PASIG PERFORMING ARTS
SPECIAL INTEREST GROUP

ORTHOPAEDIC SECTION
AMERICAN PHYSICAL THERAPY ASSOCIATION

APTA
American Physical Therapy Association
The Science of Healing. The Art of Caring.

PASIG MONTHLY CITATION BLAST: No. 112 **January 2016**

Dear Performing Arts SIG members:

CSM 2016 in Anaheim, CA is fast approaching!! We hope to see you all at the following PASIG-related events, and at the Orthopaedic Section table, Wednesday, February 17th-Saturday, February 20th.

WEDNESDAY: At CSM 2016, the PASIG will offer a 1-day preconference course, "Dynamic Neuromuscular Stabilization: Assessment & Management of Performing Artists," given by Clare Frank, PT, DPT, OCS, FAAOMPT, and Annette Karim, PT, DPT, OCS, FAAOMPT, on Wednesday, February 17, 2016, 8:00 a.m. - 5:00 p.m., in the Pacific Ballroom D, Hilton Anaheim (OR-P2-7572).

FRIDAY MORNING: The Orthopaedic Section Performing Arts SIG Membership Meeting will be held bright and early: Friday, February 19, 2016, 7:00 AM-7:45 a.m., Ballroom A, Anaheim Convention Center.

FRIDAY AFTERNOON: We will also have our regular PASIG programming, "Life on Broadway: Care of the Professional Theatrical Performer" by Jennifer Green, PT, MS, CFMT, and David Weiss, MD, FAAOS, on Friday, February 19th, 3:00 p.m. - 5:00 p.m., in room 304 AB, Anaheim Convention Center (OR-2C-3861). All are welcome!

FRIDAY NIGHT: Orthopaedic Section Meet & Greet, 6:30 p.m.-7:30 p.m., Friday, February 19, 2016, in the California Ballroom B, in the Hilton Anaheim. **Students:** The PASIG awards an annual student scholarship

The **PASIG student scholarship** recipient has been selected! Meet our winner at the PASIG business meeting, and come support our students at their poster presentations!

PASIG Fellowship Taskforce News:

An assembled team of members of the Orthopaedic Section, APTA, Performing Arts Special Interest Group (PASIG) and identified practitioners in the sub-specialty field of performing arts physical therapy, have been working to revalidate the 2004 *Description of Specialized Clinical Practice (DSCP) in Physical Therapy for Performing Artists.*

The Project Team have completed their analysis of the practice analysis survey. The technical report and practice analysis for the revalidated *Description of Advanced Specialized Clinical Practice (DASP) in Physical Therapy for Performing Artists* have been submitted to the American Board of Physical Therapy Residency and Fellowship Education (ABPTRFE) for their review.

A preliminary decision for any requested revisions is expected sometime in February 2016. If no major revisions are requested the technical report and DASP will be published for the general public soon after on the Performing Arts Special Interest Group website: https://www.orthopt.org/content/special_interest_groups/performing_arts.

We would like to thank all those who participated in the revalidation survey process.

Practice Analysis Coordinator and PASIG Fellowship Taskforce Chair
Mariah Nierman, PT, DPT, AT, OCS

The Performing Arts Project Team
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Aimee Klein, PT, DPT, DSc, OCS

Orthopaedic Section Executive Associate
Tara Fredrickson

Call for case reports: If you have a brief, clinically-focused case report on a performing arts PT patient, or a clinical commentary, please contact Annette Karim to submit your writing for the next Orthopaedic Physical Therapy Practice Magazine: neoluvsonlyme@aol.com

Tweet Tweet! We have a Twitter page!
https://twitter.com/PT4Performers
Post your articles and info on your site, let's get connected!

