P 

PROTECTION
Avoid activities and movements that increase pain during the first few days after injury.

E 

ELEVATION
Elevate the injured limb higher than the heart as often as possible.

A 

AVOID ANTI-INFLAMMATORIES
Avoid taking anti-inflammatory medications as they reduce tissue healing. Avoid icing.

C 

COMPRESSION
Use elastic bandage or taping to reduce swelling.

E 

EDUCATION
Your body knows best. Avoid unnecessary passive treatments and medical investigations and let nature play its role.

&

L 

LOAD
Let pain guide your gradual return to normal activities. Your body will tell you when it's safe to increase load.

O 

OPTIMISM
Condition your brain for optimal recovery by being confident and positive.

V 

VASCULARISATION
Choose pain-free cardiovascular activities to increase blood flow to repairing tissues.

E 

EXERCISE
Restore mobility, strength and proprioception by adopting an active approach to recovery.

E-Learning Course 1.10 PEACE & LOVE

Scientific References

2020-Dubois, B. & J.-F. Esculier. Soft-tissue injuries simply need PEACE and LOVE. British Journal of Sports Medicine 54 (2): 72-73. 4

2020-Hickey, J. T., R. G. Timmins, N. Maniar, E. Rio, P. F. Hickey, C. A. Pitcher, M. D. Williams & D. A. Opar. Pain-Free Versus Pain-Threshold Rehabilitation Following Acute Hamstring Strain Injury: A Randomized Controlled Trial. Journal of Orthopaedic & Sports Physical Therapy 50 (2): 91-103. 5

2020-van der Vlist, A. C., M. Winters, A. Weir, C. L. Ardern, N. J. Welton, D. M. Caldwell, J. A. N. Verhaar & R.-J. de Vos. Which treatment is most effective for patients with Achilles tendinopathy? A living systematic review with network meta-analysis of 29 randomised controlled trials. British Journal of Sports Medicine. 6

2019-Docking, S. I. & J. Cook. How do tendons adapt? Going beyond tissue responses to understand positive adaptation and pathology development: A narrative review. Journal of Musculoskeletal & Neuronal Interactions 19 (3): 300–310. 7

2019-Wu, Y., Y. Mu, L. Yin, Z. Wang, W. Liu & H. Wan. Complications in the Management of Acute Achilles Tendon Rupture: A Systematic Review and Network Meta-analysis of 2060 Patients. The American Journal of Sports Medicine 47 (9): 2251–2260. 8

2018-Esculier J.-F., L. J. Bouyer, B. Dubois, P. Fremont, L. Moore, B. McFadyen & J.-S. Roy. Is combining gait retraining or an exercise programme with education better than education alone in treating runners with patellofemoral pain? A randomised clinical trial. British Journal of Sports Medicine 52 (10): 659-666. 9

2018-Lopez, P., R. S. Pinto, R. Radaelli, A. Rech, R. Grazioli, M. Izquierdo & E. L. Cadore. Benefits of resistance training in physically frail elderly: a systematic review. Aging Clinical and Experimental Research 30: 889–899. 10

2018-Vuurberg, G., A. Hoorntje, L. M. Wink, B. F. W. van der Doelen, M. P. van den Bekerom, R. Dekker, C. Niek van Dijk, R. Krips, M. C. M. Loogman, M. L. Ridderikhof, F. F. Smithuis, S. A. S. Stufkens, E. A. L. M. Verhagen, R. A. de Bie & G. M. M. J. Kerkhoffs. Diagnosis, treatment and prevention of ankle sprains: update of an evidence-based clinical guideline. British Journal of Sports Medicine 52 (15): 956. 11

2017-Alentorn-Geli, E., K. Samuelsson, V. Musahl, C. L. Green, M. Bhandari & J. Karlsson. The Association of Recreational and Competitive Running With Hip and Knee Osteoarthritis: A Systematic Review and Meta-analysis. Journal of Orthopaedic & Sports Physical Therapy 47 (6): 373-390. 12

2017-Bayer, M. L., S. P. Magnusson & M. Kjaer. Early versus Delayed Rehabilitation after Acute Muscle Injury. New England Journal of Medicine 377 (13): 1300-1301.13

2017-Belavý, D., M. Quittner, N. Ridgers, Y. Ling, D. Connell & T. Rantalainen. Running exercise strengthens the intervertebral disc. Scientific Reports 7: 45975. 14

2017-Gómez-Bruton, A., Á. Matute-Llorente, A. González-Agüero, J. A. Casajús & G. Vicente-Rodríguez. Plyometric exercise and bone health in children and adolescents: a systematic review. World Journal of Pediatrics 13: 112–121. 15

