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PASIG MONTHLY CITATION BLAST: No.58 **March 2011**

Dear PASIG members:

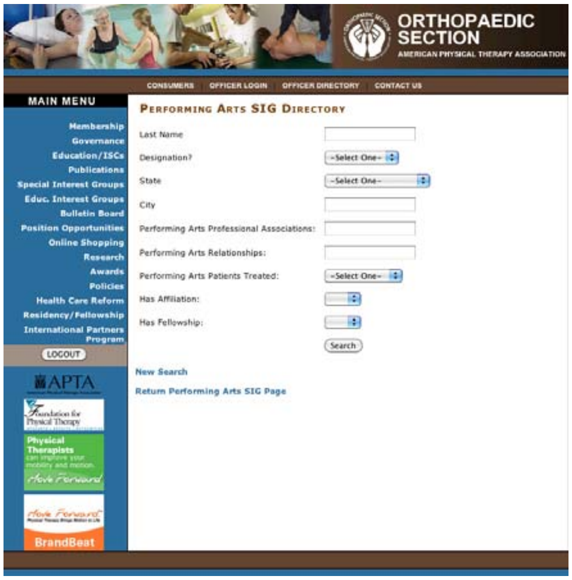
After great PASIG programming at CSM 2011, we're back to business. Traditionally, the PASIG sends our March Citation Blast to all Orthopaedic Section members. If you are intrigued by what you see, join our SIG!

The PASIG is developing a Resource Page, which will be posted on our website. It will have links to articles and citation blasts, by topic. For example, it will have links to help you find injury information regarding figure skating, dancing, gymnastics, musicians, and other aspects of performing arts. This information is being developed right now and will be LIVE on the PASIG website by CSM 2011.

If you haven't perused the PASIG Website lately, you might be missing some vital information. There is a wealth of information located there including:

- Archived monthly citation blasts, by date and topic
- Listing of officers
- Member Directory with an advanced search
- Meeting minutes from our annual meetings at CSM
- Member profile update to provide detailed information about your PA experience, relationships, practice information
- A list of clinical affiliations
- A list of Entry-level PT Programs With a Strong Performing Arts Curriculum
- Performing Arts Glossaries: Ballet, Figure Skating, Artistic Gymnastics, and Hip Hop Dance
- Information regarding the PASIG Student Scholarship
- Technical report from the PASIG practice analysis
- A bulletin board to ask questions

The PASIG needs members to complete our membership survey in order to update your profile. This is a valuable resource for colleagues who may have traveling artists in need of a physical therapist in a new location. You can fill this out online at the following address once you've logged in as an Orthopaedic Section member:
https://www.orthopt.org/surveys/membership_directory.php



Also, if you haven't already done so, please contact Kendra Gage (kmhgage@gmail.com) if you have a PA student clinical affiliation. She will need to know the following:

- Name of Practice
- Address
- Clinical coordinator
- Phone
- Fax
- E-mail
- % PA treated and type of artist
- Student requirements

For this March Citation BLAST, Marcus Kohout and Jason Tonley have selected the topic "*Taping for Ankle and Foot Dysfunction.*" They report on an interesting case study that used two taping techniques as part of their treatment. The format is an annotated bibliography of articles from 2001 – 2011. The PASIG Research Committee initiated this monthly Citation BLAST on performing arts-related topics in June 2005 in the hopes of encouraging our members to stay current in the literature and, perhaps, consider conducting research themselves. Each month we send a new list of performing arts (PA) citations to members of the PASIG to further the pursuit of PA-related scholarship. (Information about EndNote referencing software can be found at http://www.endnote.com, including a 30-day free trial).

As always, your comments, suggestions, and entry contributions to these Citation BLASTs are welcome. Please drop me an e-mail anytime.

Regards,
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Taping for Ankle and Foot Dysfunction

The following case describes a patient for whom taping was a useful adjunct to physical therapy. The patient was a 16 year old cheerleader presenting to physical therapy two weeks status post inversion ankle injury that occurred in a failed split jump. She was initially diagnosed with a lateral ankle sprain by her primary care physician, and was then referred to an orthopedic surgeon after 1 week of complaints of continual "dislocation", where she was then diagnosed with a peroneal retinaculum avulsion. She was placed in a cam boot and encouraged to avoid excessive activity. "Dislocation" persisted 1-2x/day in the boot until she was seen in physical therapy one week following her visit with Orthopedics.

Subjectively, the patient complained of recurring dislocation when exiting automobiles, turning corners, and performing active range of motion in plantar flexion and eversion. She was concerned that she might not be able to return to cheer this football season. Objective examination revealed excessive pronation during mid-stance of gait, trace effusion in the posterior lateral malleolar region, apprehension to active ROM in the combined plane of eversion and plantar flexion, as well as pain and weakness with peroneal manual muscle testing. The patient's symptoms were largely resolved by placing a posterior glide to the fibula and manually blocking subluxation of the peroneal tendons. Additionally, she had reproduction of symptoms with squatting that was alleviated with manual stabilization of the midfoot in a neutral position, i.e. limiting pronation.

Given the effects of manual stabilization on the patient's symptoms, we chose to include several taping strategies to stabilize the fibula and peroneal tendons as well as correct for abnormal foot movements. We applied two separate taping procedures to mimic our manual stabilization. The first taping procedure was to assist in preventing displacement of the fibula and peroneal tendons, the second was to assist in preventing mid foot pronation in mid-stance. The first technique applied was the fibular posterior superior relocation taping as described by Mulligan. The second taping technique applied was the modified low dye technique with first ray depression. The application of the fibular taping alone relieved 100% of the patient's symptoms with non weight-bearing movements and 75% of the patient's symptoms with squatting. The addition of the modified low-dye taping fully alleviated the patients remaining symptoms with squatting and other weight bearing activities. The patient was seen for a total of four visits over the following four weeks for continued application of tape, range of motion exercises, proprioceptive training, neuromuscular reeducation in foot posturing, and progressive resistance exercises. Upon discharge from physical therapy, the patient reported no recurrences of subluxation and returned to full participation in cheerleading while continuing fibular taping and using over the counter rigid orthotics.

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Alt W, Lohrer H, et al. (1999). Functional properties of adhesive ankle taping: neuromuscular and mechanical effects before and after exercise. Foot Ankle Int **20**(4): 238-245.

