

Strapping for knee stability: Kinetic and kinematic comparisons of dynamic, rigid, and kinesio taping

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Abstract

Background: Knee stability is crucial for lower limb function and injury prevention. Drop landing analysis is commonly used to assess landing mechanics and stability, with different taping techniques potentially enhancing knee stability. This study aimed to investigate the effects of different taping conditions on knee joint kinetics and kinematics during a DL. **Methodology:** Twenty-one athletes (age: 22±2.69 years; height: 167.76±7.47 cm; mass: 63.32±10.57 kg) performed a series of 40cm drop landings under four taping conditions – no tape, dynamic tape, rigid tape, and kinesio-tape. Continuous biomechanical data were analysed using spm1d repeated measures ANOVA ($p < 0.05$). **Results:** No significant changes were found in ground reaction force or time to stabilisation across conditions. Dynamic Postural Stability Index revealed significant differences between no tape vs dynamic tape ($p < 0.001$) in dynamic postural stability index, vertical stability index, and antero posterior stability index. While, rigid tape vs dynamic tape showed differences ($p < 0.05$) in Dynamic Postural Stability Index, antero posterior stability index, and medio lateral stability index. Further, dynamic tape vs kinesio tape saw differences in antero posterior stability index ($p = 0.005$). SPM1D analyses revealed differences ($p < 0.04$) in ankle abduction (2-15%) and rotation (1-4%; 43-61%; 67-78%), knee flexion (62-84%) and rotation (39-100) during the movement cycle, with no changes in hip movements. **Conclusion:** There were observable biomechanical changes, limited to the stability phase of landing, as well as in the Dynamic Postural Stability Index between the taping conditions, but these may not translate into improved stabilisation times and joint stability. These findings suggest that taping may not greatly affect landing kinetics or kinematics. As such, more conclusive evidence is warranted before including taping as an injury-preventative or stability-enhancement strategy for landings.

Keywords: Injury prevention, Landing Biomechanics, Knee taping, Neuromuscular Response

Introduction:

Poor landing technique is the leading risk factor for knee injuries in netball players (Chesson, Whitehead, Mackay, Jones, Heyward, Fox, Scantlebury & Janse Van Rensburg, 2024), with 46.6% of knee injuries occurring during landing, followed by slipping/tripping/sudden stopping, player contact, treading on foot, and rebounding a shot (Downs, Snodgrass, Weerasekara, Valkenborghs & Callister, 2021; Mullally, Atack, Glaister & Clark, 2021). Video analysis shows most knee injuries occur during landing, often due to rapid deceleration after a jump (Stuelcken, Mellifont, Gorman & Sayers, 2016; Belcher, Whatman & Brughelli, 2022), with injured players typically being unbalanced on landing before sustaining their injury (Belcher et al., 2022). In an effort to reduce joint instability and prevent injury, many athletes turn to joint taping. It is widely reported that joint taping, bracing, and type of footwear improve joint stability and have supplementary protective properties (Pfile, Hart, Herman, Hertel, Kerrigan & Ingersoll, 2013; Doherty, Bleakley, Delahunt & Holden, 2017; Ha, Park & Lee, 2020; Lai, Ling, Cacho, Mok and Yung, 2020). The three most commonly used tapes by athletes are rigid tape (RT), dynamic tape (DT), and kinesio tape (KT). The primary mode of action in RT is mechanical restriction, in DT is assistance in mechanical – deceleration, load absorption and assistance of movement, and KT is neurophysiological aiding in neuromuscular and proprioceptive feedback (Kendrick, 2013; McNeill & Pedersen, 2016).

Drop landings (DL) are frequently used to evaluate injury risk and physical capacity of athletes (Harry, Simms & Hite, 2024). During a DL, the hip, knee, and ankle joints execute a series of coordinated movements to absorb impact and stabilise the body. A DL can be divided into three phases: the loading phase (time between initial ground contact and the peak vertical ground reaction force (PVGRF)), the attenuation phase (time between the PVGRF and the local minimum vertical ground reaction force (GRF)), and the control phase (the total duration between the local minimum vertical GRF and the moment when the vertical centre of mass (COM) velocity crosses zero) (Harry, et al., 2024). Some key metrics analysed in each landing phase are the GRF, dynamic postural stability index (DPSI), and time to stabilisation (TTS). The TTS and DPSI are outcome measures based on GRF and are used to quantify dynamic postural stability (DPS) performance following a DL. An athlete's DPS can be used as an indicator of the ability of their ability to maintain balance during the

transition from the attenuation phase to the control phase upon landing (Amerian, ShahAli, Rezaeian & Shanbehzadeh, 2023). There is an internal correlation between DPS and landing injury risk (Niu, Zhang, Fan & Zhao, 2013). DPS is dependent on good lower-extremity muscular strength, as strength deficits have been associated with slower TTS (Cinarli, Adanur, Esen, Barasinska, Cepicka, Gabrys & Karayigit, 2022; Kamffer, Hammill, Willemse & Kramer, 2023).