Check out the Orthopaedic section Facebook page, where you can find and post PASIG info: https://www.facebook.com/pages/APTA-Orthopaedic-Section/121020534595362

Below is a list of the PASIG leadership. Please consult this list regarding contact info:

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WE NEED MORE CONTRIBUTORS TO OUR MONTHLY CITATION BLASTS!!!!
Past Monthly citation blasts are available, with citations and EndNote file, listed on the website:
http://www.orthopt.org/content/special_interest_groups/performing_arts/citations_endnotes

TOPICS THAT HAVE BEEN COVERED RECENTLY INCLUDE:
Achilles tendinopathy (Current issue)
Biomechanics and Posture in Musicians
Pilates
ACL Injuries in Dancers
Patellofemoral Pain and Dance
Neural Entrapments Found Among Musicians
Stress fractures of the foot and ankle
Dry needling

Dynamic Warm Up and Stretching
Platelet Rich Plasma Injections
Back Pain in Dancers
Hallux Valgus in Dancers
Posterior ankle impingement

If you are interested in contributing by writing a citation blast, contact me, Brooke Winder: BrookeRwinder@gmail.com

Best regards,

Brooke
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PERFORMING ARTS CONTINUING EDUCATION, CONFERENCES, AND RESOURCES

Musician Health Series, Janice Ying, PT, DPT, OCS
Glendale Adventist Therapy and Wellness Center, Los Angeles area (Eagle Rock), CA
http://www.musicianshealthcorner.com/
Healthy Musician Series - Overuse

Orthopaedic Section Independent Study Course. *20.3 Physical Therapy for the Performing Artist*.
Monographs are available for:
- Figure Skating (J. Flug, J. Schneider, E. Greenberg),
- Artistic Gymnastics (A. Hunter-Giordano, Pongetti-Angeletti, S. Voelker, TJ Manal), and
- Instrumentalist Musicians (J. Dommerholt, B. Collier).

Contact: Orthopaedic Section at: www.orthopt.org

Orthopaedic Section-American Physical Therapy Association,
Performing Arts SIG

http://www.orthopt.org/content/special_interest_groups/performing_arts
Performing Arts Citations and Endnotes
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ADAM Center
http://www.adamcenter.net/
Publications:
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Conference abstracts:
http://www.adamcenter.net/#!vstc0=conferences

Dance USA
http://www.danceusa.org/
Research resources:
http://www.danceusa.org/researchresources
Professional Dancer Annual Post-Hire Health Screen:
http://www.danceusa.org/dancerhealth

Dancer Wellness Project
http://www.dancerwellnessproject.com/
Becoming an affiliate:
http://www.dancerwellnessproject.com/Information/BecomeAffiliate.aspx

Harkness Center for Dance Injuries, Hospital for Joint Diseases
http://hjd.med.nyu.edu/harkness/
Continuing education:
http://hjd.med.nyu.edu/harkness/education/healthcare-professionals/continuing-education-courses-cme-and-ceu
Resource papers:
http://hjd.med.nyu.edu/harkness/dance-medicine-resources/resource-papers-and-forms
Links:
http://hjd.med.nyu.edu/harkness/dance-medicine-resources/links
Informative list of common dance injuries:
http://hjd.med.nyu.edu/harkness/patients/common-dance-injuries
Research publications:
http://hjd.med.nyu.edu/harkness/research/research-publications

International Association for Dance Medicine and Science (IADMS)
http://www.iadms.org/
Resource papers:
http://www.iadms.org/displaycommon.cfm?an=1&subarticlenbr=186
Links:
http://www.iadms.org/displaycommon.cfm?an=5
Medicine, arts medicine, and arts education organization links:

http://www.iadms.org/displaycommon.cfm?an=1&subarticlenbr=5
Publications:
http://www.iadms.org/displaycommon.cfm?an=3

Performing Arts Medicine Association (PAMA)
http://www.artsmed.org/
http://www.artsmed.org/symposium.html
Interactive bibliography site:
http://www.artsmed.org/bibliography.html
Related links:
http://www.artsmed.org/relatedlinks.html
Member publications:
http://artsmed.org/publications.html

