BIOMECHANICAL TAPING FOR MOVEMENT CONTROL AND LOAD MANAGEMENT IN TENDINOPATHY

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CORRECT ★ PROTECT DYNAMIc TapE ★ PERFORM ★

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WHY TAPE MECHANICALLY?

IS IT ALL ABOUT

LOAD?

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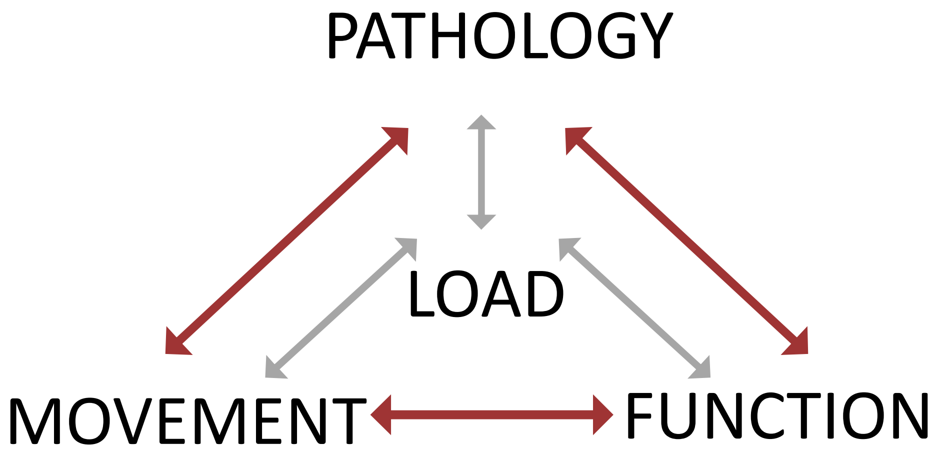

LOAD AND PATHOLOGY

PATHOLOGY

- Load is a key driver of pathology
- Inability to dissipate, adapt to or recover from load can lead to loss of structural integrity and capacity – muscle strains, ligament strains, fractures, stress reactions, tendinopathy (other factors may predispose to this)
- Load is necessary for recovery and capacity building but must be appropriate and graduated

LOAD AND MOVEMENT

MOVEMENT

- How we move influences forces/loads and vice versa
- Movement is essential for dissipating load, balance strategies, accommodating to uneven ground, optimal performance
- Movement within physiological range is normal but is it comfortable, functional and optimal for achieving the task for this person at this time. Abundance of movement choice is essential
- Movement may change in response to pain and injury – adaptive or maladaptive
- Pain may change in response to movement and exercise – bottom up and top down

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LOAD AND FUNCTION

FUNCTION

- We are a body acting on and being acted upon by our environment
- We must consistently dissipate, resist, overcome, transfer and generate forces to function successfully
- Functional deficits may exist in the absence of pain and pain may contribute to the functional deficit e.g. pain inhibition, reduction in ROM, fear of movement
- Functional requirements (e.g. to win a point or stay within the rules) may require changes in movement and load – movement choice and abundance

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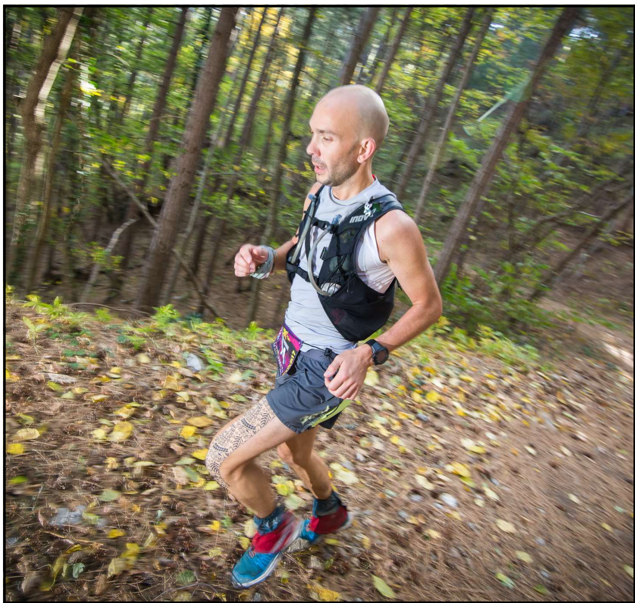

How do you handle foreseen unaccustomed loads?

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How do you settle reactive tendons (sudden unaccustomed loads)?