A landing that is considered good would be soft and controlled, with slightly bent knees, feet shoulder-width apart, and a neutral spine (Barber-Westin, Smith, Campbell & Noyes, 2010; Ericksen, Gribble, Pfile & Pietrosimone, 2013). Excessive knee extension, abduction, and internal-external rotation angles and moments during DLs have been identified as modifiable risk factors for ACL injuries (Shimokochi and Shultz, 2008; Akbari, Shimokochi, and Sheikhi, 2023). Additionally, decreased ankle dorsiflexion angles during DLs have been associated with an increased risk of ACL injuries, as they impact the kinematics of the knee and hip and increase landing stiffness (Carlson, Sheehan, and Boden, 2016; Abassi, Bleakley, and Whiteley, 2019). Previous research has shown that taping techniques can reduce lower limb GRF and decrease joint angles during DL (Hendry, Campbell, Ng, Grisbrook & Hopper, 2015; Saki, Romiani, Ziya & Gheidi, 2022; Rajasekar, Kumar, Patel, Ramprasad & Samuel, 2018; Smedley, 2022). Lower GRFs as well as decreased hip adduction and internal rotation, and tibia external rotation (also known as dynamic knee valgus (DKV)), are linked to injury risk reduction (Saki, et al., 2022; Harry, et al., 2024).

Given the high physical demands and specific jump patterns in netball, along with the significant prevalence of knee injuries among players, exploring preventative strategies such as knee taping becomes essential. Additionally, various taping techniques may alter landing mechanics and enhance knee stability. While previous research on netball players has focused on the types, prevalence, and incidence of netball injuries (Botha, Coetzee & Scall, 2020; Downs et. al., 2021; Pillay & Frantz, 2012; Sinclair, Coetzee & Schall, 2020; Whitehead, Weakley, Cormack, Alfano, Kerss, Mooney & Jones, 2021), there is no current research on the effectiveness of injury preventative measures such as joint taping on improving landing mechanics and joint instability. Previous studies have also used discrete biomechanical variables to assess efficacy during DL's as opposed to a time-continuous analysis such as statistical parametric mapping (SPM). DL analysis is crucial for identifying poor landing mechanics, where SPM can be used for better interpretation and analysis of movement and stability patterns over the entire movement curve for statistical significance (Hughes-Oliver, Harrison, Williams & Queen, 2019; Yona, Kamel, Cohen-Eick, Ovadia & Fischer, 2024). This study aimed to investigate the effects of different taping conditions on knee joint kinetics and kinematics during DL.

Materials and Methods:

Participants

Twenty-one injury-free female netball players (age: 22 ± 2.69 years; height: 167.76 ± 7.47 cm; mass: 63.32 ± 10.57 kg) participated in this study. Participants signed an informed consent form and institutional ethics approval was granted prior to the commencement of the study (*REC-1760-2022*).

Procedure

Participants were required to perform three drop landings off a 40cm box under four knee-taping conditions: No Tape (NT), Rigid Tape (RT), Dynamic Tape (DT), and Kinesio Tape (KT). For all landings, participants were instructed to place their hands on their hips, step off a 40 cm box, land with feet in a toe-first landing pattern on separate force plates, and remain stationary for three seconds (Whyte, Kennelly, Milton, Richter, O'Connor & Moran, 2017).

Taping application

Three tapes were assessed: The RT and DT conditions used the Mulligans Tape technique and KT used the "Y" formation technique.

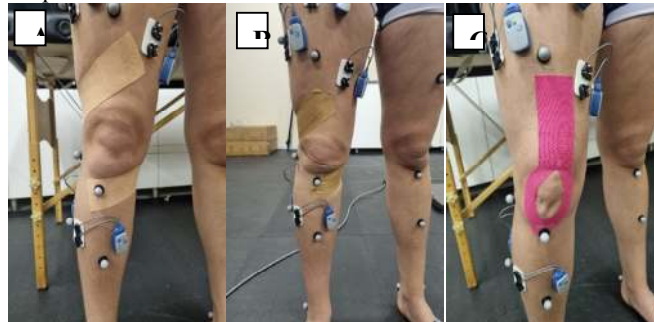


Figure 1: A- Mulligans tape technique using dynamic tape; B- Mulligans tape technique using rigid tape; C- The "Y" formation technique using kinesio tape.