2017-Taş, S., N. Bek, M. Ruhi Onur & F. Korkusuz. Effects of Body Mass Index on Mechanical Properties of the Plantar Fascia and Heel Pad in Asymptomatic Participants. Foot & Ankle International 38 (7): 779–784. 16

2017-Timmins, K. A., R. D. Leech, M. E. Batt & K. L. Edwards. Running and Knee Osteoarthritis: A Systematic Review and Meta-analysis. The American Journal of Sports Medicine 45 (6): 1447–1457. 17

2016-Owe, K. M., E. K. Bjelland, B. Stuge, N. Orsini, M. Eberhard-Gran & S. Vangen. Exercise level before pregnancy and engaging in high-impact sports reduce the risk of pelvic girdle pain: a population-based cohort study of 39 184 women. British Journal of Sports Medicine 50 (13): 817-822. 18

2015-Smeeing, D. P. J., R. M. Houwert, J. P. Briet, J. C. Kelder, M. J. M. Segers, E. J. M. M. Verleisdonk, L. P. H. Leenen & F. Hietbrink. Weight-Bearing and Mobilization in the Postoperative Care of Ankle Fractures: A Systematic Review and Meta-Analysis of Randomized Controlled Trials and Cohort Studies. PLoS ONE 10 (2): e0118320. 19

2012-Bleakley, C. M., P. Glasgow & D. C. MacAuley. Price needs updating, should we call the police? British Journal of Sports Medicine 46 (4): 220-221. 20

2010-Bleakley, C. M., S. R. O'Connor, M. A. Tully, L. G. Rocke, D. C. MacAuley, I. Bradbury, S. Keegan & S. M. McDonough. Effect of accelerated rehabilitation on function after ankle sprain: Randomised controlled trial. BMJ 340: c1964. 21

2009-Khan, K. M. & A. Scott. Mechanotherapy: How physical therapists' prescription of exercise promotes tissue repair. British Journal of Sports Medicine 43 (4): 247-252. 22

2020-Dubois, B. & J.-F. Esculier. Soft-tissue injuries simply need PEACE and LOVE. *British Journal of Sports Medicine* 54 (2): 72-73.

Rehabilitation of soft-tissue injuries can be complex. Over the years, acronyms guiding their management have evolved from ICE to RICE, then on to PRICE and POLICE. Although widely known, these previous acronyms focus on acute management, unfortunately ignoring subacute and chronic stages of tissue healing. Our contemporary acronyms encompass the rehabilitation continuum from immediate care (PEACE) to subsequent management (LOVE). PEACE and LOVE outline the importance of educating patients and addressing psychosocial factors to enhance recovery. While anti-inflammatories show benefits on pain and function, our acronyms flag their potential harmful effects on optimal tissue repair. We suggest that they may not be included in the standard management of soft-tissue injuries.

2020-Hickey, J. T., R. G. Timmins, N. Maniar, E. Rio, P. F. Hickey, C. A. Pitcher, M. D. Williams & D. A. Opar. Pain-Free Versus Pain-Threshold Rehabilitation Following Acute Hamstring Strain Injury: A Randomized Controlled Trial. *Journal of Orthopaedic & Sports Physical Therapy* 50 (2): 91-103.

Objective: The primary aim was to compare time from acute hamstring strain injury (HSI) to return-to-play (RTP) clearance following a standardized rehabilitation protocol performed within either pain-free or pain-threshold limits. Secondary aims were to compare isometric knee flexor strength, biceps femoris long head (BFLH) fascicle length, fear of movement, and reinjury occurrence at the 6-month follow-up between pain-free and pain-threshold groups.

Design: Randomized controlled trial.

Methods: Forty-three men with acute HSIs were randomly allocated to a pain-free (n = 22) or pain-threshold (n = 21) rehabilitation group. Days from HSI to RTP clearance, isometric knee flexor strength, BFLH fascicle length, fear of movement, and reinjury occurrence at the 6-month follow-up were reported.

Results: Median time from HSI to RTP clearance was 15 days (95% confidence interval [CI]: 13, 17) in the pain-free group and 17 days (95% CI: 11, 24) in the pain-threshold group, which was not significantly different (P = .37). Isometric knee flexor strength recovery at 90° of hip and 90° of knee flexion was greater in the pain-threshold group at RTP clearance by 15% (95% CI: 1%, 28%) and by 15% (95% CI: 1%, 29%) at 2-month follow-up, respectively. Improvement in BFLH fascicle length from baseline was 0.91 cm (95% CI: 0.34, 1.48) greater at 2-month follow-up in the pain-threshold group. Two reinjuries occurred in both the pain-free and pain-threshold groups between RTP clearance and the 6-month follow-up.