The purpose of the study was to investigate effects of adhesive ankle taping. Using electromyographic, goniometric, and thermologic methods, different ankle tapes were tested before and after athletic exercise in simulated inversion trauma. Twelve subjects with stable ankle joints performed five trials: with two different materials, with two taping techniques, and one trial without tape as control. After the simulated inversion trauma, approximately 35% of the initial maximum inversion amplitude was decreased by ankle taping. Depending on the technique, there was a loss of tape stability < or =14% after 30 min of athletic exercise. Thermologic analysis revealed a postexercise 6 degrees C temperature increase in the foot, especially under the tape. Initially, interpreted as the primary effect, the improved joint stabilization is based on mechanical stiffness caused by the adhesive tape. Joint stability was influenced positively by neuromuscular proprioceptive and physiological processes, characterized by relatively increased electromyographic activation.

Bragg RW, Macmahon JM, et al. (2002). Failure and fatigue characteristics of adhesive athletic tape. Med Sci Sports Exerc **34**(3): 403-410.

PURPOSE: Athletic tape has been commonly reported to lose much of its structural support after 20 min of exercise. Although many studies have addressed the functional performance characteristics of athletic tape, its mechanical properties are poorly understood. This study examines the failure and fatigue properties of several commonly used athletic tapes. METHODS: A Web-based survey of professional sports trainers was used to select the following three tapes for the study: Zonas (Johnson & Johnson), Leukotape (Beiersdorf), and Jaylastic (Jaybird & Mais). Using a hydraulic material testing system (MTS), eight samples of each tape were compared in three different mechanical tests: load-to-failure, fatigue testing under load control, and fatigue testing under displacement control. Differences in tape microstructure were used to interpret the results of the mechanical tests. RESULTS: Significant differences (P < 0.001) in failure load, elongation at failure, and stiffness were found from failure tests. Significant differences were also found (P < 0.001) in fatigue behavior under both modes of control. As a representative example, in one normalized displacement control fatigue test after 20 min of cycling, 21% (Zonas), 29% (Leukotape), and 57% (Jaylastic) of the mechanical support was lost. After cycling, all tapes loaded to failure showed increased stiffness (P < 0.001), indicating significant energy absorption during cycling. Observed differences in the tapes' microstructure were qualitatively consistent with the measured differences in their mechanical properties. CONCLUSION: In understanding the shortcomings of currently available tapes, the results of these tests can now be used as benchmarks with which to compare and develop future tape designs. Ultimately, these improved tapes should reduce ankle injuries among athletes.

Broglio SP, Monk A, et al. (2009). The influence of ankle support on postural control. J Sci Med Sport **12**(3): 388-392.

Postural control assessments are commonly administered to athletes as part of a pre-season screening. Establishing a baseline level of function permits the clinician to compare post-injury results to normal functioning during the return to play decision-making process. In the athletic setting, follow-up tests may be completed on the sideline immediately following injury. We sought to examine the effect of commonly administered external ankle joint support on postural control using the balance error scoring system (BESS) and the NeuroCom sensory organization test (SOT). Nineteen volunteers free from balance issues completed three sessions with varied ankle support: bilateral prophylactic ankle taping, laced bracing device, or barefoot. Each session included an initial balance assessment on the BESS and SOT, a 20 min treadmill walk, and post-walk balance test. Fewer errors, indicating improved balance, were committed on the BESS during the barefoot condition than the braced ankle condition (p=0.044) at the pre-walk assessment. During the post-walk assessment, fewer errors were committed during the barefoot condition compared to the braced ankle condition (p=0.034) and the taped ankle condition (p=0.037). All ankle support conditions showed similar improvements in balance between the pre and post-walk assessments on the BESS (p<0.001) and SOT composite balance score (p=0.009). These findings indicate that ankle support devices may influence postural control on the BESS, but not on the NeuroCom SOT. Clinicians using the BESS as a balance assessment device at multiple time points should be consistent in the application of ankle support devices.

Cordova ML, Scott BD, et al. (2005). Effects of ankle support on lower-extremity functional performance: a meta-analysis. Med Sci Sports Exerc **37**(4): 635-641.

Clinicians surmise that the application of external ankle support reduces the ability to perform functional skills and movements, but the outcomes from some of these studies have been inconclusive. PURPOSE: To meta-analyze studies regarding the effects of external ankle support on lower-extremity functional performance measures. METHODS: A total of 93 effects from 17 randomized controlled trials utilizing predominantly crossover designs with recreationally active participants and competitive athletes were subjected to a random-effects meta-analysis. The treatment variable was external ankle support with three levels: adhesive tape, lace-up style, and semirigid style. Differences between mean changes in treatment and control groups were computed as standardized effect sizes for sprint, agility, and vertical jump performance with their 90% confidence intervals (CI). Effect sizes >0.20 were considered substantial. RESULTS: The greatest effect of ankle support on performance was a negative effect of lace-up style brace on sprint speed (effect size -0.22, 90% CI -0.47 to 0.03), equivalent to approximately 1% impairment of speed. The other effects of external ankle support on performance were insubstantial, though most were negative, and their lower confidence limits allowed for realistic chances of impaired performance. Substantial true variation between studies, although poorly defined, was also present for some effects, further increasing the likelihood of performance impairment in some settings. CONCLUSIONS: More research is needed to reduce the uncertainty in the effects of external ankle support on performance. In the meantime, it is our opinion that the benefit in preventing injury outweighs the possibility of substantial but small impairment of performance when athletes use external ankle support.

Franettovich M, Chapman A, et al. (2008). A physiological and psychological basis for anti-pronation taping from a critical review of the literature. Sports Med **38**(8): 617-631.

Anti-pronation taping is a treatment technique commonly used by clinicians in the management of lower extremity musculoskeletal pain and injury. The clinical efficacy of anti-pronation tape is described anecdotally and has some support through clinical trials for some foot conditions. However, the mechanism(s) underlying its clinical efficacy is unknown, but are broadly categorized under mechanical, neurophysiological and psychological hypotheses. This article explores these hypotheses and contributes to the understanding of the technique.A computer database search was conducted to identify relevant experimental studies using an a priori defined search strategy. Data were extracted from reviewed articles and wherever possible mean differences between baseline and taped condition and the 95% confidence interval, as well as percentage change scores and effect size statistics were calculated. Articles were organized pertaining to the hypothetical mechanism investigated and presented accordingly into biomechanical, neurophysiological or psychological paradigms.Overall, the research to date has focused predominantly on the mechanical paradigm with far fewer papers being found for the neurophysiological and psychological paradigms. The literature provides evidence that anti-pronation tape has a biomechanical effect, which has been demonstrated by increases in navicular height and medial longitudinal arch height, reductions in tibial internal rotation and calcaneal eversion and alteration of plantar pressure patterns, under both static (i.e. standing) and dynamic (i.e.