The Mulligans Tape technique (Figure 1A) was applied with the individual positioned with the hip in slight internal rotation and knee flexed at 25° (Hendry et al., 2015; Howe, Campbell, Ng, Hall & Hopper, 2015). Tape was applied from the fibula head, passing over the tibia while applying an internal tibia torsion force

(Hendry et al., 2015; Howe et al., 2015). The tape then passed posterior, inferior to the medial knee joint line, and centrally over the posterior aspect (Hendry et al., 2015; Howe et al., 2015).

In the “Y” formation technique (Figure 1C) the tape was placed with the quadriceps in maximum stretch position. The individual was prone with their hip in a neutral position and the knee flexed (Torres, Trindade, Gonçalves & Rui, 2016). The tape was cut in a “Y” formation and applied from the anterior inferior iliac spine to the tibial anterior tuberosity (Torres, et al., 2016). The tension was placed between 50 and 75% in the middle without any stretch in the extremities (Torres, et al., 2016).

Biomechanical analysis

All kinematics were captured using the model CGM 2.5 with a 10-camera system recording at 200Hz (Vicon Vero 2.2 (Vicon Motion Systems Ltd, UK)). The calibration and 3D tracking was done using Nexus software (Vicon Motion Systems Ltd, UK). Multi-axis force plates (Bertec, Columbus, Ohio, USA) were used to measure the ground reaction forces at 1000Hz.

Data analysis

The jump profile (drop landing initiation, 0% to termination, 100%) was divided into three phases: loading (1-6%), attenuation (7-26%), and control (27-100%) (Harry, et al., 2024). Kinetic and kinematic data of the three landing attempts were time-corrected and averaged. The time to stabilisation (TTS) was determined by the intersection between the 3rd-order polynomial and normalised vertical force during the control phase (Ross & Guskiewicz, 2003). The Dynamic Postural Stability Index (DPSI) was calculated using ground reaction force (GRF) data recorded in three directions—anterior-posterior (AP), medial-lateral (ML), and vertical (V)—from initial contact to 3 seconds post-landing (Wikstrom & Tillman, 2006). Custom-written algorithms were used to analyse body positions as derived from raw marker location data in MatLab (Mathworks, Natick, Massachusetts, USA).

Statistical analysis

All data were evaluated for normality. TTS were compared using a Kruskal- Wallis test and stability indices were compared using ANOVA with a Bonferroni post-hoc test in SPSS ($p < 0.05$). Continuous biomechanical data were analysed using nonparametric smp1d repeated measures ANOVA ($p < 0.05$) in MatLab (Pataky, 2022). Post hoc analysis was conducted in the form of non-parametric paired t-tests using a Bonferroni correction p value = 0.0085.

Results:

Regarding the drop landing kinetics, smp1d analysis revealed no significant changes found in ground reaction force (GRF) across all conditions (Figure 2).

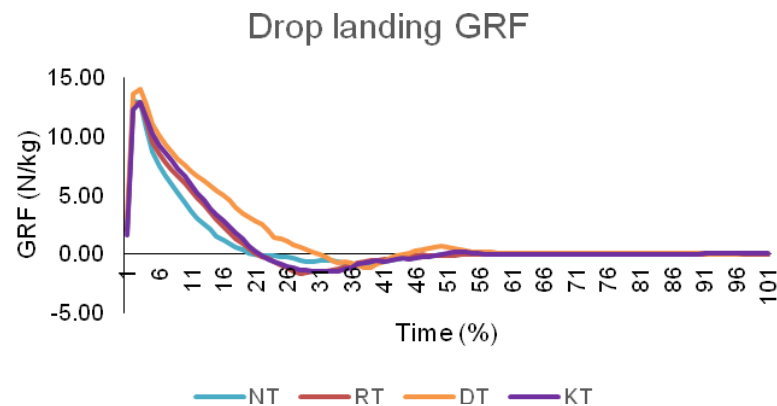


Figure 2: Ground

reaction force (GRF) during a 40cm Drop Landing: Comparison of No Tape (NT), Rigid Tape (RT), Dynamic Tape (DT), and Kinesio Tape (KT) Conditions in Twenty-One Female Netball Players (Age: 22 ± 2.69 Years; Height: 167.76 ± 7.47 cm; Mass: 63.32 ± 10.57 kg)