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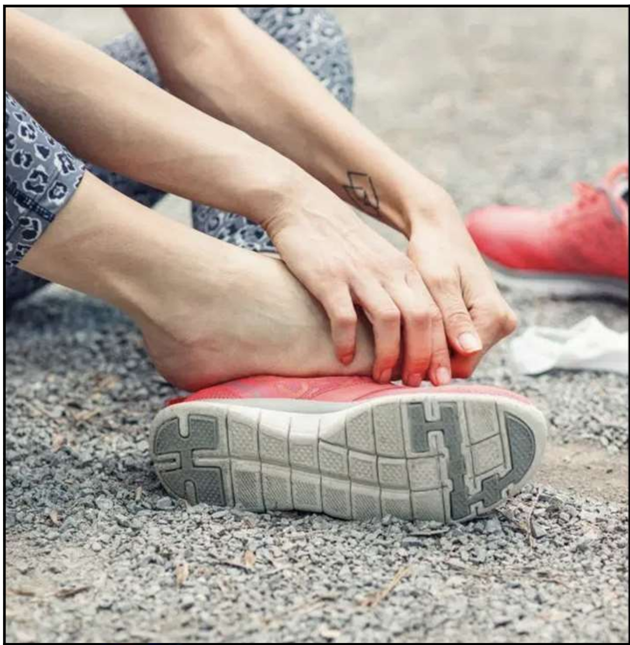

What do you do when normal activities are too much load?

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How do you handle transitions to higher load activities?

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How do you deal with short recovery periods?

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How do you get athletes through an event?

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BRIDGING THE LOAD GAPS

Activity	Peak Load (BW)	Load Rate (BW/s)
Standing Heel Raise (2 leg)	1.6	8.7
Walking (stance)	3.3	18.7
Hopping (2 leg)	4.8	56.3
Run (stance)	5.2	58.1
Forward Hop (1 leg)	7.3	67.1

Baxter, Silbernagel et al, 2020

BRIDGING THE LOAD GAPS

- Load is CUMULATIVE
- Walking is NOT a low load activity
- There are large jumps in load between common activities and you may not be able to control for those
- Although you may be able to graduate the load more specifically with a capacity building exercise program you may not have that ability during sport or under the given circumstances.

LOAD MANAGEMENT

BRIDGING THE LOAD GAPS

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LOAD MANAGEMENT

FORCE GENERATION REQUIREMENT

- What is the force that needs to be overcome and how do we change it?

1. Directly add force externally
2. Modify movement to change the kinetics (i.e. net joint moment that needs to be overcome)
3. Improve Force Generation Efficiency (FGE)
4. Improve Force Transfer Efficiency (FTE)
5. Reduce the Rate of Application (ROA) of load

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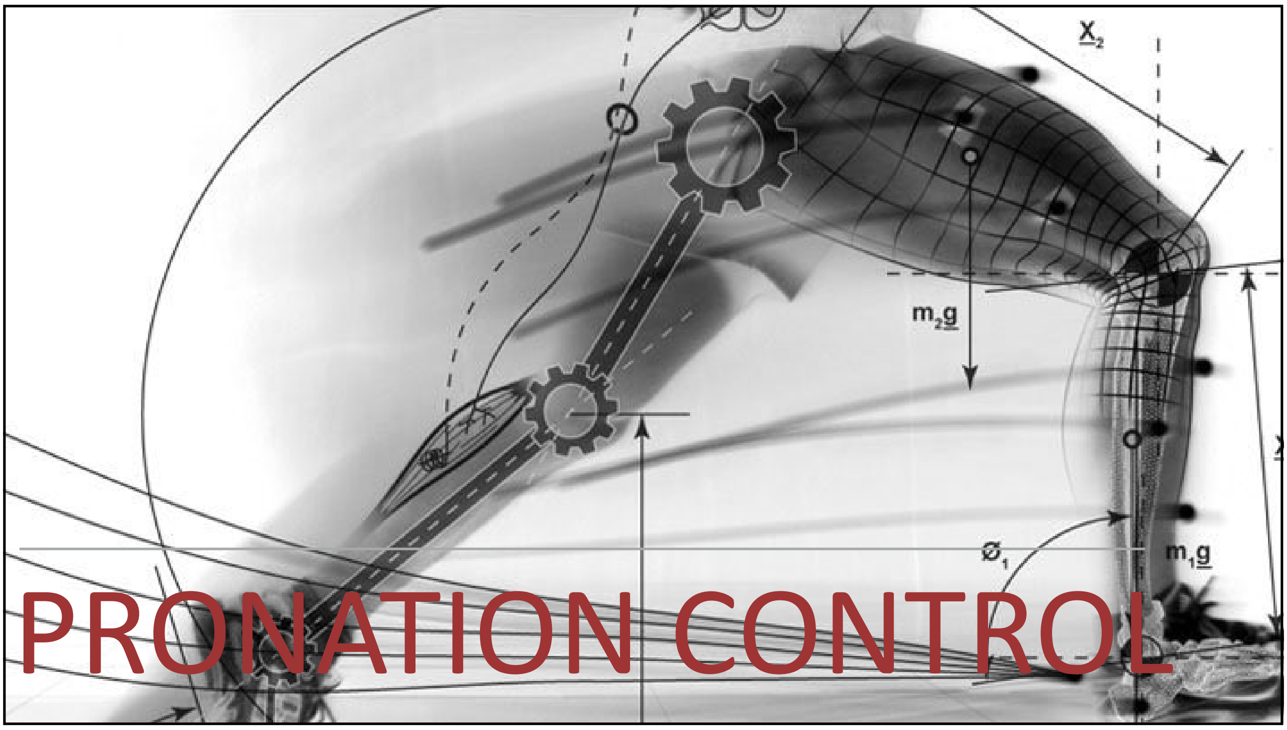