walking, jogging, running) conditions. The reduction in pronation was dependent on the surrogate measure of pronation used, but generally ranged from as little as 5% increase in longitudinal arch height during jogging to as much as a 33% change in calcaneal eversion during walking. Preliminary evidence from few studies suggests that anti-pronation tape has a neurophysiological effect as it has been shown to reduce the activity of several muscles of the leg during dynamic tasks such as walking, hopping, cutting, back pedalling and drop jumps. Data were difficult to extract from these papers, but it would appear from a small study that the reduction is in the order of about 45% for tibialis posterior. To date, there has been limited investigation of the psychological effects of anti-pronation tape. A main issue, as with most placebo or sham interventions for physical therapy research, is that of an appropriate comparator in this regard. Consequently, these effects are currently not well understood. This article reports of evidence in support of anti-pronation tape exerting a biomechanical effect. As its name suggests, it does reduce pronation. There is emerging evidence of a neurophysiological effect, which is generally one of reduction in muscle activity, but caution is urged in over-interpreting a few studies on small sample sizes. Further research is required in this paradigm before sports medicine practitioners can utilize these findings in day-to-day clinical practice. Due to insufficient evidence, this article was unable to draw any conclusions as to the psychological effects of the tape, but the article does prompt the need for further exploration into the possible role of placebo in the clinical effects of anti-pronation taping.

Franettovich M, Chapman A, et al. (2010). Continual use of augmented low-Dye taping increases arch height in standing but does not influence neuromotor control of gait. Gait & Posture **31**(2): 247-250.

This study investigated the effect of continual use of augmented low-Dye (ALD) taping on neuromotor control of the lower limb during gait, as well as foot posture and mobility. Twenty-eight females were randomly allocated to wear ALD tape continuously or a no-tape control for a mean 12 + or - 2 days. Electromyographic activity from 12 lower limb muscles, three-dimensional motion at the ankle, knee, hip and pelvis (i.e., measures of neuromotor control) and foot posture and mobility was measured before and after the tape or control interventions. For the tape group, arch height ratio (=arch height/distance from heel to first metatarsophalangeal joint line) was greater by 0.006 (95% confidence interval: 0.0002-0.01, p = 0.04) following the intervention period, whereas no change was observed for the control group (-0.003 (-0.01-0.004), p = 0.36). The difference between groups (0.009 (0.0004-0.02), p = 0.04) equated to a 0.16 cm increase in arch height for the tape group following continual use of ALD tape. There was no change in neuromotor control of gait following continual use of ALD taping (p > 0.05). Continual use of ALD tape for approximately 12 days produced a small change in foot posture, but no alteration in neuromotor control. Previous literature suggests that this increase in arch height is likely to be clinically relevant and may be one factor that contributes to the known efficiency of ALD tape in the treatment of lower extremity pain and injury.

Franettovich M, Chapman A, et al. (2008). Tape that increases medial longitudinal arch height also reduces leg muscle activity: a preliminary study. Med Sci Sports Exerc **40**(4): 593-600.

PURPOSE: : To evaluate the initial effects of antipronation taping (APT) on foot posture and electromyographic (EMG) activity of tibialis anterior (TA), tibialis posterior (TP), and peroneus longus (PL) muscles during walking. METHODS: : Five asymptomatic individuals who exhibited lower medial longitudinal arch height on a clinical assessment of gait walked on a treadmill for 10 min before and after the application of an APT technique-specifically, the augmented low-Dye. Arch height (AH) in standing as well as peak and average amplitude, duration, time of onset, and time of offset of recorded EMG activity during walking were analyzed for each condition. RESULTS: : APT produced a mean (95% confidence interval (CI)) increase in AH of 12.9% (6.5-19.3; P = 0.005). Mean (95% CI) reductions in peak and average EMG activation of TA (peak: -23.9% (-34.0 to -13.9); average: -7.8% (-13.6 to -2.0)) and TP (peak: -45.5% (-77.3 to -13.7); average: -21.1% (-41.6 to -0.6)) were observed when walking with APT (P < 0.05). The APT also produced a small increase in duration of TA EMG activity of 3.7% (0.9-6.5) of the stride cycle duration, largely because of an earlier onset of EMG activity (4.4%; -8.1 to -0.8 of a stride cycle; P < 0.05). CONCLUSION: : APT reduces activity of the TA and TP muscles during walking while increasing AH, which provides preliminary evidence of its role in reducing the load of these key extrinsic muscles of the ankle and the foot. Follow-up study is required to evaluate these findings.

Franettovich M, Chapman AR, et al. (2010). Augmented low-Dye tape alters foot mobility and neuromotor control of gait in individuals with and without exercise related leg pain. J Foot Ankle Res **3**: 5.

BACKGROUND: Augmented low-Dye (ALD) tape is frequently used in the management of lower limb musculoskeletal pain and injury, yet our knowledge of its effect is incomplete, especially in regard to its neuromotor effects. METHODS: We measured electromyographic (EMG) activity of twelve lower limb muscles, three-dimensional kinematics of the ankle, knee, hip and pelvis, foot posture and foot mobility to determine the physiological effect of ALD tape. Fourteen females with exercise related leg pain and 14 matched asymptomatic females walked on a treadmill under three conditions: pre-tape, tape and post-tape. A series of repeated measure analysis of variance procedures were performed to investigate differences in EMG, kinematic, foot posture and mobility measurements. RESULTS: Application of ALD tape produced reductions in recruitment of tibialis anterior (7.3%) and tibialis posterior (6.9%). Large reductions in midfoot mobility (0.45 to 0.63 cm) and increases in arch height (0.58 cm), as well as moderate changes in ankle motion in the sagittal (2.0 to 5.3 degrees) and transverse planes (4.0 to 4.3 degrees) were observed. Reduced muscle activation (<3.0%) and increased motion (<1.7 degrees) was observed at more proximal segments (knee, hip, pelvis) but were of smaller magnitude than at the foot and ankle. Changes in foot posture, foot mobility, ankle kinematics and leg muscle activity did not persist following the removal of ALD tape, but at more proximal segments small changes (<2.2 degrees , <5.4% maximum) continued to be observed following the removal of tape. There were no differences between groups. CONCLUSIONS: This study provides evidence that ALD tape influences muscle recruitment, movement patterns, foot posture and foot mobility. These effects occur in individuals with and without pain, and are dissipated up the kinetic chain. ALD tape should be considered in the management of individuals where increased arch height, reduced foot mobility, reduced ankle abduction and plantar flexion or reduced activation of leg muscles is desired.