There was no statistical difference ($p = 0.583$) in the Time to stabilisation (TTS) (Table 1). Significant differences were seen in the Dynamic Postural Stability Index (DPSI) ($P < 0.001$) between NT and DT ($p < 0.001$) and RT and DT ($p = 0.05$), as well as Vertical Stability Index (VSI) ($P < 0.001$) between NT and DT ($p < 0.001$) (Table 1). Furthermore, significant differences were seen in the Anterior-Posterior Stability Index (APSI) ($P < 0.001$) between NT and DT ($p < 0.001$), RT and DT ($p = 0.006$), and DT and KT ($p = 0.005$), as well as, Medio-Lateral Stability Index (MLSI) ($P = 0.017$) between RT and DT ($p = 0.016$) (Table 1).

Table 1: Time to stabilization and dynamic stability indexes during a 40cm Drop Landing: Comparison of No Tape (NT), Rigid Tape (RT), Dynamic Tape (DT), and Kinesio Tape (KT) Conditions in Twenty-One Female Netball Players

Taping condition	No tape (NT)	Rigid tape (RT)	Dynamic tape (DT)	Kinesio tape (KT)
Time to Stabilisation (TTS) (ms)	300.27±52.99	305.51±61.58	291.24±55.16	290.70±94.07
Dynamic Postural Stability Index (DPSI)*	0.27±0.07†	0.31±0.06†	0.37±0.10	0.31±0.07
Vertical Stability Index (VSI)*	0.26±0.07†	0.30±0.06	0.36±0.10	0.31±0.07
Anterior-Posterior Stability Index (APSI)*	0.06±0.01†	0.07±0.01†	0.08±0.02	0.07±0.01†
Medio-Lateral Stability Index (MLSI)*	0.02±0.01	0.02±0.01†	0.03±0.01	0.02±0.01

* significantly different across conditions

† significantly different from dynamic tape

SPM1D analyses of joint kinematics revealed significant changes in ankle abduction (2-15%, $p = 0.01$) and rotation (1-4%, $p = 0.01$; 43-61%, $p = 0.01$; 67-78%, $p = 0.04$) (figure 3). Significant differences were also seen at the knee joint in flexion (62-84%, $p = 0.01$) and rotation (39-100%, $p = 0.01$) (figure 4). No differences were noted in hip joint kinematics across the various conditions (Figure 5).

Post hoc tests revealed significant differences in ankle rotation with NT vs DT (1-8%; 36-83%) and ankle abduction with NT vs KT (3-17%) and RT vs KT (0-9%), as well as, knee flexion with NT vs RT (72-80%), NT vs DT (73-100%), NT vs KT (53-100%) and in knee rotation with NT vs RT (36-100%), NT vs DT (55-100%), RT vs KT (31-100%), and DT vs KT (39-100%).