Conclusion: Pain-threshold rehabilitation did not accelerate RTP clearance, but resulted in greater recovery of isometric knee flexor strength and better maintenance of BFLH fascicle length, compared to pain-free rehabilitation.

2020-van der Vlist, A. C., M. Winters, A. Weir, C. L. Ardern, N. J. Welton, D. M. Caldwell, J. A. N. Verhaar & R.-J. de Vos. Which treatment is most effective for patients with Achilles tendinopathy? A living systematic review with network meta-analysis of 29 randomised controlled trials. *British Journal of Sports Medicine*.

Objective: To provide a consistently updated overview of the comparative effectiveness of treatments for Achilles tendinopathy.

Design: Living systematic review and network meta-analysis.

Data sources: Multiple databases including grey literature sources were searched up to February 2019.

Study eligibility criteria: Randomised controlled trials examining the effectiveness of any treatment in patients with both insertional and/or midportion Achilles tendinopathy. We excluded trials with 10 or fewer participants per treatment arm or trials investigating tendon ruptures.

Data extraction and synthesis: Reviewers independently extracted data and assessed the risk of bias. We used the Grading of Recommendations Assessment, Development and Evaluation to appraise the certainty of evidence.

Primary outcome measure: The validated patient-reported Victorian Institute of Sport Assessment-Achilles questionnaire.

Results: 29 trials investigating 42 different treatments were included. 22 trials (76%) were at high risk of bias and 7 (24%) had some concerns. Most trials included patients with midportion tendinopathy (86%). Any treatment class seemed superior to wait-and-see for midportion Achilles tendinopathy at 3 months (very low to low certainty of evidence). At 12 months, exercise therapy, exercise+injection therapy and exercise+night splint therapy were all comparable with injection therapy for midportion tendinopathy (very low to low certainty). No network meta-analysis could be performed for insertional Achilles tendinopathy.

Summary/conclusion: In our living network meta-analysis no trials were at low risk of bias and there was large uncertainty in the comparative estimates. For midportion Achilles tendinopathy, wait-and-see is not recommended as all active treatments seemed superior at 3-month follow-up. There seems to be no clinically relevant difference in effectiveness between different active treatments at either 3-month or 12-month follow-up. As exercise therapy is easy to prescribe, can be of low cost and has few harms, clinicians could consider starting treatment with a calf-muscle exercise programme.

2019-Docking, S. I. & J. Cook. How do tendons adapt? Going beyond tissue responses to understand positive adaptation and pathology development: A narrative review. *Journal of Musculoskeletal & Neuronal Interactions* 19 (3): 300-310.

Understanding how tendons adapt to load is crucial to understanding how training can improve performance, minimise the risk of injury and aid rehabilitation. Adaptation is the positive response of an organism or tissue to benefit its function. In tendons, numerous tissue responses to load have been identified *in vivo*. Changes in tendon dimensions, structure on imaging, mechanical properties, and blood flow have been reported in response to mechanical stimuli. However, research has focused on tissue level changes with little understanding of how changes at the tissue level affect the person, their athletic performance or injury risk. Tendons can have a paradoxical response to load, load can induce positive adaptation, however it is also a major factor in the development of tendon pathology and pain. Tendon pathology is a risk factor for developing symptoms, yet the high rate of asymptomatic pathology suggests that the pathological tendon must adapt to be able to tolerate load. Similarly, there is mounting evidence to suggest that tendon remodelling or repair is not necessary for a positive clinical outcome following rehabilitation, suggesting that the tendon must adapt via other mechanisms. This narrative review synthesises evidence of how normal and pathological tendons adapts to load, and how this relates to adaptation of load capacity and function of the individual.

2019-Wu, Y., Y. Mu, L. Yin, Z. Wang, W. Liu & H. Wan. Complications in the Management of Acute Achilles Tendon Rupture: A Systematic Review and Network Meta-analysis of 2060 Patients. *The American Journal of Sports Medicine* 47 (9): 2251–2260.

Background: Acute Achilles tendon rupture (ATR) has increased in the past decade, and many new treatments and rehabilitation regimens have been introduced. But major complications in ATR management remain an unsolved problem.

Purpose: To compare the risk of major complications of acute ATR after different combinations of treatments and rehabilitation regimens.

Study Design: Systematic review and network meta-analysis.

Method: The authors searched 4 databases (PubMed, Medline, Embase, and the Cochrane Library) from the date of inception until February 2018 for articles in English. The authors considered randomized controlled trials comparing interventions and rehabilitation protocols for acute ATR and restricted (1) interventions to nonoperative treatment, minimally invasive surgery, and open surgery and (2) rehabilitation protocols to accelerated rehabilitation and early immobilization. Major complications were assessed—namely, rerupture, deep infection, and deep vein thrombosis (DVT). Only patients with primary acute ATR were considered. Quality assessment was performed with the Cochrane "risk of bias" tool. A series of additional tests were conducted to ensure the validity of the results.