Hyland MR, Webber-Gaffney A, et al. (2006). Randomized controlled trial of calcaneal taping, sham taping, and plantar fascia stretching for the short-term management of plantar heel pain. J Orthop Sports Phys Ther **36**(6): 364-371.

STUDY DESIGN: Prospective, experimental, randomized, single-factor, pretest/posttest design. OBJECTIVES: To examine the effects of a calcaneal and Achilles-tendon-taping technique, utilizing only 4 pieces of tape and not involving the medial arch, on the symptoms of plantar heel pain. BACKGROUND: Plantar fasciitis is one of the most common causes of heel and foot pain. Physical therapists have applied many techniques in an attempt to relieve the symptoms of plantar heel pain, including various taping methods for which there is little existing evidence. METHODS AND MEASURES: Subjects (n=41) were randomly assigned into 4 groups: (1) stretching of the plantar fascia, (2) calcaneal taping, (3) control (no treatment), and (4) sham taping. A visual analog scale (VAS) for pain and a patient-specific functional scale (PSFS) for functional activities were measured pretreatment and after 1 week of treatment (posttreatment). RESULTS: A significant difference was found posttreatment among the groups for the VAS (P < .001). Specifically, significant differences

were found between stretching and calcaneal taping (mean + SD, 4.6 +/- 0.7 versus 2.7 +/- 1.8; P = .006), stretching and control (mean +/- SD, 4.6 +/- 0.7 versus 6.2 +/- 1.0; P = .026), calcaneal taping and control (mean +/- SD, 2.7 +/- 1.8 versus 6.2 +/- 1.0; P < .001), and calcaneal taping and sham taping (mean +/- SD, 2.7 +/- 1.8 versus 6.0 +/- 0.9; P < .001). No significant difference among groups was found for posttreatment PSFS (P = .078). CONCLUSIONS: Calcaneal taping was shown to be a more effective tool for the relief of plantar heel pain than stretching, sham taping, or no treatment.

Jamali B, Walker M, et al. (2004). Windlass taping technique for symptomatic relief of plantar fasciitis. J Sport Rehabil **13**(3): 228-243.

Context: Windlass taping is used to reduce pain in plantar fasciitis and thought to take stress off the plantar fascia. Objective: To investigate the effects of windlass taping. Design: Single group, repeated measures. Setting: Outpatient physical therapy clinics. Patients: 20 subjects with plantar fasciitis. Intervention: Windlass taping technique. Main Outcome Measures: Pretaping and posttaping measures included pain levels using a visual analog scale (VAS), resting-stance calcaneal position, tibial position, and navicular height. Fifteen also reported a VAS after wearing the tape for 24 h. Results: Median VAS score 37 mm pretape and 6 mm immediately posttape and 24 h later. Wilcoxon matched-pairs signed ranks test significant (P = .001) for reduction in pain scores. Paired t tests significant (P = .01) for a difference between means of pretaping and posttaping measurements for resting-stance positions. Conclusions: Windlass taping decreased pain in patients with plantar fasciitis and caused small changes in resting-stance positions.

Kelly LA, Racinais S, et al. (2010). Augmented low dye taping changes muscle activation patterns and plantar pressure during treadmill running. J Orthop Sports Phys Ther **40**(10): 648-655.

STUDY DESIGN: Randomized, crossover study. OBJECTIVE: To examine changes in muscle activity and plantar pressure during running with the application of augmented low Dye (ALD) taping. BACKGROUND: ALD taping is used clinically as part of management for lower limb injury. As of yet, no studies have examined the effect of this taping method on muscle activity and plantar pressure during running, simultaneously. METHODS: Thirteen healthy recreational runners(mean +/- SD age, 31.7 +/- 4.9 years; height, 181.7 +/- 4.6 cm; body mass, 81.6 +/- 5.9 kg) completed a 6-minute run on a treadmill at a speed of 10 km.h(1), with 3 different taping conditions (ALD, control tape, no tape), applied in randomized order. Peak and average EMG signal amplitude, onset time, and burst duration were calculated for the vastus medialis, vastus lateralis, and the gluteus medius. In-shoe plantar pressures were also recorded. All data were calculated based on an average of 20 steps collected after 5 minutes of treadmill running. RESULTS: ALD taping significantly altered muscle activity and plantar pressure during treadmill running by (1) delaying the onset of the EMG signal of the gluteus medius, vastus medialis, and vastus lateralis, and (2) increasing lateral midfoot plantar pressure. CONCLUSION: ALD taping significantly alters plantar pressure and muscle activation patterns during treadmill running. These findings give insight into the neuromuscular effect of a taping procedure that is used commonly in a clinical setting.

Kersting UG, Kriwet A, et al. (2006). The role of footwear-independent variations in rearfoot movement on impact attenuation in heel-toe running. Research in Sports Medicine **14**(2): 117-134.

Impact forces and rearfoot eversion have been linked to overuse injuries in running. Modeling approaches suggest that both factors interact in that reduced foot eversion relates to increased impact maxima and vice versa. The aim of this study was to alter rearfoot eversion by applying three different combinations of ankle taping and bracing. Ten subjects were tested while running at 4 m/s on an instrumented treadmill. Sagittal plane kinematics,

rearfoot eversion, tibial acceleration, pressure under the heel, and vertical ground reaction force (GRF) were collected simultaneously over 12 to 14 steps. All interventions reduced the maximum eversion significantly compared with unrestricted running. The largest effect was shown for combined bracing and taping, reducing rearfoot movement by 6.1 degrees while impact force varied only marginally. Overall, relationships between parameters contradict predictions by existing models of foot-ground interaction. Changes in muscular activation remain as a candidate in the regulation of impact mechanics in running.

Landorf KB, Radford JA, et al. (2005). Effectiveness of low-Dye taping for the short-term management of plantar fasciitis. J Am Podiatric Med Assoc **95**(6): 525-530.