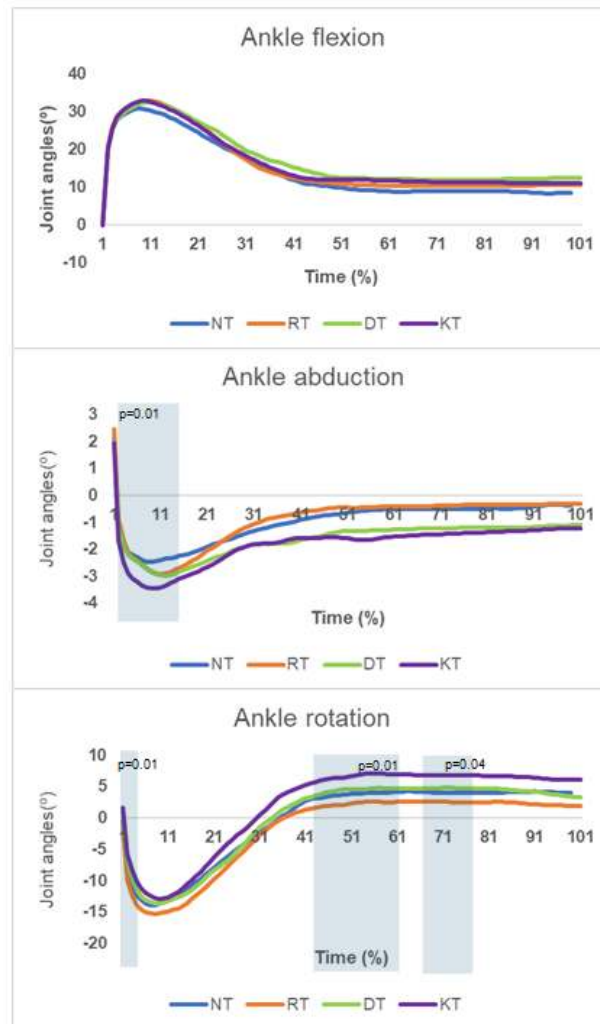


Figure 3 Comparison of Ankle Joint Angles during a 40cm Drop Landing across No Tape (NT), Rigid Tape (RT), Dynamic Tape (DT), and Kinesio Tape (KT) Conditions in Twenty-One Female Netball Players: Highlighted Areas Indicate Significant Changes

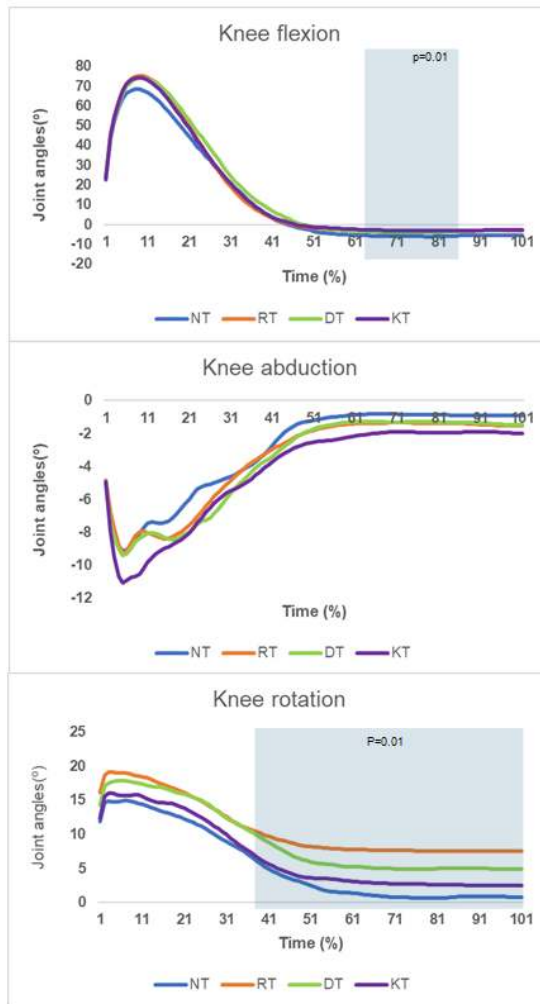


Figure 4 Comparison of Knee Joint Angles during a 40cm Drop Landing across No Tape (NT), Rigid Tape (RT), Dynamic Tape (DT), and Kinesio Tape (KT) Conditions in Twenty-One Female Netball Players. Highlighted Areas Indicate Significant Changes

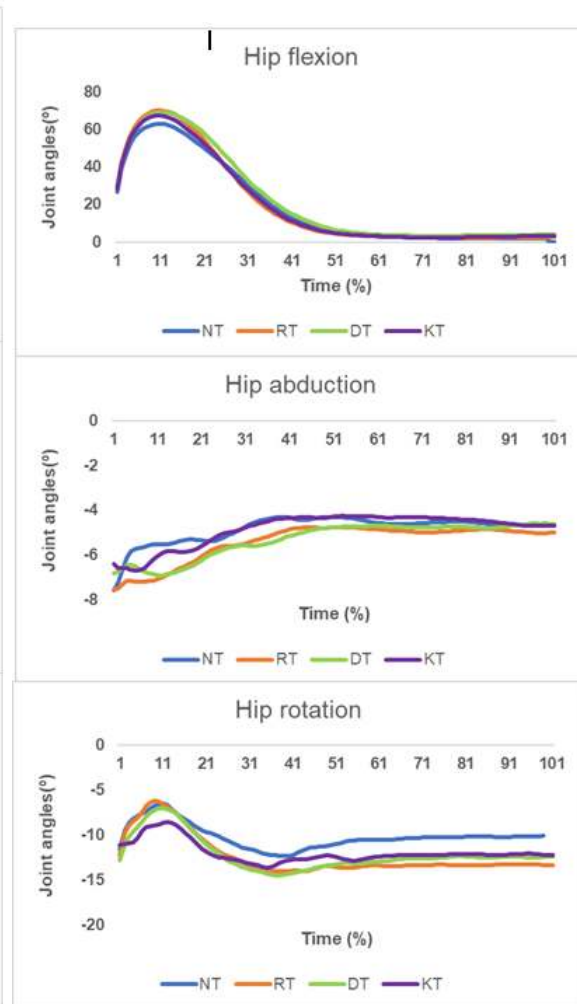


Figure 5 Comparison of Hip Joint Angles during a 40cm Drop Landing across No Tape (NT), Rigid Tape (RT), Dynamic Tape (DT), and Kinesio Tape (KT) Conditions in Twenty-One Female Netball Players.