Results: Twenty-nine randomized controlled trials with 2060 patients were included in this Bayesian network meta-analysis. The mean incidence of overall major complications from all managements was 9.13% (median, 6.67%). The mean incidence rates of rerupture, deep infection, and DVT from all managements were 5%, 1.50%, and 2.67%, respectively. According to relative risk, nonoperative treatment combined with early immobilization was significantly associated with a higher risk of major complications. According to the surface under the cumulative ranking curve, minimally invasive surgery with accelerated rehabilitation had the highest possibility (79.7%) of being the best management with regard to minimizing major complications.

Conclusion: For treating acute ATR, management combining minimally invasive surgery with accelerated rehabilitation had the highest possibility of being superior in terms of major complication risks, according to the surface under the cumulative ranking curve. Management combining nonoperative treatment with early immobilization was statistically associated with a higher risk of complications as compared with the other methods of management.

2018-Esculier J.-F., L. J. Bouyer, B. Dubois, P. Fremont, L. Moore, B. McFadyen & J.-S. Roy. Is combining gait retraining or an exercise programme with education better than education alone in treating runners with patellofemoral pain? A randomised clinical trial. *British Journal of Sports Medicine* 52 (10): 659-666.

Design: Single-blind randomised clinical trial.

Objective: To compare the effects of three 8-week rehabilitation programmes on symptoms and functional limitations of runners with patellofemoral pain (PFP).

Methods: Sixty-nine runners with PFP were randomly assigned to one of three intervention groups: (1) education on symptoms management and training modifications (education); (2) exercise programme in addition to education (exercises); (3) gait retraining in addition to education (gait retraining). Symptoms and functional limitations were assessed at baseline (T0), and after 4, 8 and 20 weeks (T4, T8 and T20) using the Knee Outcome Survey of the Activities of Daily Living Scale (KOS-ADLS) and visual analogue scales (VASs) for usual pain, worst pain and pain during running. Lower limb kinematics and kinetics during running, and isometric strength were also evaluated at T0 and T8. The effects of rehabilitation programmes were assessed using two-way analysis of variance.

Results: No significant group × time interactions ($p<0.447$) were found for KOS-ADLS and VASs. All three groups showed similar improvements at T4, T8 and T20 compared with T0 ($p<0.05$). Only the exercises group increased knee extension strength following rehabilitation (group × time: $p<0.001$) and only the gait retraining group (group × time: $p<0.001$) increased step rate (+7.0%) and decreased average vertical loading rate (−25.4%).

Conclusion Even though gait retraining and exercises improved their targeted mechanisms, their addition to education did not provide additional benefits on symptoms and functional limitations. Appropriate education on symptoms and management of training loads should be included as a primary component of treatment in runners with PFP.

2018-Lopez, P., R. S. Pinto, R. Radaelli, A. Rech, R. Grazioli, M. Izquierdo & E. L. Cadore. Benefits of resistance training in physically frail elderly: a systematic review. *Aging Clinical and Experimental Research* 30: 889–899.

Aim: Exercise is one of the most important components in frailty prevention and treatment. Therefore, we systematically reviewed the effect of resistance training (RT) alone or combined with multimodal exercise intervention on muscle hypertrophy, maximal strength, power output, functional performance, and falls incidence in physically frail elderly.

Methods: MEDLINE, Cochrane CENTRAL, PEDro, and SPORTDiscus databases were searched from 2005 to 2017. Studies must have mentioned the effects of RT (i.e., included or not in multimodal training) on at least one of the following parameters: muscle mass, muscle strength, muscle power, functional capacity, and risk of falls in frail elderly.

Results: The initial search identified 371 studies and 16 were used for qualitative analysis for describing the effect of strength training performed alone or in a multimodal exercise intervention. We observed that RT alone or in a multimodal training may induce increases of 6.6–37% in maximal strength; 3.4–7.5% in muscle mass, 8.2% in muscle power, 4.7–58.1% in functional capacity and risk of falls, although some studies did not show enhancements.

Conclusion: Frequency of 1–6 sessions per week, training volume of 1–3 sets of 6–15 repetitions and intensity of 30–70%1-RM promoted significant enhancements on muscle strength, muscle power, and functional outcomes. Therefore, in agreement with previous studies, we suggest that supervised and controlled RT represents an effective intervention in frailty treatment.