Low-Dye taping is often used as a short-term treatment for plantar fasciitis. We evaluated the short-term effectiveness of low-Dye taping in relieving pain associated with plantar fasciitis. In this comparative study conducted at a university-based clinic, 65 participants with plantar fasciitis who received low-Dye taping for 3 to 5 days were compared with 40 participants who did not receive taping. Pain before and after treatment was measured using a visual analog pain scale. Analysis of the data was by the intention-to-treat principle, and a linear regression approach to analysis of covariance was used to compare effects. The visual analog pain scale score improved by a mean of 20 mm (from 44 to 24 mm) in the taping group and worsened by a mean of 6 mm (from 51 to 57 mm) in the control group. The analysis of covariance-adjusted difference in therapeutic effect favored the taping group by 31.7 mm (95% confidence interval, 23.6-39.9 mm) and was statistically significant ($t = 7.71$). In the short term, low-Dye taping significantly reduces the pain associated with plantar fasciitis. These findings are the first quantitative results to demonstrate the significant therapeutic effect of this treatment modality in relieving the symptoms associated with plantar fasciitis.

Lange B, Chipchase L, et al. (2004). The effect of low-Dye taping on plantar pressures, during gait, in subjects with navicular drop exceeding 10 mm. J Orthop Sports Phys Ther **34**(4): 201-209.

STUDY DESIGN: A preintervention and postintervention, repeated-measures experimental design. OBJECTIVES: To investigate the immediate effect of low-Dye taping on peak and mean plantar pressures during gait in subjects with navicular drop exceeding 10 mm. BACKGROUND: Low-Dye taping is commonly used to support the longitudinal and transverse arches of the foot in an attempt to reduce the effects of symptoms associated with excessive pronation. Plantar pressure measurement has been used as an indirect indicator of pronation during gait. METHOD AND MEASURES: The right foot of 60 subjects was tested using the Emed-AT system to obtain plantar pressure values. Subjects performed 6 barefoot walks over the Emed pressure platform while taped and a further 6 walks while untaped. Plantar pressures were recorded. Each footprint obtained was divided into 10 sections or 'masks.' Average peak and mean plantar pressure values (N/cm2) were calculated for both taped and untaped walks for each mask. RESULTS: Paired t tests demonstrated significant changes in peak plantar pressure in 8 of the 10 areas of the foot and significant changes in mean plantar pressure in 9 of the 10 areas of the foot. Low-Dye taping significantly decreased pressure under the heel and the medial and middle forefoot, while increasing pressure under the lateral midfoot and under the toes. A significant decrease in mean plantar pressure was observed under the lateral forefoot, while no significant difference was demonstrated in peak plantar pressure under this area. The area under the medial midfoot demonstrated no significant change in either peak or mean pressure. CONCLUSIONS: Low-Dye taping significantly altered peak and mean plantar pressure values in subjects with navicular drop exceeding 10 mm. In particular, peak and mean plantar pressure increased under the lateral midfoot and under the toes, and decreased under the heel and forefoot, suggesting that a decrease in the amount of pronation occurred.

Matsusaka N, Yokoyama S, et al. (2001). Effect of ankle disk training combined with tactile stimulation to the leg and foot on functional instability of the ankle. Am J Sports Med **29**(1): 25-30.

Twenty-two university students with unilateral functional instability of the ankle participated in this study. They were randomly assigned to one of two experimental groups. Subjects in both groups were trained to stand on the affected limb on an ankle disk. In group 1, two pieces of 1-cm wide nonelastic adhesive tape were applied to the skin around the lateral malleolus from the distal third of the lower leg to the sole of the foot before the training sessions. Subjects in group 2 participated in the training sessions without the application of the adhesive tape. Training was performed for 10 minutes a day, five times per week, for a period of 10 weeks. Subjects were tested for postural sway while standing on the affected limb before, during, and after the training period. In group 1, postural sway values decreased significantly after 4 weeks compared with the pretraining performance, and they were within the normal range after not more than 6 weeks of training. In group 2, the values did not improve significantly compared with the pretraining performance until after 6 weeks of training, and they were not within the normal range until after 8 weeks of training. The findings suggest that the 2-week earlier correction of postural sway in group 1 was due to an increased afferent input from skin receptors that were stimulated by the traction of the adhesive tape.

Meana M, Alegre LM, et al. (2008). Kinematics of ankle taping after a training session. Int J Sports Med **29**(1): 70-76.

This study aimed to test the effectiveness of ankle taping on the limitation of forced supination during a change of direction, as well as the losses of effectiveness after a 30-minute training session. Fifteen young men with no ankle injury volunteered for the study. The static and dynamic ranges of movement (ROM) were measured before and after a training session. The dynamic measurements were recorded using high-speed 3D photogrammetry. The differences between static and dynamic measures of ankle supination and plantar flexion were significant. The losses of effectiveness during supination and ankle plantar flexion restriction were 42.3 % and 47.6 %, respectively. Ankle taping was effective in restricting the maximal static ROMs before a training session, but the effectiveness decreased after 30 min of training. The present study shows the necessity of performing dynamic ROM analysis of sports techniques involved in the ankle sprain mechanism in order to determine the degree of tape restriction after a training session, because there were differences between static and dynamic ankle ROMs. The lack of effects on the restriction of the dynamic plantar flexion would bring into question the necessity of ankle taping in subjects without previous injuries.

Meyer J, Kulig K, et al. (2002). Differential diagnosis and treatment of subcalcaneal heel pain: a case report. J Orthop Sports Phys Ther **32**(3): 114-122; discussion 122-114.

OBJECTIVE: To describe the examination and intervention strategy utilized in the differential diagnosis and treatment of a patient with subcalcaneal heel pain. BACKGROUND: The patient was a 44-year-old man with an 8-month history of left subcalcaneal heel pain. He presented with a chief complaint of limited standing and walking tolerance secondary to pain in the left heel. He had not responded to previous treatments of rest, anti-inflammatory medication, cortisone injections, and exercise prescription. MATERIALS AND METHODS: The patient's subcalcaneal heel pain was reproduced utilizing the straight leg raise (SLR) in combination with ankle dorsiflexion and eversion to sensitize the tibial nerve. These findings suggested a neurogenic component to the dysfunction. Because restricted ankle dorsiflexion, excessive pronation, and posterior tibialis weakness were also found, mechanical dysfunctions also likely contributed to the etiology of heel pain. The patient was treated for 10 visits over a period of 1 month. Treatment consisted of active and passive motions aimed at restoring pain-free soft-tissue motion along the course of the tibial nerve. In addition, low-dye taping and therapeutic exercises were utilized to control excessive pronation and reduce stress on the plantar structures of the foot. RESULTS: The patient's SLR increased from 42 degrees to 54 degrees and became pain-free. Dorsiflexion range of motion increased from 3 degrees to 8 degrees in the left ankle, and left posterior tibialis strength was normalized. Over a period of 1 month the patient's symptoms were resolved, and his standing and walking tolerance was fully restored. CONCLUSION: Assessment and potential contribution of neural dysfunction should be considered in patients with subcalcaneal heel pain.