(Educators, researchers, and clinicians, please continue to email your conference and continuing education information to include in future blasts)

Achilles tendinopathy

Dancers place a high demand on the Achilles tendon due to the specific requirements at the foot and ankle with jumps, leaps, landings, plies, and pointe work. JOSPT recently published an issue in 2015 that updated members on advances in the pathophysiology and management of tendinopathy. This month's blast highlights some relevant articles from the JOSPT issue as well as other journals published recently (in the past year) that apply to the management of Achilles tendon dysfunction. Investigations in concentric and eccentric exercises, return to sport progression, and use of modalities and adjunct therapies are all included. Enjoy!

Brooke Winder, PT, DPT, OCS
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Chang, Yi-Ping, et al. "Effects of Therapeutic Physical Agents on Achilles Tendon Microcirculation." *journal of orthopaedic & sports physical therapy* 45.7 (2015): 563-569.

Study Design

Controlled laboratory study.

Objectives

To measure Achilles tendon microcirculation (total hemoglobin [THb] and oxygen saturation [StO2]) before and after the application of a physical agent in

asymptomatic participants, and to compare differences between application location and physical agent dosage.

Background

Tendon microcirculation can be altered by superficial heating or cryotherapy.

Methods

Fifty-one healthy adults (median age, 22 years; range, 20–34 years) were recruited and randomly assigned into 1 of 4 groups. Participants in each group received an intervention consisting of 1 of the following 4 physical agents: ultrasound (n = 12), interferential current (n = 14), low-level laser (n = 11), or vibration massage (n = 14). In each group, the selected intervention was applied at 2 different doses (ultrasound, 0.8 or 1.2 W/cm^2; laser, 5.4 or 18 J) or target locations (vibration and electrostimulation, calf muscle or Achilles tendon). For each participant, each dose or target location was randomly applied to 1 randomly selected lower leg (each leg receiving only 1 of the 2 options).

Results

The StO2 values significantly increased after ultrasound at both doses (P<.008), and the THb value significantly increased for the higher dose only (P<.008). Both THb and StO2 values also significantly increased in response to vibration massage targeting the Achilles tendon (P<.008), and these values were greater than those resulting from the vibration massage applied to the calf muscle (P = .003 and .002, respectively). No significant THb and StO2 differences were found after the application of interferential current or low-level laser.

Conclusion

Tendon microcirculation increases after ultrasound and vibration massage intervention concentrated on the Achilles tendon. These modalities may be considered for the purpose of temporarily increasing microcirculation in the tendon.

Couppé, Christian, et al. "Eccentric or concentric exercises for the treatment of tendinopathies." *J Orthop Sports Phys Ther* 45 (2015): 853-863.

SYNOPSIS: Tendinopathy is a very common disorder in both recreational and elite athletes. Many individuals have recurrent symptoms that lead to chronic conditions and termination of sports activity. Exercise has become a popular and somewhat efficacious treatment regime, and isolated eccentric exercise has been particularly promoted. In this clinical commentary, we review the relevant evidence for different exercise regimes in tendinopathy rehabilitation, with particular focus on the applied loads that are experienced by the tendon and how the exercise regime may affect these applied loads. There is no convincing clinical evidence to demonstrate that isolated eccentric loading exercise improves clinical outcomes more than other loading therapies. However, the great variation and sometimes insufficient reporting of the details of treatment protocols may hamper the interpretation of what may be the optimal exercise regime with respect to parameters such as load magnitude, speed of movement, and recovery period between exercise sessions. Future studies should control for these loading parameters, evaluate various

exercise dosages, and think beyond isolated eccentric exercises to arrive at firm recommendations regarding rehabilitation of individuals with tendinopathies

Beyer, Rikke, et al. "Heavy Slow Resistance Versus Eccentric Training as Treatment for Achilles Tendinopathy A Randomized Controlled Trial." ***The American journal of sports medicine*** **(2015): 0363546515584760.**