2018-Vuurberg, G., A. Hoorntje, L. M. Wink, B. F. W. van der Doelen, M. P. van den Bekerom, R. Dekker, C. Niek van Dijk, R. Krips, M. C. M. Loogman, M. L. Ridderikhof, F. F. Smithuis, S. A. S. Stufkens, E. A. L. M. Verhagen, R. A. de Bie & G. M. M. J. Kerkhoffs. Diagnosis, treatment and prevention of ankle sprains: update of an evidence-based clinical guideline. *British Journal of Sports Medicine* 52 (15): 956.

This guideline aimed to advance current understandings regarding the diagnosis, prevention and therapeutic interventions for ankle sprains by updating the existing guideline and incorporate new research. A secondary objective was to provide an update related to the cost-effectiveness of diagnostic procedures, therapeutic interventions and prevention strategies. It was posited that subsequent interaction of clinicians with this guideline could help reduce health impairments and patient burden associated with this prevalent musculoskeletal injury. The previous guideline provided evidence that the severity of ligament damage can be assessed most reliably by delayed physical examination (4–5 days post trauma). After correct diagnosis, it can be stated that even though a short time of immobilisation may be helpful in relieving pain and swelling, the patient with an acute lateral ankle ligament rupture benefits most from use of tape or a brace in combination with an exercise programme.

New in this update: Participation in certain sports is associated with a heightened risk of sustaining a lateral ankle sprain. Care should be taken with non-steroidal anti-inflammatory drugs (NSAIDs) usage after an ankle sprain. They may be used to reduce pain and swelling, but usage is not without complications and NSAIDs may suppress the natural healing process. Concerning treatment, supervised exercise-based programmes preferred over passive modalities as it stimulates the recovery of functional joint stability. Surgery should be reserved for cases that do not respond to thorough and comprehensive exercise-based treatment. For the prevention of recurrent lateral ankle sprains, ankle braces should be considered as an efficacious option.

2017-Alentorn-Geli, E., K. Samuelsson, V. Musahl, C. L. Green, M. Bhandari & J. Karlsson. The Association of Recreational and Competitive Running With Hip and Knee Osteoarthritis: A Systematic Review and Meta-analysis. *Journal of Orthopaedic & Sports Physical Therapy* 47 (6): 373-390.

Study Design: Systematic review and meta-analysis.

Background: Running is a healthy and popular activity worldwide, but data regarding its association with osteoarthritis (OA) are conflicting.

Objectives: To evaluate the association of hip and knee OA with running and to explore the influence of running intensity on this association.

Methods: PubMed, Embase, and Cochrane Library databases were used to identify studies investigating the occurrence of OA of the hip and/or knee among runners. A meta-analysis of studies comparing this occurrence between runners and controls (sedentary, nonrunning individuals) was conducted. Runners were regarded as "competitive" if they were reported as professional/elite athletes or participated in international competitions. Recreational runners were individuals running in a nonprofessional (amateur) context. The prevalence rate and odds ratio (with 95% confidence interval [CI]) for OA between runners (at competitive and recreational levels) and controls were calculated. Subgroup analyses were conducted for OA location (hip or knee), sex, and years of exposure to running (less or more than 15 years).

Results: Twenty-five studies (n = 125810 individuals) were included and 17 (n = 114829 individuals) were meta-analyzed. The overall prevalence of hip and knee OA was 13.3% (95% CI: 11.6%, 15.2%) in competitive runners, 3.5% (95% CI: 3.4%, 3.6%) in recreational runners, and 10.2% (95% CI: 9.9%, 10.6%) in controls. The odds ratio for hip and/or knee OA in competitive runners was higher than that in recreational runners (1.34; 95% CI: 0.97, 1.86 and 0.86; 95% CI: 0.69, 1.07, respectively; controls as reference group; for difference, $P<.001$). Exposure to running of less than 15 years was associated with a lower association with hip and/or knee OA compared with controls (OR = 0.6; 95% CI: 0.49, 0.73).

Conclusion: Recreational runners had a lower occurrence of OA compared with competitive runners and controls. These results indicated that a more sedentary lifestyle or long exposure to high-volume and/or high-intensity running are both associated with hip and/or knee OA. However, it was not possible to determine whether these associations were causative or confounded by other risk factors, such as previous injury.

2017-Bayer, M. L., S. P. Magnusson & M. Kjaer. Early versus Delayed Rehabilitation after Acute Muscle Injury. *New England Journal of Medicine* 377 (13): 1300-1301.

Acute traumatic muscle-strain injuries are common and result in a substantial loss of time and risk of recurrence. Treatment options such as platelet-rich plasma are ineffective. The extent to which the timing of rehabilitation influences clinical recovery of strain injuries remains unknown. We investigated whether early or delayed use of injured musculotendinous tissue affected recovery after acute muscle-strain injuries.

2017-Belavý, D., M. Quittner, N. Ridgers, Y. Ling, D. Connell & T. Rantalainen. Running exercise strengthens the intervertebral disc. *Scientific Reports* 7: 45975.