Discussion:

The study aimed to investigate the effects of different taping conditions on knee joint stability and joint angles during a DL. No significant changes were found in GRF across all conditions or in TTS. However, significant differences were seen in DPSI, VSI, and APSI between NT and DT. While RT vs DT showed differences in DPSI, APSI, and MLSI. Further, DT vs KT only saw differences in APSI. SPM1D analyses revealed significant changes in ankle abduction and rotation, as well as knee flexion and rotation during the landing cycle, with no changes in hip movements.

Previous research has indicated positive effects of knee taping in reducing GRF and increasing dynamic knee stability during drop landings and dynamic tasks (Rajasekar et al., 2018; Hendry, et. al., 2015; Jafarnezhadgero, Shahverdi & Madadi Shad, 2017; Oliveira, da Silva & Silva, 2017; Park & Kim, 2018; Ha, et al., 2020; Saki et al., 2022; Smedley, 2022). As such, it was hypothesised that DT and RT knee taping would have the largest influence on the lower limb kinetics. However, no significant changes in ground reaction force (GRF) were observed across all conditions in this study (Figure 2). Previous research on the influence of taping on GRF is varied. Research by Ha, et al. (2020) and Sanzo and Zerpa (2016) found that DT, RT, and KT did not influence GRF during landings. Conversely, Jafarnezhadgero, et al. (2017) found that KT on the tibialis anterior and hip reduced GRF upon landing, but the difference seen between Jafarnezhadgero, et al. (2017) and the current study may be due to the different taping techniques used where the current study used Mulligan's technique and Y-taping. Further, the previous studies used discrete (discontinuous) analysis, only taking a specified number of values in a given range to extract the peak values such as durations, maximums, and minimums of the data points, whereas this study analysed data using continuous analysis, which takes infinitely many values in a given range, and is beneficial in tracking functional adaptations throughout the movement (Mayya, Monteiro & Ganapathy, 2017).

Time to Stabilisation (TTS) and Dynamic Postural Stability Index (DPSI) offer complementary insights into stability. TTS is particularly useful for evaluating the speed of stabilisation, while DPSI provides a more comprehensive assessment of dynamic postural control (Huurnink, Fransz, Kingma, de Boode & van Dieën,