Background: Previous studies have shown that eccentric training has a positive effect on Achilles tendinopathy, but few randomized controlled trials have compared it with other loading-based treatment regimens.
Purpose: To evaluate the effectiveness of eccentric training (ECC) and heavy slow resistance training (HSR) among patients with midportion Achilles tendinopathy.
Study Design: Randomized controlled trial; Level of evidence, 1.
Methods: A total of 58 patients with chronic (>3 months) midportion Achilles tendinopathy were randomized to ECC or HSR for 12 weeks. Function and symptoms (Victorian Institute of Sports Assessment–Achilles), tendon pain during activity (visual analog scale), tendon swelling, tendon neovascularization, and treatment satisfaction were assessed at 0 and 12 weeks and at the 52-week follow-up. Analyses were performed on an intention-to-treat basis.
Results: Both groups showed significant ($P < .0001$) improvements in Victorian Institute of Sports Assessment–Achilles and visual analog scale from 0 to 12 weeks, and these improvements were maintained at the 52-week follow-up. Concomitant with the clinical improvement, there was a significant reduction in tendon thickness and neovascularization. None of these robust clinical and structural improvements differed between the ECC and HSR groups. However, patient satisfaction tended to be greater after 12 weeks with HSR (100%) than with ECC (80%; $P = .052$) but not after 52 weeks (HSR, 96%; ECC, 76%; $P = .10$), and the mean training session compliance rate was 78% in the ECC group and 92% in the HSR group, with a significant difference between groups ($P < .005$).
Conclusion: The results of this study show that both traditional ECC and HSR yield positive, equally good, lasting clinical results in patients with Achilles tendinopathy and that the latter tends to be associated with greater patient satisfaction after 12 weeks but not after 52 weeks.

Habets, B., and R. E. H. Cingel. "Eccentric exercise training in chronic mid-portion Achilles tendinopathy: A systematic review on different protocols." ***Scandinavian journal of medicine & science in sports*** **25.1 (2015): 3-15.**

Although eccentric exercise training has shown favorable results in chronic mid-portion Achilles tendinopathy, the optimum dosage remains unknown. A systematic review of the literature was performed in accordance with the PRISMA guidelines, in order to describe different exercise protocols and to determine the most effective

training parameters. An extensive search in MEDLINE, EMBASE, CINAHL, and CENTRAL revealed 14 randomized and clinical controlled trials. Strong evidence was found for the Alfredson exercise protocol. In this 12-week protocol, exercises are performed 3×15 repetitions twice daily, both with a straight and bent knee. Exercises are performed at slow speed, and load is increased when exercises are without pain. Strong evidence was also found for gradual onset of exercises during the first week of the Alfredson program, but no uniformity of protocols exists. Other exercise protocols did achieve similar results, but many studies had some methodological shortcomings or lacked a detailed description of their training parameters. Because of the heterogeneity of study populations and outcome measures, and lack of reporting of training compliance data, a definitive conclusion regarding the most effective training parameters could not be made. Further research comparing the content of different exercise protocols is warranted.

Imai, Kan, et al. "Biomechanical and histological effects of augmented soft tissue mobilization therapy on achilles tendinopathy in a rabbit model." ***Journal of manipulative and physiological therapeutics*** **38.2 (2015): 112-118.**