PRONATION CONTROL

PRONATION CONTROL

SUBTALAR JOINT MECHANICS

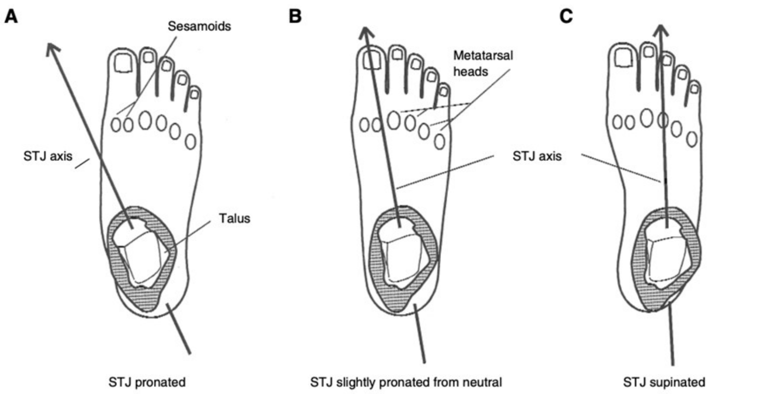

Figure 2. When a foot that functions normally is in relaxed bipedal stance, resting slightly pronated from neutral position, the subtalar joint (STJ) axis passes through the posterior-lateral calcaneus posteriorly and above the first intermetatarsal space anteriorly (center, B). As the subtalar joint undergoes pronation motion, the talus internally rotates and medially translates in relation to the plantar foot, causing the subtalar joint axis to internally rotate and medially translate (left, A). As the subtalar joint undergoes supination motion, the talus and subtalar joint axis externally rotate and laterally translate in relation to the plantar foot (right, C).

Kirby, 2001 Journal of American Podiatric Medical Association

PRONATION CONTROL

WINDLASS ARCH SUPPORT

LOAD MANAGEMENT

ARCH SUPPORT TECHNIQUE

1. Directly add force externally – creates a supination moment and resists the foot lengthening longitudinally and transversely
2. Modify movement to change the kinetics - the shift results in a reduced net pronation moment that needs to be controlled/overcome (arch support orthoses reduce peak AT load)
3. Improve Force Generation Efficiency (FGE) – improved length-tension of supinators, reduced pain inhibition as pain is load-dependent
4. Improve Force Transfer Efficiency (FTE) – increased lever arm of Tib Post, supinated position is closed packed and therefore more stable, tri-planar force closure enhances this, reduced tendon compliance with cyclic loading (also load dependent)
5. Reduce the Rate of Application (ROA) of load – decelerate pronation, reduce magnitude over same time.

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EMERGING RESEARCH

- **The effects of Dynamic Tape for Medial Longitudinal Arch Support on Navicular Height and Plantar Pressures during Running Activity, Bage, 2017**
- Investigated changes in navicular drop in asymptomatic subjects with >10mm drop
- Measurements taken, pre, post, after 20 minutes of running and after 30 minutes of running
- Significant changes found at all intervals and no difference between 20 minutes and 30 minutes

The effects of Dynamic Tape for medial longitudinal arch support on navicular height and plantar pressures during running activity.