2019). While there were no statistically different TTS for the various knee taping conditions, KT (290.70 ± 94.07 ms) reported the shortest and RT (305.51 ± 61.58 ms) the longest durations. The KT condition may have had a better effect on TTS due to the enhancement of proprioception, allowing for better joint position feedback, as previous research has shown that KT can increase proprioceptive feedback during dynamic tasks and alter the sensory system which contributes to improved balance performance (Song, Lin & Chang, 2017). Therefore, the enhanced proprioception provided by KT may also lead to a quicker stabilisation upon landing. Additionally, better balance performance is closely related to a lower DPSI since it is essential for preserving stability during movement (Lee, Shin, Han, Sun Hwang, Lee, & Jang, 2022), which may indicate better postural control. The DPSI reported significant differences between NT and DT ($p < 0.001$) and RT and DT ($p = 0.05$), with the highest DPSI being for DT (0.37 ± 0.10), indicating reduced stability with DT. DPSI is an index of stability control and is calculated using the fluctuation of GRF data around the origin of landing, recorded in three planes—vertical, anterior-posterior, and medial-lateral (Wikstrom & Tillman, 2006; Kiers, Ellenberger, Jermann, Oberle, Frey & Spörri, 2022). The strongest contributor to DPSI was VSI, where the highest VSI was seen with DT (0.36 ± 0.10), mirroring the pattern observed with DPSI, with significant differences seen between NT and DT ($p < 0.001$). A larger VSI, as seen in the DT condition, indicates less control over the vertical forces during the landing which may lead to excessive loading to the knee joint. Although not significant, it can be seen (Figure 2) that DT had the largest GRF compared to the other conditions, which is also reflected in the VSI. The APSI reported significant differences between NT and DT ($p < 0.001$), RT and DT ($p = 0.006$), and DT and KT ($p = 0.005$). Lastly, the MLSI exhibited significant differences between RT and DT ($p = 0.016$). Previous research has shown that knee taping improves dynamic knee stability by improving dynamic knee valgus (DVK) in the MLSI plane in stair climbing and squats when analysed using a perceived stability questionnaire and video analysis (Oliveira et al., 2017; Park & Kim, 2018; Ha, et al., 2020). These results differ from this current study where the taped condition did not affect MLSI and this may be due to the previously researched tasks being done on injured participants with low-impact tasks in comparison to this study done on healthy participants in a high-impact landing task. The findings on DPSI suggest that the three taping conditions reduced stability upon landing, with DT ($\sigma = 0.10$) causing the most instability and the largest difference seen in VSI. Previous studies have examined DPSI in single-leg drop landings without taping conditions, with limited research on double-leg drop landings. Previous research has also primarily focused on the effects of ankle taping on DPSI during landing tasks, with conflicting results reported (Nakajima & Baldrige, 2013; De Ridder, Willems, Vanrenterghem & Roosen, 2015; Liu, Wang, Dai, Wang & Chen, 2024), however, Liu, et al. (2024) found that ankle taping reduced peak ankle inversion angle, peak vertical ground reaction force, and peak ankle inversion moment and increased peak knee flexion angle. This suggests that ankle taping may affect the overall kinetic chain, knee stability, and DPSI. While it is seen that DPSI is linked to dynamic postural control, kinematics can also provide valuable insights into postural control.

Continuous kinematic data were analysed using SPM1D analyses. The results revealed significant changes in ankle abduction (2-15%, $p = 0.01$) in the loading phase of the landing and ankle rotation (1-4%, $p = 0.01$; 43-61%, $p = 0.01$; 67-78%, $p = 0.04$) in the loading and control phases (figure 3). In the initial phase of landing, the ankle undergoes substantial rotation and abduction as part of the body's immediate response to impact with the ground, crucial for shock absorption and stabilising the foot and lower limb. Post hoc tests revealed significant differences in ankle rotation with NT vs DT (1-8%; 36-83%). Mackay, Stearne, Wild, Nugent, Murdock, Mastaglia and Hall (2020) found that Mulligan's taping technique with DT at the knee, also used in this study, increased the ankle's external rotation during a running task, which may have had a similar effect on the DL in this study. Significant differences were also seen in ankle abduction with NT vs KT (3-17%) and RT vs KT (0-9%). Although no significant differences were seen in the taping conditions in knee abduction, it can be observed that the most knee abduction was in the KT condition too. Although there is no current research on the impact of knee taping on ankle kinematics during a DL, it is known that dysfunction or modification at one joint, such as the knee, may cause change to its neighbouring joint, such as the ankle (Ziabari, Razi, Haghpahani, Lubberts, Valiollahi, Khazaei, Taghadosi & DiGiovanni, 2022), and this may account for the similar changes seen at the ankle compared to the knee.

Moving up the kinetic chain, the greatest effects were expected to be seen at the knee joint as this is where the different taping conditions were placed. Significant changes were seen at the knee joint (figure 4) in flexion (62-84% $p = 0.01$) during the control phase of landing, showing that the knee was in a more flexed position once participants had regained their final stance position. These data indicate an increased knee flexion under the various taped conditions compared to the NT condition (NT vs RT (72-80%), NT vs DT (73-100%), NT vs KT (53-100%)). This may suggest that all the taping conditions (RT, DT, and KT) caused an increase in knee flexion upon landing compared to the NT condition. It is noted that decreased hip and knee flexion during a landing results in a stiffer and more extended posture, which puts athletes at risk for knee injury (Cortes, Quammen, Lucci, Greska & Onate, 2012). Therefore, increased knee flexion on landing can improve joint energy absorption, decreasing the risk of injury (Dai, Garrett, Gross, Padua, Queen, & Yu, 2015; Slovák, Zahradník, Land, Sarvestan, Hamill & Abdollahipour, 2024). Previous studies have found that KT did not influence knee flexion angles during landings (Limroongreungrat & Boonkerd, 2019; Saki, et al., 2022), however, these studies were done on injured populations which may have caused a different outcome compared