There is currently no evidence that the intervertebral discs (IVDs) can respond positively to exercise in humans. Some authors have argued that IVD metabolism in humans is too slow to respond anabolically to exercise within the human lifespan. Here we show that chronic running exercise in men and women is associated with better IVD composition (hydration and proteoglycan content) and with IVD hypertrophy. Via quantitative assessment of physical activity we further find that accelerations at fast walking and slow running (2 m/s), but not high-impact tasks, lower intensity walking or static positions, correlated to positive IVD characteristics. These findings represent the first evidence in humans that exercise can be beneficial for the IVD and provide support for the notion that specific exercise protocols may improve IVD material properties in the spine. We anticipate that our findings will be a starting point to better define exercise protocols and physical activity profiles for IVD anabolism in humans.

2017-Gómez-Bruton, A., Á. Matute-Llorente, A. González-Agüero, J. A. Casajús & G. Vicente-Rodríguez. Plyometric exercise and bone health in children and adolescents: a systematic review. *World Journal of Pediatrics* 13: 112–121.

Background: Many jumping interventions have been performed in children and adolescents in order to improve bone-related variables and thus, ensure a healthy bone development during these periods and later in life. This systematic review aims to summarize and update present knowledge regarding the effects that jumping interventions may have on bone mass, structure and metabolism in order to ascertain the efficacy and durability (duration of the effects caused by the intervention) of the interventions.

Data sources: Identification of studies was performed by searching in the database MEDLINE/PubMed and SportDiscus. Additional studies were identified by contacting clinical experts and searching bibliographies and abstracts. Search terms included "bone and bones", "jump*", "weight-bearing", "resistance training" and "school intervention". The search was conducted up to October 2014. Only studies that had performed a specific jumping intervention in under 18-year olds and had measured bone mass were included. Independent extraction of articles was done by 2 authors using predefined data fields.

Results: A total of 26 studies were included in this review. Twenty-four studies found positive results as subjects included in the intervention groups showed higher bone mineral density, bone mineral content and bone structure improvements than controls. Only two studies found no effects on bone mass after a 10-week and 9-month intervention. Moreover, those studies that evaluated the durability of the effects found that some of the increases in the intervention groups were maintained after several years.

Conclusions: Jumping interventions during childhood and adolescence improve bone mineral content, density and structural properties without side effects. These type of interventions should be therefore implemented when possible in order to increase bone mass in early stages of life, which may have a direct preventive effect on bone diseases like osteoporosis later in life.

2017-Taş, S., N. Bek, M. Ruhi Onur & F. Korkusuz. Effects of Body Mass Index on Mechanical Properties of the Plantar Fascia and Heel Pad in Asymptomatic Participants. *Foot & Ankle International* 38 (7): 779–784.

Background: Musculoskeletal foot disorders have a high incidence among overweight and obese individuals. One of the important factors causing this high incidence may be plantar fascia and heel pad (HP)–related mechanical changes occurring in these individuals. The aim of the present study was to investigate the plantar fascia and HP stiffness and thickness parameters in overweight and obese individuals and compare these values with those of normal-weight individuals.

Methods: This study was carried out in 87 (52 female, 35 male) healthy sedentary individuals between the ages of 19 and 58 years (34 ± 11 years). Participants were subsequently categorized according to body mass index (BMI) as normal weight (18.5 kg/m^2 < BMI < 25 kg/m^2) or overweight and obese (BMI ≥25 kg/m^2). Plantar fascia and HP thickness and stiffness were measured with an ultrasonography device using a linear ultrasonography probe.

Results: Overweight and obese individuals had higher HP thickness (P < .001), plantar fascia thickness (P = .001), heel pad microchamber layer (MIC) stiffness (P < .001), and heel pad macrochamber layer (MAC) stiffness (P < .001), whereas they had lower plantar fascia stiffness (P < .001) compared with the individuals with normal weight. BMI had a moderate correlation with HP thickness (P < .001, r = 0.500), plantar fascia thickness (P = .001, r = 0.536), MIC stiffness (P < .001, r = 0.496), and MAC stiffness (P < .001, r = 0.425). A negative and moderate correlation was found between BMI and plantar fascia stiffness (P < .001, r = –0.439).

Conclusion: Increased BMI causes a decrease in the stiffness of plantar fascia and an increase in the thickness of the plantar fascia as well as the thickness and stiffness of HP. Increased body mass could cause changes in the mechanical properties of HP and plantar fascia.

2017-Timmins, K. A., R. D. Leech, M. E. Batt & K. L. Edwards. Running and Knee Osteoarthritis: A Systematic Review and Meta-analysis. *The American Journal of Sports Medicine* 45 (6): 1447–1457.

