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Orthopaedic & Sports Medicine Service

LATEST ORTHOPAEDIC UPDATES

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Time	Event	Who
07:30 – 08:00	Refreshments	
08:00	Welcome Message	Dr Doron Sher
	Update on Syndesmosis Injuries	Dr Todd Gothelf
	Tarsometatarsal Joint Injury / Arthritis	Dr John Negrine
	Osteoarthritis of the base of the thumb	Dr Kwan Yeoh
	Panel Discussion	
	Exercise Prescription (Part 1)	Dr Paul Annett
	Exercise Prescription (Part 2)	Dr John Best
	Enhancing repair and recovery of connective tissue with diet	Dr Paul Mason
	Panel Discussion	
10:30-11.00	**Morning Tea**	
	Physio question	Dr Todd Gothelf
	How to choose the right hip replacement prosthesis	Dr Andreas Loefler
	Anterolateral Ligament and Medial Patellofemoral Ligament Reconstruction	Dr Doron Sher
	Posterolateral Corner Injuries	Dr Ivan Popoff
	Panel Discussion	
	The evolution of shoulder instability surgery – which operation is best?	Dr Jerome Goldberg
	Panel Discussion	
13.00	Close	

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Update on Syndesmosis Injuries

Syndesmosis ankle sprains, or high ankle sprains, are estimated to occur in 7% to 18% of all ankle sprains. These ankle sprains are more severe than the more common lateral ankle sprain, resulting in more significant disability, more difficult rehab, and a delayed return to sports. Studies have shown that return to sports may take two to six weeks. When these syndesmosis injuries are unstable, they require surgical fixation to stabilise the joint and ensure good outcomes.

With recent advances in imaging technology (MRI) and arthroscopic techniques, early identification of the syndesmotic injury has improved. With better ability to detect a syndesmosis injury, early intervention may help to improve outcomes. Missed syndesmosis injuries left untreated may result in prolonged recovery, persistent pain, and ankle arthrosis.

Anatomy

The three ligaments that make up the syndesmosis are the:
- AITFL- Anterior inferior tibiofibular ligament
- PITFL- Posterior inferior tibiofibular ligament
- ITFL- Interosseous tibiofibular ligament

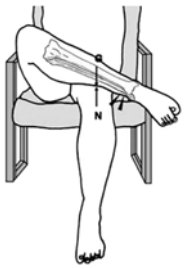
Clinical Examination

The following tests are useful in assessing all ankle sprains for a syndesmosis injury:

Squeeze Test- The tibia and fibula are squeezed together at the midcalf which reproduces pain at the syndesmosis confirming a syndesmosis injury.

External Rotation Test- The leg is stabilized with the knee flexed at 90 degrees while externally rotating the foot. Pain is reproduced at the syndesmosis.

Crossed Leg Test- One leg is crossed over the other while in a sitting position. Pain is reproduced at the syndesmosis when downward pressure is applied to the medial side of the knee.



ATFL tenderness- Tenderness over the ATFL ligament indicates a lateral ankle sprain rather than a syndesmosis injury. One study demonstrated that positive tenderness at the ATFL suggested that stability of the syndesmosis was more likely.

Deltoid tenderness- Tenderness at the deltoid ligament suggests a syndesmosis injury rather than a lateral ankle sprain.

Investigations

Ultrasound- A thorough ankle ultrasound should comment on the ATFL, CFL, AITFL, and deltoid ligaments. Rupture of the AITFL and Deltoid ligament rupture indicate a syndesmosis injury, while an intact AITFL may help to rule out a syndesmosis injury.

MRI- This is the gold standard to demonstrate injury to the AITFL, PITFL, and associated chondral injury. Static widening of the syndesmosis can be seen. However, this is NOT a dynamic study to demonstrate instability.

Weight Bearing Radiographs- Standing AP, L, and mortise views should be done of BOTH ankles to compare and assess for widening of the syndesmosis, or medial clear space widening.

Classification and Treatment

The West Point Ankle Grading System is useful to help guide treatment.

