiences show that there are positive effects from this KinesioTape design, but the scientific literature does not show enough support for its efficacy (Huang, C 2011). Numerous reasons may have contributed to the need for more significant change. The mechanics of the vertical jump are influenced by muscle strength, power, and coordination. KinesioTape alone is not powerful enough to enhance all these factors (Nakajima, M 2013). There are also individual differences such as biomechanics, muscle patterns, injury, or fitness levels. Every athlete is different and may have struggles or advantages.

Changes in the protocol could have also made differences; having the athletes have less time between jumps could have improved their jumps. Multiple athletes would be in the lab at once and having them waiting for different periods of time could have resulted in stiffness and needing another warm-up. We changed how we placed markers on participants; instead of using

stick tape, we changed to a Velcro strap. This strap was tied around the athlete's waist, knees, ankles, and feet. This change was made due to the temperature in the lab, causing athletes to sweat and the tape to stop sticking. The Velcro straps could have added discomfort, which could have influenced performance. We only placed markers on the hips and lower extremities due to the issues of sweat and markers falling off. This did not impact on the results, creating more accuracy in the movements we needed to collect for this study.

It is important to note that KinesioTape is a valuable tool that can improve performance but is not a substitute for proper strength and conditioning training (Sarvestan, J 2020). Athletes should also focus on training to improve their performance on the vertical jump. KinesioTape can be used to optimize performance and lower the risk of injury (Nakajima, M 2013). It is important to note that KinesioTape is more effective 24 hours after placing the tape. In theory, KinesioTape should enhance blood circulation and lymphatic drainage in muscles, giving the participant 24 hours with the tape applied may have enhanced performance (Liu, L 2021).

Additionally, the timing of movements could have played a role in reaching peak vertical jump performance. The lack of changes in jump height may have been due to different body parts, such as the hips and knees, where no tape design was established. During the launch phase, adding tape to other body areas helped improve the vertical jump, ankle velocities, and knee velocities.

Conclusion

In conclusion, insufficient data shows significant changes from our KinesioTape design when applied during a vertical jump. Our finding showed no ankle or knee angular velocity change, resulting in consistent jump heights. The placebo participants also showed the same differences in jump height as those with the resistance tape design. KinesioTape remains a top choice

throughout all sports, and for athletes seeking performance enhancement, the evidence supporting its effectiveness in improving jump height is limited (Sarvestan, J 2020). More research and different taping designs are needed to understand the actual impacts and potential benefits of KinesioTape in athletic performance. The addition of KinesioTape around the knee and the ankle has the potential to improve vertical jump performance (Sarvestan, J 2020). Joint stability, muscle activation, reduced fatigue, psychological benefits, and enhanced proprioception are all potential results of KinesioTape (Huang, C 2011). Studying more designs and protocols at an individual level could provide significant changes in performance.

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