Background: Osteoarthritis (OA) is a chronic condition characterized by pain, impaired function, and reduced quality of life. A number of risk factors for knee OA have been identified, such as obesity, occupation, and injury. The association between knee OA and physical activity or particular sports such as running is less clear. Previous reviews, and the evidence that informs them, present contradictory or inconclusive findings.

Purpose: This systematic review aimed to determine the association between running and the development of knee OA.

Study Design: Systematic review and meta-analysis.

Methods: Four electronic databases were searched, along with citations in eligible articles and reviews and the contents of recent journal issues. Two reviewers independently screened the titles and abstracts using prespecified eligibility criteria. Full-text articles were also independently assessed for eligibility. Eligible studies were those in which running or running-related sports (eg, triathlon or orienteering) were assessed as a risk factor for the onset or progression of knee OA in adults. Relevant outcomes included (1) diagnosis of knee OA, (2) radiographic markers of knee OA, (3) knee joint surgery for OA, (4) knee pain, and (5) knee-associated disability. Risk of bias was judged by use of the Newcastle-Ottawa scale. A random-effects meta-analysis was performed with case-control studies investigating arthroplasty.

Results: After de-duplication, the search returned 1322 records. Of these, 153 full-text articles were assessed; 25 were eligible, describing 15 studies: 11 cohort (6 retrospective) and 4 case-control studies. Findings of studies with a diagnostic OA outcome were mixed. Some radiographic differences were observed in runners, but only at baseline within some subgroups. Meta-analysis suggested a protective effect of running against surgery due to OA: pooled odds ratio 0.46 (95% CI, 0.30-0.71). The I^2 was 0% (95% CI, 0%-73%). Evidence relating to symptomatic outcomes was sparse and inconclusive.

Conclusion: With this evidence, it is not possible to determine the role of running in knee OA. Moderate- to low-quality evidence suggests no association with OA diagnosis, a positive association with OA diagnosis, and a negative association with knee OA surgery. Conflicting results may reflect methodological heterogeneity. More evidence from well-designed, prospective studies is needed to clarify the contradictions.

2016-Owe, K. M., E. K. Bjelland, B. Stuge, N. Orsini, M. Eberhard-Gran & S. Vangen. Exercise level before pregnancy and engaging in high-impact sports reduce the risk of pelvic girdle pain: a population-based cohort study of 39 184 women. *British Journal of Sports Medicine* 50 (13): 817-822.

Objective: To examine whether an association exists between exercise levels pre-pregnancy and pelvic girdle pain in pregnancy. Pelvic girdle pain in pregnancy has been associated with physical inactivity, a risk factor for adverse pregnancy outcomes.

Methods: We used data from a population-based cohort study including 39 184 nulliparous women with a singleton pregnancy enrolled in the Norwegian Mother and Child Cohort study. Pre-pregnancy exercise frequency and types were assessed by questionnaire in pregnancy week 17. Pelvic girdle pain, defined as combined pain in the anterior pelvis and in the posterior pelvis bilaterally, was self-reported in pregnancy week 30. Multivariable Poisson regression estimated risks of pelvic girdle pain associated with pre-pregnancy exercise. We examined a dose–response association of prepregnancy exercise frequency using restricted cubic splines. A test for non-linearity was also conducted. Final models were adjusted for pre-pregnancy BMI, age, education, history of low back pain and history of depression.

Results: 4069 women (10.4%) reported pelvic girdle pain in pregnancy and the prevalence among women who were non-exercisers prepregnancy was 12.5%. There was a non-linear association for pre-pregnancy exercise and risk of pelvic girdle pain (test for non-linearity, p=0.003). Compared to non-exercisers, women exercising 3–5 times weekly pre-pregnancy had a 14% lower risk of developing pelvic girdle pain in pregnancy (aRR 0.86, 95% CI 0.77 to 0.96). Taking part in high-impact exercises such as running, jogging, orienteering, ballgames, netball games and high-impact aerobics were associated with less risk of pelvic girdle pain.

Summary: Women who exercise regularly and engage in high-impact exercises before the first pregnancy may have a reduced risk of pelvic girdle pain in pregnancy.

2015-Smeeing, D. P. J., R. M. Houwert, J. P. Briet, J. C. Kelder, M. J. M. Segers, E. J. M. M. Verleisdonk, L. P. H. Leenen & F. Hietbrink. Weight-Bearing and Mobilization in the Postoperative Care of Ankle Fractures: A Systematic Review and Meta-Analysis of Randomized Controlled Trials and Cohort Studies. *PLoS ONE* 10 (2): e0118320.

Purpose: To determine the effectiveness and safety of interventions used for rehabilitation after open reduction and internal fixation of ankle fractures.