Grade I- Sprains to the AITFL and are stable with stress testing. These are stable injuries and can be managed with a period of immobilization, reduced weight bearing, and gradual rehabilitation.

Grade II- Latent diastasis is present, where the tibia and fibula relationship look normal on non-stress views of the ankle on x-ray, CT scan, or MRI, but stress views demonstrate widening of the syndesmosis. Treatment in this category has been controversial. Some advocate non-operative treatment while others support surgical treatment. Further, the amount of instability may vary greatly in this category, perhaps allowing those with more subtle instability to do well with non-operative treatment, while those with more severe instability may benefit from surgical stabilization.

Grade III- Frank diastasis is present, with widening of the syndesmosis on non-stress views on x-ray, CT scan, or MRI. Generally, these are best treated with surgical stabilization.

Three Take Home Messages:

- A High Ankle Sprain (Syndesmosis Injury) must be looked for when a player sprains his ankle as missing one can result in severe prolonged disability. A history of an external rotation injury, pain at the tib-fib joint with an external rotation stress test, or a squeeze test should raise suspicion for a syndesmosis injury.
- Confirmation of a syndesmosis injury can be attained with an MRI. Instability of the joint is best assessed with weight bearing x-rays of the affected and unaffected side. CT scan or stress views are also options. Finally, arthroscopic assessment may sometimes be necessary to assess for instability.
- Referral to an Orthopaedic Surgeon for surgical treatment is essential when there is a fracture, frank diastasis of the ankle mortise, or suspicion of a syndesmosis injury.

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Tarsometatarsal joint injury/arthritis

Lisfranc injury

- Named after a Napoleonic surgeon Jacques Lisfranc de St. Martin (1790-1847) who didn't actually describe the injury – he described an amputation through the joints
- "A surgeon and gynaecologist", trained as an assistant to Guillaume Dupuytren
- "Pioneered operations including removal of the rectum, lithotomy in women and amputation of the cervix"

What do we call the "lisfranc joints?"

- The tarsometatarsal joints
- Anatomy well known to you
- The second metatarsal base is recessed & strong ligament is on the plantar
- surface connecting the medial cuneiform to the base of the second metatarsal...the "Lisfranc ligament"

Lisfranc anatomy

Common injury

- Commonly missed, commonly under estimated, long time to recovery, don't always do well!

Common - ?Really? (No not really!)

- 0.2% of fractures
- 1:70,000 people in a hospital catchment area
- 20% are missed

Mechanism of injury

- 43% Motor vehicle accidents
- 24% from falls, jumps or twisting injury
- 13% due to crush injury

Important to differentiate.

- **High velocity vs low velocity**

Illustrative case – 55 year old male	
History • Falls off a ladder • Pain & tenderness midfoot unable to weight-bear • Plantar ecchymosis sign **Examination** • Tende r over midfoot • "Piano key sign" causes intense pain **Initial x-rays** • "Something is going on at the 1-2 Interval?" • Suspect Lisfranc injury **Examination under anaesthetic** **Lisfranc injury - marked instability** • Needs reduction and fixation **Post - op** • 6 weeks non-weight bearing • 4 weeks in a walking boot • Patient doing very well • Routine screw removal at 6 months • "Pay the lady at the door" **Patient returns at 12 months** • Doc it hurts • I can't walk long distances • I certainly can't run • I have developed a lump on the inside of my foot	**Look carefully - The ligament didn't heal** • But Doc' - I've already spent 6 weeks in plaster and 4 weeks in a boot • What do I do now? • My foot is terrible - I can't go on like this! **Non- operatively "Jolly him along"** • Buy a bike, Take up swimming • Firm insole • Cortisone injection under ultrasound control by a reliable radiologist • Anti-inflammatories **Doc' is there nothing else that can be done?** • Salvage is a fusion **How is it done?** **X-rays on the table** **What next?** • 6 weeks non-weight bearing/4 weeks in boot • Swelling for 6 months • Fusion rate is 90% • Function surprisingly good!