Tools

Bage, Dawn (2017) *The effects of Dynamic Tape for medial longitudinal arch support on navicular height and plantar pressures during running activity.* Undergraduate thesis, University of Chichester.

Text
Dawn Bage.pdf - Submitted Version
Restricted to Registered users only

Download (365kB)

Abstract

Objectives: To determine if dynamic tape (DT) effectively supports the medial longitudinal arch during running.
Methods: Twelve participants (Mean (SD) age 23(±6.5) years) who were asymptomatic and exhibited a navicular drop >10mm were studied. Navicular height (NH) and plantar pressures (PP) were measured at four intervals during a single testing session: pre-tape, post-tape, post 20 minutes and post 30 minutes running. The participants non-dominant foot was untaped and acted as a control. A repeated measures analysis of variance (ANOVA) was used to assess NH on tape condition and time. T-tests were used to determine whether significant ($p<0.05$) differences in NH occurred with taping.
Results: A two-way repeated measures ANOVA identified that the untaped leg responded differently to the taped leg over time ($F(3,33)=20.776$, $p<0.0005$). DT resulted in statistically significant increases in NH pre to post-tape ($p<0.0005$); Pre-tape to 20 minutes running ($p<0.0005$) and Pre to 30 minutes running ($p<0.0005$). Whilst NH remained significantly higher than pre-tape there were statistically significant decreases in post-tape to 20 ($p=0.004$) and post-tape to 30 ($p=0.001$). There was no significant decrease between 20 and 30 minutes running ($p=0.137$). No significant changes were found for PP due to error in experimental design/statistical analysis.
Conclusions: Results indicate that DT successfully increases NH and maintains effective support of the MLA in up to 30 minutes running. Results for PP were not as expected but this was due to error in experimental design. Future research should focus on the effect of DT on PP during running but as there is a lack studies utilising DT, any RCT with larger sample sizes including both symptomatic and asymptomatic participants would be of value.

EMERGING RESEARCH

- **Comparison of the Effects of Barefoot, Kinesio Tape and Dynamic Tape on Static and Dynamic Balance in Subjects with Asymptomatic Flexible Flat Feet, Lim & Park, 2020**
- Dynamic Taping increased composite reach scores in Y Balance Test significantly over Kinesio Tape and Barefoot conditions
- Dynamic Taping reduced AP and lateral variability during walking
- These have been shown to be poorer in those with Flexible Flat Feet

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Original Article
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Comparison of the Effects of Barefoot, Kinesio Tape, and Dynamic Tape on Static and Dynamic Balance in Subjects With Asymptomatic Flexible

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Key Words
Balance
Dynamic tape
Flexible flatfoot
Kinesio Tape

Background: Flat-footed persons with collapsed medial longitudinal arch lose flexibility after skeletal maturity, resulting in several deformities and soft tissue injuries. Although arch support taping is usually applied in the clinic to support the collapsed arch, research on the use of different types of tape for more efficient arch support in flat-footed persons is lacking.

Objects: The purpose of this study was to examine three conditions (barefoot, kinesio tape, and dynamic tape) and compare their effects on static and dynamic balance in persons with asymptomatic flexible flatfoot.

Methods: Twenty-two subjects (9 females and 13 males) with asymptomatic flexible flatfoot participated in this study. The subjects performed the Y-balance test to measure the composite reach score. The subjects also performed a 30-second standing test to measure the center of pressure (COP) path length and a walking test to measure anteroposterior and lateral variability using the Zebris FDM system. One-way repeated-measures analysis of variance compared the three conditions applied to the subjects' feet for each balance variable.

Results: The composite reach score significantly increased following the application of dynamic tape compared with barefoot and that of kinesio tape compared with barefoot. There was no significant difference in the COP path length during standing among the three conditions. Anteroposterior and lateral variability during walking significantly with dynamic tape application compared with barefoot.

Conclusion: The results of this study suggest that, in persons with asymptomatic flexible flatfoot, application of kinesio tape and dynamic tape may be effective in increasing the composite reach score in Y-balance test, whereas application of dynamic tape may be effective in reducing anteroposterior and lateral variability during walking.