Methods: A systematic review and meta-analysis was performed using both randomized trials and cohort studies. The effect of mobilization, weight-bearing, and unprotected weight-bearing as tolerated on postoperative recovery was compared using the Olerud Molander score, return to work/daily activities, and the rate of complications.

Results: A total of 25 articles were included. Ankle exercises resulted in earlier return to work and/or daily activities compared to immobilization (mean difference (MD) -20.76 days; 95% confidence interval (CI) -40.02 to -1.50). There was no difference in the rate of complications between exercises and immobilization (risk ratio (RR) 1.22; 95% CI 0.60 to 2.45) or between early and late weight-bearing (RR 1.26; 95%CI 0.56 to 2.85).

Interpretation: Results of this meta-analysis show that following ankle surgery, 1) active exercises accelerate return to work and daily activities compared to immobilization, 2) early weight-bearing tends to accelerate return to work and daily activities compared to late weight-bearing. Active exercises in combination with immediate weight-bearing may be a safe option.

2012-Bleakley, C. M., P. Glasgow & D. C. MacAuley. Price needs updating, should we call the police? *British Journal of Sports Medicine* 46 (4): 220-221.

2010-Bleakley, C. M., S. R. O'Connor, M. A. Tully, L. G. Rocke, D. C. MacAuley, I. Bradbury, S. Keegan & S. M. McDonough. Effect of accelerated rehabilitation on function after ankle sprain: Randomised controlled trial. *BMJ* 340: c1964.

Objective: To compare an accelerated intervention incorporating early therapeutic exercise after acute ankle sprains with a standard protection, rest, ice, compression, and elevation intervention.

Design: Randomised controlled trial with blinded outcome assessor.

Setting: Accident and emergency department and university based sports injury clinic.

Participants: 101 patients with an acute grade 1 or 2 ankle sprain.

Interventions: Participants were randomised to an accelerated intervention with early therapeutic exercise (exercise group) or a standard protection, rest, ice, compression, and elevation intervention (standard group).

Main outcome measures: The primary outcome was subjective ankle function (lower extremity functional scale). Secondary outcomes were pain at rest and on activity, swelling, and physical activity at baseline and at one, two, three, and four weeks after injury. Ankle function and rate of reinjury were assessed at 16 weeks.

Results: An overall treatment effect was in favour of the exercise group (P=0.0077); this was significant at both week 1 (baseline adjusted difference in treatment 5.28, 98.75% confidence interval 0.31 to 10.26; P=0.008) and week 2 (4.92, 0.27 to 9.57; P=0.0083). Activity level was significantly higher in the exercise group as measured by time spent walking (1.2 hours, 95% confidence interval 0.9 to 1.4 v 1.6, 1.3 to 1.9), step count (5621 steps, 95% confidence interval 4399 to 6843 v 7886, 6357 to 9416), and time spent in light intensity activity (53 minutes, 95% confidence interval 44 to 60 v 76, 58 to 95). The groups did not differ at any other time point for pain at rest, pain on activity, or swelling. The reinjury rate was 4% (two in each group).

Conclusion: An accelerated exercise protocol during the first week after ankle sprain improved ankle function; the group receiving this intervention was more active during that week than the group receiving standard care.

2009-Khan, K. M. & A. Scott. Mechanotherapy: How physical therapists' prescription of exercise promotes tissue repair. *British Journal of Sports Medicine* 43 (4): 247-252.

Mechanotransduction is the physiological process where cells sense and respond to mechanical loads. This paper reclaims the term "mechanotherapy" and presents the current scientific knowledge underpinning how load may be used therapeutically to stimulate tissue repair and remodelling in tendon, muscle, cartilage and bone. The purpose of this short article is to answer a frequently asked question "How precisely does exercise promote tissue healing?" This is a fundamental question for clinicians who prescribe exercise for tendinopathies, muscle tears, non-inflammatory arthropathies and even controlled loading after fractures. High-quality randomised controlled trials and systematic reviews show that various forms of exercise or movement prescription benefit patients with a wide range of musculoskeletal problems.1–4 But what happens at the tissue level to promote repair and remodelling of tendon, muscle, articular cartilage and bone? The one-word answer is "mechanotransduction", but rather than finishing there and limiting this paper to 95 words, we provide a short illustrated introduction to this remarkable, ubiquitous, non-neural, physiological process. We also re-introduce the term "mechanotherapy" to distinguish therapeutics (exercise prescription specifically to treat injuries) from the homeostatic role of mechanotransduction. Strictly speaking, mechanotransduction maintains normal musculoskeletal structures in the absence of injury. After first outlining the process of mechanotransduction, we provide well-known clinical therapeutic examples of mechanotherapy–turning movement into tissue healing.