What does the literature say?
- No demonstrable instability («2mm) separation on x-ray (EUA stable)
- Non-weight bearing 6 weeks protected weight bearing 4 weeks
- 16 weeks off sport

RCT pure ligamentous injury
ORIF vs primary fusion
ORIF Reduction and fixation 20 patients
Primary arthrodesis 21 patients
The arthrodesis patients did 'better (92%) rated their recovery to pre-injury level compared to (65%) in the ORIF group *Ly and Coetzee JBJS Am 88(3) 2006*
Another RCT
- 40 patients comparing ORIF to primary arthrodesis
- No difference at any point in time - SF-36/patient reported satisfaction
- Obviously fewer operations in the primary arthrodesis group,

Henning et al Foot Ankle 30(10) 2009, Henning et al Foot Ankle Int.30(10) 2009.
Should we be doing primary arthrodesis?
- Consider in high energy injuries
- Consider in severe articular cartilage damage
- Athletic injuries I would still treat with reduction and fixation but always warn the patient that they do not always heal

How not to miss a lisfranc?
- Suspicion
- Try to get weight bearing xrays
- Look for the gap between the bases of first and second metatarsals
- Is the second metatarsal aligned with the intermediate cuneiform?
- A comparison weight bearing film of the other foot is very useful.

Note the relationships
I rarely order an MRI (for Lisfranc injuries)

Tarso-metatarsal arthritis

Midfoot arthritis
- More common in older patients
- Presents with pain and swelling across the midfoot

Why are the second and third joints more frequently involved?
• Sagittal motion at the tarso-metatarsal joints
1 - 1.6, **2** - 0.6, **3** - 3.5, **4** - 9.6, **5** - 10.2 – (ie:. Motion increases laterally)
Primary vs secondary arthritis
- Primary occurs in the 6th decade
- Secondary most often after a Lisfranc injury occurs in the 4th decade
- Either can be associated with a flat foot

Symptoms
- Pain
- Swelling
- Pressure in shoes
- Night pain

Good plain xrays
Treatment - Non surgical
- Anti-inflammatories
- Rocker soled shoes
- "Skip lacing" the shoes
- Cortisone - 3 months relief *(Drakonaki EE, Kho JS, Sharp RJ, Ostlere SJ. Efficacy of ultrasound-guided steroid injections for pain management of midfootjoint degenerative disease. Skeletal radiology 2011;40:1001-6)*
- No evidence for PRP and stem cells

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Surgical treatment

- Fusion of the first, second and third joints
- Fourth and fifth joints no perfect solution
- Good operation long recovery

"Bob's Balls" zirconium arthroplasty

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Osteoarthritis of the base of the thumb

Which joints?

- Carpometacarpal (CMC) joint
- Scaphotrapeziotrapezoidal (STT) joint

Why this talk?

- Common errors!
    - Missed diagnosis
    - Inadequate treatment

When to suspect this?

- Pain
    - May be vague ache
- Carpal tunnel syndrome
- Palpate carefully
    - Palpate associated joints

Common differential diagnoses

- Trigger thumb
- De Quervains tenosynovitis
- (Fracture)
- (CMC joint instability)

Imaging

- Always x-ray
    - Appropriate views of the whole thumb
- (CT)
- (MRI)

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Treatment

- Stop pain receptors & pathways
    - Oral medications
    - Steroid injection

- Stop joint surfaces from causing pain
    - Splint
    - Physiotherapy
    - Specific targeted surgery
        - Arthroscopic debridement & removal of loose bodies
        - Realign worn joint surfaces (osteotomy)
    - Remove worn joint surfaces
        - Arthrodesis
        - Suspension arthroplasty (trapeziectomy)
        - Arthroplasty with synthetic materials

Further reading

1. Murray PM. Chapter 11 - Treatment of the Osteoarthritic Hand and Thumb. In: Green's Operative Hand Surgery, 7th edn. Elsevier Health Sciences; 2016. pp. 345–72.
2. Wajon A, Vinycomb T, Carr E, Edmunds I, Ada L. Surgery for thumb (trapeziometacarpal joint) osteoarthritis. Cochrane Database Syst Rev. 2015 Feb 23;(2):CD004631.