Objective
Augmented soft tissue mobilization (ASTM) has been used to treat Achilles tendinopathy and is thought to promote collagen fiber realignment and hasten tendon regeneration. The objective of this study was to evaluate the biomechanical and histological effects of ASTM therapy on rabbit Achilles tendons after enzymatically induced injury.
Methods
This study was a non-human bench controlled research study using a rabbit model. Both Achilles tendons of 12 rabbits were injected with collagenase to produce tendon injury simulating Achilles tendinopathy. One side was then randomly allocated to receive ASTM, while the other received no treatment (control). ASTM was performed on the Achilles tendon on postoperative days 21, 24, 28, 31, 35, and 38. Tendons were harvested 10 days after treatment and examined with dynamic viscoelasticity and light microscopy.
Results
Cross-sectional area in the treated tendons was significantly greater than in controls. Storage modulus tended to be lower in the treated tendons but elasticity was not significantly increased. Loss modulus was significantly lower in the treated tendons. There was no significant difference found in tangent delta (loss modulus/storage modulus). Microscopy of control tendons showed that the tendon fibers were wavy and type III collagen was well stained. The tendon fibers of the augmented soft tissue mobilization treated tendons were not wavy and type III collagen was not prevalent.
Conclusion
Biomechanical and histological findings showed that the Achilles tendons treated with ASTM had better recovery of biomechanical function than did control tendons.

Mani-Babu, Sethu, et al. "The Effectiveness of Extracorporeal Shock Wave Therapy in Lower Limb Tendinopathy A Systematic Review." *The American journal of sports medicine* 43.3 (2015): 752-761.

Background: There is accumulating evidence for the effectiveness of extracorporeal shock wave therapy (ESWT) when treating lower limb tendinopathies including greater trochanteric pain syndrome (GTPS), patellar tendinopathy (PT), and Achilles tendinopathy (AT).
Purpose: To evaluate the effectiveness of ESWT for lower limb tendinopathies.
Study Design: Systematic review and meta-analysis.
Methods: PubMed (Medline), Embase, Web of Knowledge, Cochrane, and CINAHL were searched from inception to February 2013 for studies of any design investigating the effectiveness of ESWT in GTPS, PT, and AT. Citation tracking was performed using PubMed and Google Scholar. Animal and non–English language studies were excluded. A quality assessment was performed by 2 independent reviewers, and effect size calculations were computed when sufficient data were provided.
Results: A total of 20 studies were identified, with 13 providing sufficient data to compute effect size calculations. The energy level, number of impulses, number of sessions, and use of a local anesthetic varied between studies. Additionally, current evidence is limited by low participant numbers and a number of methodological weaknesses including inadequate randomization. Moderate evidence indicates that ESWT is more effective than home training and corticosteroid injection in the short (<12 months) and long (>12 months) term for GTPS. Limited evidence indicates that ESWT is more effective than alternative nonoperative treatments including nonsteroidal anti-inflammatory drugs, physical therapy, and an exercise program and equal to patellar tenotomy surgery in the long term for PT. Moderate evidence indicates that ESWT is more effective than eccentric loading for insertional AT and equal to eccentric loading for midportion AT in the short term. Additionally, there is moderate evidence that combining ESWT and eccentric loading in midportion AT may produce superior outcomes to eccentric loading alone.
Conclusion: Extracorporeal shock wave therapy is an effective intervention and should be considered for GTPS, PT, and AT particularly when other nonoperative treatments have failed.

Michener, Lori A., and Kornelia Kulig. "Not all tendons are created equal: implications for differing treatment approaches." *journal of orthopaedic & sports physical therapy* 45.11 (2015): 829-832.

The majority of muscles have distinct tendinous attachments to bones; however, only a few tendons develop painful conditions. That simple observation prompts us to ask a few questions. Are there commonalities in morphology and pathology

among the painful tendons? What contributes to the propensity for pathology in some, but not all, tendons? And, consequently, should all tendinopathies be managed equally? Two common tendinopathies are those affecting the Achilles and supraspinatus, which are presented in this special issue and serve as excellent models to discuss similarities and contrasts.