to this study on a healthy population. Indeed, it has been found that DT and RT increased knee flexion angles during running and landing tasks in healthy populations (Howe et al., 2015; Wu, Lin, Chen, Chao & Hsieh, 2024), the findings of this study corroborate the present results. Significant changes were also noted in knee rotation (39-100%, $p = 0.01$) in the control phase of landing, with significant differences seen in NT vs RT (36-100%), NT vs DT (55-100%), RT vs KT (31-100%), and DT vs KT (39-100%), suggesting that the knee joint remained in a rotated position during the control phase with the DT and RT conditions. The taping technique used for RT and DT was Mulligan's tape technique. It has been shown that the Mulligan taping technique, whether using RT or DT, increases knee internal rotation (Mackay, et al., 2020). This may explain the increased knee joint rotation in the RT and DT conditions during the control phases of the landing when the participant was stable and stationary, it can, however, be seen that the knee rotation during the loading and attenuation phases appear to be unchanged, therefore the RT and DT conditions did not influence the landing dynamics.

No significant changes were seen in hip movements (Figure 5). During the initial phase of landing, immediately after the feet make contact with the ground, the hip goes into flexion and rotation with some degree of abduction. This is likely an immediate adjustment to the impact forces, helping to absorb the impact, stabilise the hip joint, and dissipate the landing impact forces (Dai, et al., 2015; Slovák, et al., 2024). Previous research on taping in the lower limbs has also shown to not influence hip flexion upon landing (Sheikhi, Letafatkar, Hogg & Naseri-Mobaraki, 2021).

A DL combined with continuous analysis is a useful tool to identify athletes at risk for injury due to poor stability or poor force absorption over the entire movement cycle. Taping has been increasingly used by athletes as a preventative measure for injuries. Different taping types have different primary modes of action which could assist in dynamic movements such as DLs. In RT the primary mode of action is mechanical restriction, for DT it is to assist mechanical – deceleration, load absorption, and movement, and for KT it is neurophysiological (Kendrick, 2013; McNeill & Pedersen, 2016). When comparing the three taping conditions to NT in this study, the RT shows some degree of mechanical restriction in joint abduction and rotation, and the KT may have shown some degree of neurophysiological adaptation in proprioception. While previous research has shown that taping has the greatest impact on injured populations (De Vries, van den Akker-Scheek, Haak, Diercks, van der Worp & Zwerver, 2017; Torres, et al., 2016; Jafarnejadgero, et al., 2017; Song, et al., 2017; Sinclair, et al., 2020), this research assessed whether taping in an uninjured population would assist in injury prevention by altering landing mechanics. Although minor significant differences were seen in the DPSI and joint angles, no single taping condition influenced knee stability significantly more than the other.

Conclusion:

Although individual taping conditions may affect stabilisation metrics, such as the significant differences seen in DPSI and joint angles (ankle abduction and rotation, and knee flexion and rotation) mainly during the stability phase of landing, the statistical significance was not substantial enough to conclude that any one taping condition consistently outperformed the others. Furthermore, no kinematic differences were noted during the loading and attenuation phases indicating that strategies for successful DLs may involve more complex mechanisms than those evaluated in the current study. Lastly, no changes were seen between GRF (as linked to the main injury risk) in the various taped conditions.

Despite the taping conditions showing no substantial changes in the kinematics and kinetics in the loading and attenuation phases of the DL, changes were seen in the stability phase of the landing, suggesting that taping may contribute to the proprioceptive feedback and control for stabilisation without altering the biomechanics of the landing. Increasing proprioceptive feedback, especially in athletes returning from injury, plays an important role in improving landing strategies and reducing the risk of injury. This, in turn, highlights the need for a multi-faceted approach to improving knee joint stability and suggests that taping should be one part of a broader injury prevention and performance enhancement strategy. Therefore, further investigation or larger sample sizes may be needed to clarify the subtle differences observed in this study. Further, taped knees might prove to be more beneficial in more dynamic movements such as a drop jump landing (DJL) or countermovement jump (CMJ), however, these need to be investigated.

While this research offers valuable insights into stability during landing, a few limitations can be considered. The DL protocol may not best simulate the random landings experienced in sports, and future studies may consider simulating different landing conditions when assessing for stability. Additionally, within the data collection of this study, all the landings were successful being that no injuries occurred and all landings resulted in balance and stability being maintained. If the unsuccessful attempts were included in the data analysis, the results may have had a different outcome. These may be of consideration in future studies.

Disclosure statement:

No potential conflict of interest was reported by the author(s).

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