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Exercise Prescription

1. Exercise / Physical Activity: an introduction

Exercise is essential and irreplaceable for optimal health. The World Health Organisation (WHO) ranks physical inactivity as the 4th leading cause of mortality worldwide after hypertension, diabetes and obesity. 90% of Americans fail to meet the basic criteria for physical activity on a weekly basis and more than 50% of Australians have not exercised in the proceeding 3-month period. Physical inactivity is currently a major worldwide health issue. As health practitioners it is our role to educate both our own patients and the general community about the positive benefits of physical activity.

a) What is physical activity?

Physical activity is using your muscles to move your body, which involves burning energy. Daily tasks could involve domestic tasks including gardening or vacuuming. Exercise is a type of physical activity that is planned, structured and involves some repetition of movement, such as brisk walking, dancing or cycling. Physical Fitness is a set of skills required to do a specific physical activity, for example to play tennis. Sport is a more specific form of delivery of physical activity and exercise.

b) Why exercise?

There are well-documented health benefits of exercise. Physical benefits include improvements in cardiovascular disease, obesity, diabetes, breast and bowel cancer, asthma, joint disorders, muscular strength, bone strength and immune function. Psychologically exercise can reduce depression, anxiety and prevent Alzheimer's disease.

Exercise is more effective than medication for the treatment of stroke and as effective for the secondary prevention of coronary heart disease and diabetes. A 150-minute dose of moderate-to-vigorous physical activity (MVPA) accumulated per week can reduce the risk of most major chronic diseases by 25–50%. In addition, 15 minutes of MVPA per day (or 75 min/week) is associated with approximately a 15% relative mortality risk reduction, and the benefits increase with increasing dose. A longitudinal study looking at all-cause mortality in over 40,000 Americans, performed under the guidance of exercise scientist Dr Stephen Blair, demonstrated physical inactivity had the same relative contribution to mortality as smoking, diabetes and obesity (smokadiabesity!) combined. The health cost of 1 day of inactivity is the equivalent of smoking 3 cigarettes a day, or one pack a week. Exercise reduces cancer risk over a number of different sites, including colon (50%), breast and lung (up to 30%) and also prostate. Finally exercise has a significant effect on brain function and reduction of dementia symptoms and it's severity.

It is clear that physical activity has a substantial and positive effect on health and this message needs to be spread by all health professionals to the general community.

c) The principals of prescribing exercise

The question must be asked why exercise is not well prescribed or performed in our community. Specific issues for medical practitioners may include being time poor, being under-skilled in prescribing exercise or undervaluing the importance of exercise. Physiotherapists are in an ideal position to be involved in exercise prescription as many are already regularly active, understand the importance of exercise and have time in their consultations to discuss physical activity when performing treatment.

Most guidelines developed from agencies including the WHO and the American College of Sports Medicine would suggest to **aim for 30 mins of physical activity, 5 times per week, accumulating 150 minutes of physical activity per week**. This can be in accumulated or non-consecutive amounts, for example three ten-minute periods per day. Any change in intensity of activity will improve cardiovascular fitness. It would also appear that the overall relative risk of all health related issues is reduced further when performing 60 minutes of activity, when compared to 30 minutes. There is a good case for prescribing 2 pills rather than one!

Practical steps for exercise prescription start with enquiring about physical activity during the consultation. This should ideally take no more than 2-3 minutes. **The 2 most important questions include firstly, on average how many days per week do you engage in physical activity and secondly, on those days how long do you exercise for?** A written prescription building towards accumulating 150 min/week is crucial and it takes less than a minute to do this. Your patients should be encouraged to measure and record their physical activity. Some patients find devices such as step counters or phone apps may help to provide important feedback to reach their exercise goals. Patients may also be referred on as is felt appropriate to the practitioner's skill level. Consider resources such as sport and exercise physicians, exercise physiologists and certified fitness instructors. Follow-up with the patient is essential to chart progress, set goals, solve problems, and identify and use social supports.