Midgley W, Hopkins JT, et al. (2007). The effects of external ankle support on dynamic restraint characteristics of the ankle in volleyball players. Clinical J Sport Med **17**(5): 343-348.

OBJECTIVE: To examine any changes in electromechanical delay and reaction time as a result of the use of external ankle supports over an entire season (3-5 months) in college volleyball players. DESIGN: A 2 x 3 pre-post factorial design. SETTING: Biomechanics laboratory, Human Performance Research Center. PARTICIPANTS: Thirty healthy, active male and female intercollegiate volleyball players were recruited for this study (age, 20.4 +/- 2.3 years; height, 183.1 +/- 8.6 cm; weight, 74.0 +/- 9.5 kg). INTERVENTIONS: External supports consisted of the subjects wearing either tape or braces for practices and games for the duration of the volleyball season. Subjects in the control group wore nothing on their ankles for practices and games for the duration of the volleyball season. MAIN OUTCOME MEASURES: The electromechanical delay (EMD) of the peroneus longus was determined by the onset of force contribution after artificial activation, as measured by electromyographic (EMG) and forceplate data. Reaction time was measured after an inversion perturbation during walking. RESULTS: No significant ($F_{2,27} = 0.141$, $P = 0.869$) interaction was observed for reaction time between the groups over time. No significant ($F_{2,27} = 0.236$, $P = 0.791$) interaction was observed for EMD between groups over time. CONCLUSION: Use of an external ankle support over an entire season does not induce neuromuscular changes in the onset timing of the peroneus longus.

Moiler K, Hall T, et al. (2006). The role of fibular tape in the prevention of ankle injury in basketball: A pilot study. J Orthop Sports Phys Ther **36**(9): 661-668.

STUDY DESIGN: Prospective nonrandomized controlled trial. OBJECTIVES: To determine the effect of fibular repositioning tape (FRT) on incidence and severity of ankle injury. BACKGROUND: Pain and functional disability is common following ankle sprain and a major problem in sport. A novel method of taping, FRT, which has been described to prevent ankle sprain, requires less tape than traditional methods and is easier to apply. The objective of this study was to determine the effect of FRT on the incidence and severity of ankle injury in basketball. METHODS AND MEASURES: One hundred twenty-five male basketball players were assigned at time of play to either the control (209 exposures) or FRT (224 exposures) condition in a manner of convenience. Control participants had the choice on the use and type of prophylaxis, excluding FRT. FRT participants were taped using the method described by Mulligan. Ankle injury data were collected after each exposure. Injury severity was determined by functional limitation, pain levels, and days to return to play. RESULTS: Four hundred forty-three measured basketball exposures resulted in 11 ankle injuries. All injuries occurred in subjects with a history of previous ankle sprain. Significantly less ankle injuries were sustained by members of the FRT condition (n = 2), compared to members of the control condition (n = 9) (Fisher exact test, P = .03). The odds ratio of sustaining an ankle injury was 0.20 (P = .04; 95% confidence interval [CI]: 0.04, 0.93) when taped with FRT and the number needed to treat was 22 (95% CI, 12-312). CONCLUSIONS: This study provides preliminary data regarding the prophylactic effects of FRT on ankle injury in male basketball players.

Nolan D, Kennedy N (2009). Effects of low-dye taping on plantar pressure pre and post exercise: an exploratory study. BMC Musculoskeletal Disorders **10**: 40.

BACKGROUND: Low-Dye taping is used for excessive pronation at the subtalar joint of the foot. Previous research has focused on the tape's immediate effect on plantar pressure. Its effectiveness following exercise has not been investigated. Peak plantar pressure distribution provides an indirect representation of subtalar joint kinematics. The objectives of the study were 1) To determine the effects of Low-Dye taping on peak plantar pressure immediately post-application. 2) To determine whether any initial effects are maintained following exercise. METHODS: 12 asymptomatic subjects participated; each being screened for excessive pronation (navicular drop > 10 mm). Plantar pressure data was recorded, using the F-scan, at four intervals during the testing session: un-taped, baseline-taped, post-exercise session 1, and post-exercise session 2. Each exercise session consisted of a 10-minute walk at a normal pace. The foot was divided into 6 regions during data analysis. Repeated-measures analysis of variance (ANOVA) was used to assess regional pressure variations across the four testing conditions. RESULTS: Reduced lateral forefoot peak plantar pressure was the only significant difference immediately post tape application ($p = 0.039$). This effect was lost after 10 minutes of exercise ($p = 0.036$). Each exercise session resulted in significantly higher medial forefoot peak pressure compared to un-taped; ($p = 0.015$) and ($p = 0.014$) respectively, and baseline-taped; ($p = 0.036$) and ($p = 0.015$) respectively. Medial and lateral rearfoot values had also increased after the second session ($p = 0.004$), following their non-significant reduction at baseline-taped. A trend towards a medial-to-lateral shift in pressure present in the midfoot immediately following tape application was still present after 20 minutes of exercise. CONCLUSION: Low-Dye tape's initial effect of reduced lateral forefoot peak plantar pressure was lost after a 10-minute walk. However, the tape continued to have an effect on the medial forefoot after 20 minutes of exercise. Further studies with larger sample sizes are required to examine the important finding of the anti-pronatory trend present in the midfoot.

O'Sullivan K, Kennedy N, et al. (2008). The effect of low-dye taping on rearfoot motion and plantar pressure during the stance phase of gait. BMC Musculoskeletal Disorders **9**: 111.

BACKGROUND: Low-dye (LD) taping is commonly used to reduce rearfoot pronation. No studies have previously investigated the effectiveness of LD taping using both plantar pressure distribution (F-Scan) and 3-D (CODA) analysis of rearfoot motion. METHODS: 20 healthy subjects with a navicular drop test exceeding 10 mm participated in the study. T tests were used to determine whether significant ($p < 0.05$) differences in plantar pressure and rearfoot motion occurred with LD taping. RESULTS: LD taping resulted in statistically significant increases in peak plantar pressure in the lateral midfoot ($p = 0.000$), along with significant decreases in pressure in the medial forefoot ($p = 0.014$), and the medial ($p = 0.000$) and lateral hindfoot ($p = 0.007$). No significant changes occurred in the medial midfoot ($p = 0.794$) or lateral forefoot ($p = 0.654$). When assessed using motion analysis, taping resulted in a statistically significant decrease in rearfoot pronation ($p = 0.006$), supination ($p = 0.025$) and total rearfoot range of motion ($p = 0.000$). The mean rearfoot position during stance was not significantly different however ($p = 0.188$). CONCLUSION: LD taping is associated with alterations in peak plantar pressure in the midfoot and forefoot that indicate reduced pronation with LD taping. However, LD taping appears to reduce both pronation and supination in the rearfoot, rather than simply reducing pronation, when assessed using 3D motion analysis. Therefore, it would appear that LD taping does indeed reduce pronation, by restricting rearfoot motion in general, rather than pronation specifically. The degree of change observed with LD taping was however very small, and further research is needed to clarify the clinical significance of these initial findings.