EMERGING RESEARCH

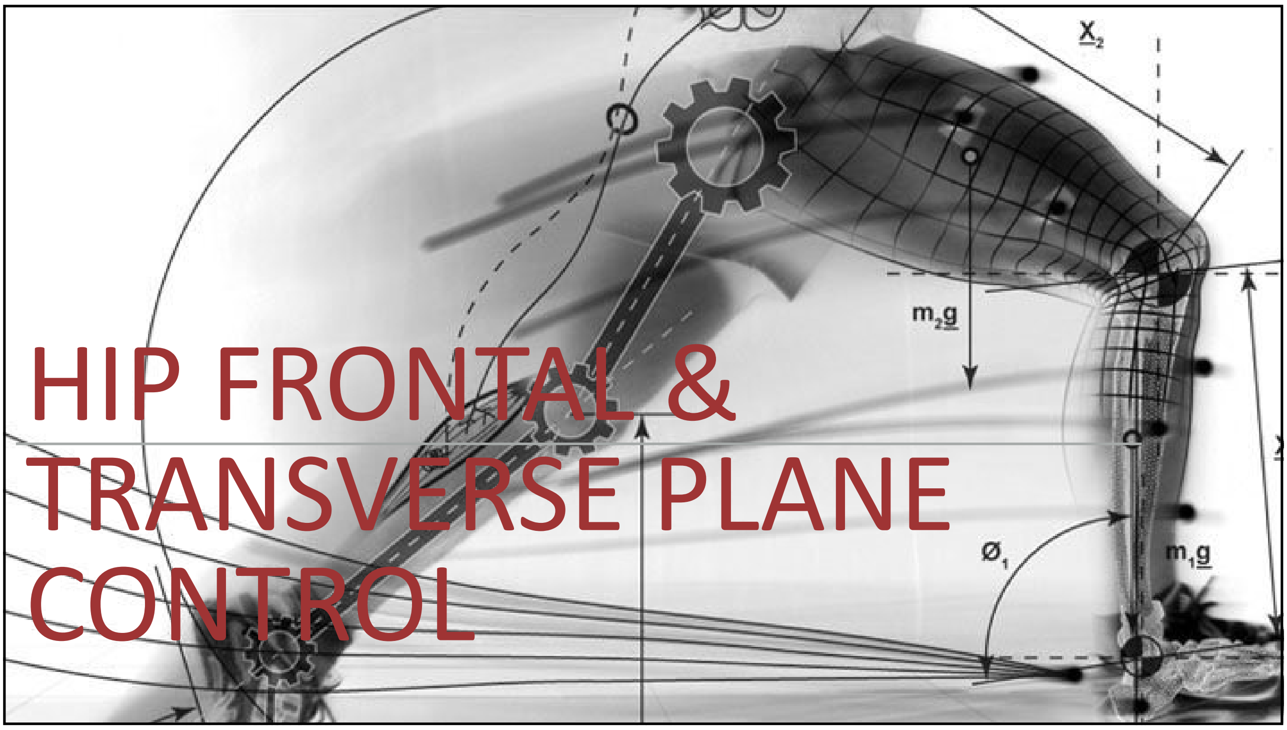
- **The Effect of Dynamic Taping on Flexible Flat Feet, Kourtoglou, 2019**
- Dynamic Taping increased navicular height and reduced navicular drop in single and double leg standing
- Significant shift in plantar pressures generally reducing medially and increasing laterally (although some increase under Hallux - not 1st MT)

ABSTRACT

Background and Objective: Flexible flatfoot is a condition which is related with further musculoskeletal disorders. The dynamic taping is supposed to support the longitudinal and transverse arches of the foot and with the line of pull aim to increase the medial longitudinal arch and reduce the excessive pronation and soft tissue laxity. These are also the main characteristics of this condition. This study aims to investigate the effect of dynamic taping on navicular height, navicular drop and on the plantar pressure during static and dynamic measurements in subjects with asymptomatic flexible flatfeet.
Method: Thirteen participants with navicular height less than 59mm and navicular drop more than 10mm participated in this study. From all the subjects the navicular height and the navicular drop, from double and one-leg standing, were taken. After that the subjects performed 3 tasks in the pressure plate; double-leg standing, one-leg standing and walking. The whole procedure was repeated with the foot taped.
Results: Paired t-tests revealed significant increase of the navicular height (p=.009) and significant decrease of the navicular drop both in double (p=.000) and one-leg standing (p=.010). A significant increase of the loads under the midfoot is noticed during the three tasks (p=.002; p=.001; p=.000). During the double-leg standing there is also significant reduction of the pronation (p=.000) while significantly increasing loads under the hallux (p=.049). Significant increase under the contact area is noticed during the one-leg standing (p=.030) and a significant reduction of the loads under the metatarsal 2 and 3 during the walking was found (p=.027; p=.008).
Conclusion: This study demonstrates that the tape can control the navicular height and the navicular drop. It also reveals some shifting of the loads from the medial to the lateral side without all of the outcomes being significant.