Peters, Janne A., et al. "Preventive interventions for tendinopathy: A systematic review." ***Journal of Science and Medicine in Sport*** **(2015).**
Tendinopathy, the most prevalent tendon disorder which is considered as the clinical diagnosis of pain and dysfunction, is common in sports and its prevalence is ever-increasing. Despite the lack of clarity about risk factors, various preventive interventions for tendinopathy have been investigated. The main objective of this study is to review current preventive interventions for tendinopathy in the major regions: ankle, knee, hip, groin, shoulder and elbow.
Design
A systematic literature search was conducted.
Methods
The PubMed and Embase databases were explored to identify articles that met the inclusion criteria. The included studies were assessed on methodological quality and data was summarized.
Results
Ten articles were included that describe a wide variety of preventive interventions. These were divided into three categories: stretch and exercise interventions, shoe adaptations and other interventions. The methodological quality of the studies was moderate to high. Three out of ten studies showed a significant beneficial result.
Conclusions
There is limited evidence that a long-term intervention including balance training is effective in the prevention of patellar and Achilles tendinopathy. Shoe adaptations in the form of shock absorbing insoles could have a preventive effect on Achilles tendinopathy. Hormone replacement therapy seems to reduce the risk for structural Achilles tendon changes in active post-menopausal women. No evidence was found for a positive effect of stretching exercises. Prophylactic eccentric training and stretching can increase the risk of injury in asymptomatic players with patellar tendon abnormalities. A limited amount of studies was available and more research is needed on (multifactorial) etiology, risk factors and preventive interventions.

Plinsinga, Melanie L., et al. "Evidence of nervous system sensitization in commonly presenting and persistent painful tendinopathies: a systematic review." ***journal of orthopaedic & sports physical therapy*** **45.11 (2015): 864-875.**
Study Design
Systematic review.

Objectives
To elucidate if there is sensitization of the nervous system in those with persistent rotator cuff (shoulder), lateral elbow, patellar, and Achilles tendinopathies.
Background
Tendinopathy can be difficult to treat, and persistent intractable pain and dysfunction are frequent. It is hypothesized that induction or maintenance of persistent pain in tendinopathy may be, at least in part, based on changes in the nervous system.
Methods
The PRISMA guidelines were followed. Relevant articles were identified through a computerized search in Embase, PubMed, and Web of Science, followed by a manual search of reference lists of retained articles. To be eligible, studies had to include quantitative sensory testing and evaluate individuals diagnosed with a persistent tendinopathy of the rotator cuff (shoulder), lateral elbow, patella, or Achilles tendon. Methodological quality assessment was evaluated with the Newcastle-Ottawa Scale.
Results
In total, 16 full-text articles met the criteria for inclusion, of which the majority were case-control studies with heterogeneous methodological quality. No studies on Achilles tendinopathy were found. Mechanical algometry was the predominant quantitative sensory testing used. Lowered pressure pain threshold was observed across different tendinopathies at the site of tendinopathy, as well as at other sites, the latter being suggestive of central sensitization.
Conclusion
Although more research on sensory abnormalities is warranted, it appears likely that there is an association between persistent tendon pain and sensitization of the nervous system. This evidence is primarily from studies of upper-limb tendinopathy, and caution should be exercised with inference to lower-limb tendinopathy

Scott, Alex, Ludvig J. Backman, and Cathy Speed. "Tendinopathy: update on pathophysiology." *journal of orthopaedic & sports physical therapy* 45.11 (2015): 833-841.

Tendinopathy has become the accepted term to describe a spectrum of changes that occur in damaged and/or diseased tendons. Over the past 2 decades, there have been new insights into tendon pathophysiology of relevance to clinicians, including (1) better characterization of the overuse injury process and the resultant structural and functional disruption in chronically painful tendons, (2) improved understanding of the pathomechanics associated with chronic tendon injury, and (3) greater knowledge about the influence of lifestyle factors and drugs on tendon pathology. The implications of these new insights are discussed.

Scott, Lisa A., Shannon E. Munteanu, and Hylton B. Menz. "Effectiveness of orthotic devices in the treatment of achilles tendinopathy: A systematic review." *Sports Medicine* 45.1 (2015): 95-110.