Purcell SB, Schuckman BE, et al. (2009). Differences in ankle range of motion before and after exercise in 2 tape conditions. Am J Sports Med **37**(2): 383-389.

BACKGROUND: Athletic tape has been used on the ankle to decrease range of motion and to prevent injuries. Results from previous research found that with physical exercise athletic tape loses some of its restricting properties; recently, a new self-adherent taping product was developed that may restrict range of motion regardless of exercise. HYPOTHESIS: Self-adherent tape will maintain ankle range of motion restriction more than traditional white cloth tape both before and after activity. STUDY DESIGN: Controlled laboratory study. METHODS: Twenty volunteers participated in testing procedures on 3 separate days, 1 for each taping condition (self-adherent, white cloth, and no tape). The participant's ankle range of motion was measured with an electrogoniometer before application of the tape, immediately after application of the tape, and after 30 minutes of physical exercise. Range of motion was measured in 2 planes of motion: inversion to eversion and dorsiflexion to plantar flexion. RESULTS: White cloth tape and self-adherent tape both restricted inversion to eversion range of motion immediately after application, but with 30 minutes of exercise only the self-adherent tape maintained the decreased range of motion. For dorsiflexion to plantar flexion range of motion, the white tape and self-adherent tape both significantly decreased range of motion immediately after application and after the exercise protocol. CONCLUSIONS AND CLINICAL RELEVANCE: The self-adherent tape maintained range of motion restriction both before and after exercise. Conversely, the white cloth tape lost some of its restrictive properties after 30 minutes of exercise.

Radford JA, Burns J, et al. (2006). The effect of low-Dye taping on kinematic, kinetic, and electromyographic variables: a systematic review. J Orthop Sports Phys Ther **36**(4): 232-241.

STUDY DESIGN: A systematic review. OBJECTIVE: To determine the strength of evidence of the effect of low-Dye taping on lower limb kinematic, kinetic, and electromyographic variables. BACKGROUND: Low-Dye taping is a foot-taping technique that aims to limit foot pronation and is commonly used to treat a number of foot disorders. METHODS AND MEASURES: Systematic review of randomized or quasi-randomized trials examining the effect of low-Dye taping compared with no taping on kinematic, kinetic, and electromyographic variables. Trials were identified by searching CINAHL, EMBASE, MEDLINE, SPORTDiscus, and CENTRAL, and by recursive checking of bibliographies. Data were extracted from published trials and from mail contact with authors for further information as necessary. Meta-analyses were planned for all outcomes using the generic inverse variance method. Sensitivity analyses were planned by pooling data from nonrandomized trials. Statistical heterogeneity was assessed using the quantity I2. RESULTS: Six trials met inclusion criteria and, of these, 5 trials reported sufficient data on kinematic and kinetic variables to be included in the analysis. Results from the 5 randomized trials were considered robust when pooled with data from 7 nonrandomized trials in a sensitivity analysis. When compared to no taping, low-Dye taping increased navicular height immediately after application (weighted mean difference [WMD], 5.90 mm; 95% confidence interval [CI], 0.41 to 11.39; P = .04) and had no effect on navicular height post exercise (WMD, 4.70 mm; 95% CI, -0.61 to 10.01; P = .08), maximum rearfoot eversion while walking (WMD, -0.59 degrees; 95% CI, -2.53 to 1.35; P = .55), and total rearfoot range of motion while walking (WMD, 2.3 degrees; 95% CI, -0.64 to 5.24; P = .13). CONCLUSIONS: Low-Dye taping provides a small change in navicular height post application, although it is unclear whether this change is clinically important. There was high heterogeneity between some trials examining other variables, indicating that more research is needed to confirm the results of previous trials.

Riemann BL, Schmitz RJ, et al. (2002). Effect of ankle taping and bracing on vertical ground reaction forces during drop landings before and after treadmill jogging" J Orthop Sports Phys Ther **32**(12): 628-635.

STUDY DESIGN: Single-group repeated-measures experimental design. OBJECTIVES: The purpose of this study was to evaluate the effects of prophylactic ankle stabilization on vertical ground reaction forces before and after treadmill jogging. BACKGROUND: Previous research has demonstrated acute effects of ankle taping and bracing on ankle joint kinematics and vertical ground reaction forces during drop landings. Based on the number of investigations demonstrating increased range of motion of the braced or taped ankle following exercise, it may be plausible that the aforementioned landing alterations may return to normal following an exercise bout. METHODS AND MEASURES: Fourteen healthy recreational participants performed stiff and soft drop landings before and after a 20-minute treadmill exercise bout under 3 different ankle stabilizer conditions (no stabilizer, ankle brace, and ankle tape). A forceplate was used to collect ground reaction force data under the dominant foot. The first and second peak impact force, as well as the time to each of the 2 peak forces, were determined for each trial and used as dependent variables. RESULTS: The time to reach peak forces were significantly less under the ankle brace and tape conditions in comparison to the control (no-stabilizer) condition. CONCLUSIONS: It appears that ankle taping and bracing decrease the time to reach peak impact forces. These alterations indicate that during dynamic activity the musculoskeletal structures of the body may be subjected to loads within shorter time periods. Whether these effects are detrimental over time remains speculative at this point and requires further research.

Russo SJ, Chipchase LS (2001). The effect of low-Dye taping on peak plantar pressures of normal feet during gait. <u>Australian J Physiother</u> **47**(4): 239-244.