Keywords: *flexible flatfeet, arch taping, dynamic tape, pressure plate, arch index*

PRACTISE ARCH AND PLANTAR FLEXION TECHNIQUES



HIP FRONTAL & TRANSVERSE PLANE CONTROL

HIP JOINT MECHANICS

- Increased velocity & magnitude of hip adduction and internal rotation implicated in several lower limb conditions
- High frontal plane knee projection angle associated with increased risk of secondary non contact ACL injuries
- Greater Trochanteric Pain Syndrome (GTPS) – suggested increase in both overwork (tensile loading) and reduced efficiency of force generation as well as compressive loading
- Relative increase in contribution of the ITB tensioners and reduced contribution from trochanteric tensioners – increased adduction and increased compression

HIP ADDUCTION & INTERNAL ROTATION CONTROL

GREATER TROCHANTERIC PAIN SYNDROME

HIP ADDUCTION & INTERNAL ROTATION CONTROL

GREATER TROCHANTERIC PAIN SYNDROME

1. Directly add force externally – creates hip extension, abduction and external rotation moments
2. Modify movement to change the kinetics – reduced Dynamic Valgus changes loading profile at the knee. Less adduction reduce compressive loading at the insertions at the Greater Trochanter.
3. Improve Force Generation Efficiency (FGE) – improved length-tension of glutei, reduced pain inhibition. Less adduction may reduce contribution of ITB tensioners (due to length-tension) which in turn may further reduce compressive loading and allow for better recruitment of trochanteric tensioners in weight-bearing, non pain producing activities to build capacity.
4. Improve Force Transfer Efficiency (FTE) – improved lateral pelvic control and possibly improved load transfer across SIJ and lumbo-pelvic-hip complex in gait due to less flexion/adduction which counternutates the sacrum and is a loose packed position.
5. Reduce the Rate of Application (ROA) of load – reduces velocity and magnitude of frontal and transverse plane motion.

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HIP ADDUCTION & INTERNAL ROTATION CONTROL

GREATER TROCHANTERIC PAIN SYNDROME

- Compared taping in shortened position (active) to taping in a relatively lengthened (passive) position
- Active tape significantly reduces hip adduction moment and movement displacement during walking gait
- Active tape significantly reduces internal rotation and pelvic obliquity displacement during walking gait
- Active tape provides a statistically significant reduction in pain in women with GTPS
- This suggests that effect is largely mechanical

ELSEVIER
Gait & Posture
Available online 18 March 2019
In Press, Accepted Manuscript

Full length article

Does Dynamic Tape change the walking biomechanics of women with greater trochanteric pain syndrome? A double-blind randomised controlled crossover trial

NA Robinson [a], W Spratford [b], M Welvaert [c], J Gaida [d], AM Fearon [e]

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HIP ADDUCTION & INTERNAL ROTATION CONTROL

DYNAMIC VALGUS

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DYNAMIC TAPING AND HIGH FRONTAL PLANE KNEE PROJECTION ANGLE IN FEMALE VOLLEYBALL ATHLETES

Natalia Bittencourt[1], Marcela Leite[1], Alysson Zuin[2], Marina Pereira[1], Gabriela Gonçalves[1], Silvanio Signoretti[1]
Author affiliations +

Abstract

Background Two-dimensional frontal plane knee projection angle (FPKPA) has been used to assess dynamic knee alignment during single leg squat in athletes with patellofemoral pain and to screen athletes who are at risk for anterior cruciate ligament (ACL) injury. The Dynamic Taping (DT) could be used in motor control training to decrease load of lower limbs muscles and improve movement pattern.

Objective Compare FPKPA before and after the application of dynamic taping in female volleyball athletes.

Design Cross-sectional study.

Setting The FPKPA was used to measure knee medial motion. The ICC was 0.90 and the standard error of measurement (SEM) was 1.65°. All these measurements were performed at Minas Tenis Clube.

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HIP ADDUCTION & INTERNAL ROTATION CONTROL

DYNAMIC VALGUS

- Investigated a similar technique on elite female volleyballers during single leg squat
- Measured high frontal plane knee projection angle
- Showed that significant collapse (>10º) when untaped was reduced to <5º when taped (5º being reported as a critical threshold)
- A similar study looking at female runners showed similar results in reduction in velocity and magnitude of hip adduction and internal rotation when taped in the shortened position – presented at APA conference 2019

PRACTISE HIP EXT/ABD/ER AND KNEE EXT TECHNIQUES