Orthotic devices such as foot orthoses, splints, taping and bracing are recommended for Achilles tendinopathy (AT). This systematic review was conducted to review the current evidence for the effectiveness of orthotic devices for the treatment of mid-portion or insertional AT. Electronic bibliographic databases (MEDLINE, EMBASE, Current Contents, CINAHL and SPORTDiscus) were searched in May 2014. The methodological quality of included studies was evaluated using the Quality Index. Where possible, effects were determined using standardised mean differences. The strength of evidence for each intervention was determined according to the quality and number of studies. Twelve studies satisfied the inclusion criteria; nine studies investigated mid-portion AT, whilst three studies did not distinguish between mid-portion and insertional pathology. Weak evidence showed that foot orthoses were equivalent to physical therapy, and equivalent to no treatment. Very weak evidence supported the use of adhesive taping alone or when combined with foot orthoses. Moderate evidence showed that the AirHeel™ brace was as effective as a calf muscle eccentric exercise programme, and weak evidence showed that this intervention was not beneficial when added to a calf muscle eccentric exercise programme. Weak evidence showed that an ankle joint dorsiflexion night splint was equally effective to a calf muscle eccentric exercise programme, and strong evidence showed that this intervention was not beneficial when added to a calf muscle eccentric exercise programme. These findings may aid clinical decision making in the context of AT, however further high-quality studies are required.

Silbernagel, Karin Grävare, and Kay M. Crossley. "A Proposed Return to Sport Program for Patients With Midportion Achilles Tendinopathy: Rationale and Implementation." *The Journal of orthopaedic and sports physical therapy* (2015): 1-42.

Achilles tendinopathy is a common overuse injury in athletes involved in running and jumping activities and sports. The intervention with the highest level of evidence is exercise-therapy and it is recommended that all patients initially be treated with exercise for at least 3 months prior to considering other treatment options. Recovery from Achilles tendinopathy can take up to a year and there is a high propensity for recurrence especially during the return to sport phase. The extent of the tendon injury, the age and sex of the athlete, the magnitude of pain/symptoms, the extent of impairments, and the demands of the sport all need to be considered when planning for return to sport. This clinical commentary describes an approach to return to sport for patients with midportion Achilles tendinopathy. The aim of the return to sport program is to facilitate the decision-making process in returning an athlete with midportion Achilles tendinopathy back to full sport participation and minimize the chances for recurrence of the injury.

Willisch, Matthew, et al. "Eccentric loading increases peak torque angle of the ankle plantar flexors in healthy volunteers." *International Journal of Sports and Exercise Medicine* 1.2 (2015).

Eccentric loading of the ankle plantar Flexor's (PF) has demonstrated clinical efficacy in the conservative treatment of Achilles tendinopathy, however, its mechanism of therapeutic benefit remains unclear. The purpose of this study was to examine the effects of PF eccentric loading on PF angle to peak torque (AtPT), peak torque (PT) and lower limb vertical stiffness. Thirty healthy volunteers were randomised to an eccentric (n=15) or concentric (n=13) exercise group. A 10-week loading programme of the ankle plantar flexors was completed. AtPT, PT and vertical stiffness were compared within and between groups before and after the interventions. AtPT increased in the eccentric group by 3.2° dorsiflexion ($p=0.001$) and decreased by 0.7° dorsiflexion ($p=0.528$) for the concentric group with significant post-intervention group differences ($p<0.001$). PT levels were unchanged following the interventions for both groups ($p>0.2$); however, post-intervention the eccentric group showed a greater PT than the concentric group ($p>0.05$). Between group comparison showed no significant difference in vertical stiffness ($p>0.5$). However, the concentric group demonstrated a vertical stiffness increase of 765kNm^{-1} ($p \geq 0.05$). This study demonstrates that a clinically derived eccentric loading programme can produce an adaptive shift in AtPT of the ankle plantar flexors in a healthy population. These results support the theory that in part, eccentric loading derives its therapeutic benefit from mechanisms that influence plantar flexor motor performance.