This study investigated whether low-Dye anti-pronation taping altered peak plantar pressures of normal feet during gait. The Emed-AT-2 platform system was used to measure peak plantar pressures. Forty subjects performed two sets of six walks over the Emed-AT-2 forceplate. One set of walks was performed barefoot whilst the other set was performed with the low-Dye tape applied to the right foot. Computer software divided the heel, midfoot and forefoot into six areas (masks) for analysis. The mean for the peak plantar pressures (N/cm(2)) of each of these masks was determined for both sets of walks. Paired t-tests found a significant difference between the barefoot and taped peak plantar pressures in each of the six masks. Overall low-Dye anti-pronation taping significantly altered the peak plantar pressures of normal feet during gait. Of particular interest was that a significant reduction in mean peak plantar pressure was observed in the medial midfoot (1.4 N/cm(2)) whilst a significant increase occurred in the lateral midfoot (2.6 N/cm(2)).

Shima N, Maeda A, et al. (2005). Delayed latency of peroneal reflex to sudden inversion with ankle taping or bracing. <u>Int J Sports Medicine</u> **26**(6): 476-480.

The purpose of the present study was to examine the effects of ankle taping and bracing based on the peroneal reflex in the hypermobile and normal ankle joints with and without history of ankle injury. Thirty-six ankle joints of 18 collegiate American football athletes with and without previous history of injury were studied. The angle of talar tilt (TT) was measured by stress radiograph for classifying normal (TT</=5 degrees) or hypermobile (TT>5 degrees) ankles. They were tested with taping, bracing, and without any supports as a control. The latency of peroneus longus muscle was measured by a sudden inversion of 25 degrees using surface EMG signals. The results of the present study show no significant three-way Group (hypermobile or normal ankles) by History (previously injured or uninjured ankles) by Condition (control, taping, or bracing) interaction, while Condition main effect was significant ($p<0.05$). There were significant differences between control (80.8 ms) and taping (83.8 ms, $p<0.01$), between control and bracing (83.0 ms, $p<0.05$), but not between taping and bracing ($p>0.05$). In conclusion, ankle taping and bracing delayed the peroneal reflex latency not only for hypermobile ankles and/or injured ankle joints but also for intact ankle joints.

Stanek JM, McLoda TA, et al. (2006). The effects of external support on electromechanical delay of the peroneus longus muscle. <u>Electromyogr Clin Neurophysiol</u> **46**(6): 349-354.

Ankle taping and bracing is commonly used in athletics and both have been shown to be effective in reducing injury. Ankle proprioception has been shown to increase with external support due to the activation of cutaneous mechanoreceptors, however, the sensorimotor effect has not been studied Electromechanical delay (EMD) is defined as the time lag from the onset of electrical activity in the muscle to the subsequent mechanical response. The purpose of this investigation was to measure and compare the EMD of the peroneus longus muscle during ankle unsupported, braced, and taped conditions. Thirty-one (10 male, 21female) healthy, college-aged subjects participated in the study (age: 20.9 +/- 1.8 years, mass 70.3 +/- 15.8 kg, height 171.1 +/- 9.6 cm). Each subject was assigned a random order for the three external support conditions. The subject was positioned on a force platform and instructed to actively evert the ankle. We examined the time lag between the onset of electrical activity in the peroneus longus muscle and a change in force as detected by the force platform. Five trials were completed for each condition and a repeated measures ANOVA was used to determine statistical significance. The results showed no significant difference between the three external support conditions. We concluded that external support through taping and bracing does not affect the EMD of the peroneus longus muscle in healthy subjects.

Vicenzino B, McPoil T, et al. (2007). Plantar foot pressures after the augmented low dye taping technique. J Athletic Training **42**(3): 374-380.

CONTEXT: Taping and orthoses are frequently applied to control excessive foot pronation to treat or prevent musculoskeletal pain and injury of the lower limb. The mechanism(s) by which these devices bring about their clinical effects are at best speculative and require systematic evaluation. OBJECTIVE: To determine the initial effect of the augmented low Dye taping technique (ALD) on plantar foot pressures during walking and jogging. DESIGN: Within-subjects, repeated-measures randomized control trial. SETTING: Gait research laboratory. PATIENTS OR OTHER PARTICIPANTS: Fifteen women and 7 men with an average age of 28.0 +/- 7.4 years who were asymptomatic. INTERVENTION(S): Participants walked and jogged along a 12-m walkway before and after the application of ALD. The untaped side served as the control. MAIN OUTCOME MEASURE(S): Peak and mean maximum plantar pressure data were calculated for the medial and lateral areas of the rear and midfoot and the medial, central, and lateral forefoot areas. Thus, a 3-factor model was tested: condition (ALD, control) x time (preapplication, postapplication) x area (medial and lateral rearfoot and midfoot and medial, central, and lateral forefoot). RESULTS: Significant 3-way interactions were present for both peak and mean maximum plantar pressure during walking (F (6,126) = 9.55, P = .006 and F (6,126) = 11.36, P = .003, respectively) and jogging (F (6,126) = 5.76, P = .026 and F (6,126) = 4.56, P = .045, respectively) tasks. The ALD predominantly increased plantar pressures in the lateral midfoot during walking and jogging. In addition, tape reduced mean maximum pressure at the medial forefoot and at the medial rearfoot during walking. CONCLUSIONS: The ALD, which has previously been shown to reduce excessive pronation, produced significant increases in lateral midfoot plantar pressures, thereby providing additional information to be considered when the mechanism(s) of action of such a treatment are modeled.

Wilkerson GB, Kovaleski JE, et al. (2005). Effects of the subtalar sling ankle taping technique on combined talocrural-subtalar joint motions. Foot & Ankle Int **26**(3): 239-246.

BACKGROUND: The findings of research on the effectiveness of ankle taping for protection against ligament injury have been inconsistent, and the topic remains controversial. The precise orientation of the force vectors created by tension within the various tape strip components of an ankle taping procedure may be a critical factor influencing the degree of motion restraint that is provided. We hypothesized that the addition of the subtalar sling component to the widely recognized standard (Gibney) ankle taping procedure would enhance restraint of ankle motion. This was a controlled laboratory study, with fully repeated

measures (subjects served as their own controls). METHODS: An ankle arthrometer was used to quantify anteroposterior (AP) translation and frontal plane inversion-eversion (I-E) tilt of the talocrural-subtalar joints under untaped and taped conditions in normal subjects. A 15-minute exercise session was conducted to loosen the tape before measurement of its effect on motion restraint. RESULTS: The ankle taping procedure that incorporated the subtalar sling provided significantly greater restriction of postexercise AP translation ($p < 0.001$, $\eta^2 = 0.63$) and postexercise I-E tilt ($p < 0.001$, $\eta^2 = 0.66$). CONCLUSIONS: The subtalar sling ankle taping procedure provides greater restriction of motions associated with ankle instability than the more widely used Gibney procedure.