The options for exercise and physical activity are endless, and should be limited only by a patient's interests and imagination. Most importantly it should be an activity that is enjoyable to that person, which will help improve their compliance. It shouldn't feel like torture! Variety is also important to prevent staleness and to provide other alternatives if injury occurs. A patient who only swims will quickly become inactive if they develop a shoulder impingement problem.

An ideal program may include **30-60 minutes of continuous aerobic activity 3-4 times per week**. A moderate intensity is desirable, but any intensity is beneficial. Aim for 60-70% maximum heart rate, or still being able to speak in sentences when talking. The program may include a variety of walking, running, swimming or riding a bike, depending on patient preference. In addition, 1-2 sessions of resistance-based exercise should be considered to improve muscle strength and function. Lastly a core strength and flexibility program such as yoga or Pilates could be incorporated once a week.

Summary of Aerobic Exercise Intensity Features

Intensity %	HR Max	Symptoms	Examples
Very Light	<50	Conversational, can sing	Walking, most swimming
Light	20-63	Conversational	Brisk walking, dancing, table- tennis, golf, gardening
Moderate	64-76	Speak short sentences, slight sweating	Brisk walking to light jog, tennis, cycling on hills, paddling
Hard	77-93	Severe breathlessness and sweating	Fast running, climbing stairs, wood-chopping

'%HR Max' refers to the percentage of one's maximal heart rate (unaffected by medications)

NOTES:

2. Considerations for the Older Adult / Athlete

The term 'older' carries differing meanings around the world. In developing countries, it is associated with the ability of living independently and obtaining gainful employment. The WHO quantifies 'older' as >50 years. The United Nations uses >60 years. In Western countries 'older' is considered >65 years which comprises 15% of the Australian population. Our older community is then sub-categorised into 'young-old' (65-75yrs), old (75-85yrs) and very old (>85yrs).

The physiological changes with ageing are well understood. These will be looked at from a cardio-respiratory, musculoskeletal and neurological perspective. In addition, the prescription of exercise must be tailored to these changes.

a) Cardio-respiratory changes

From the age of 50 there is a 5-10% decline in VO2max per decade. A VO2max of 15-20ml/kg is required for independent community living. The sedentary elderly often reach this around age 80-85. Cardiac output is reduced due to a combination of factors including reduced myocardial function, the use of medications and reduced maximal heart rate.

b) Musculoskeletal changes

The process of sarcopenia – loss of muscle mass, strength and endurance – commences at age 25. This becomes significant after 65 years when at least 25% of peak youth strength is lost. At 80 years there is 50% loss of skeletal muscle (muscle atrophy). Degenerative changes within most tissues occur, in particular the development of tendinopathy and articular cartilage degeneration.

c) Neurological changes

Proprioceptive, sensory and cognitive changes occur. The proprioceptive and sensory changes increase the risk of falls, and therefore hospital admission for trauma care. The outcomes from these admissions generally leave older patients in a declining health state. Cognitive changes, such as short-term memory loss, may affect compliance to exercises and also the ability to learn new movements.

d) Other factors

Sleep, hormonal changes, fatigue and adjusting to the changing seasons of life. All have to be taken into account when considering the prescription of exercise. Increasing rest / recovery times (e.g. naps) should be kept in mind.

e) The principles of prescribing exercise in the older adult / athlete

The health benefits of exercise for the older adult are profound. The ability to improve aerobic performance, strength and balance still occurs despite the ageing process. The results are most impressive with the most sedentary individuals. Recent studies have shown that cardiac function may be improved with High Intensity Interval Training (HIIT) in older patients. Knee and hip osteoarthritis symptoms can be reduced by 50%. Bone mineral density (BMD) can improve in the first decade post-menopause, with BMD improvements also found in older men.

The physiological changes in our older patients should cause us to repeatedly review our patient's goals. Closer attention to BP and HR changes and response to exercise is required. In diabetic patients consideration of hydration, nutrition, retinopathy and also neuropathy all need close consideration.

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Fundamentally exercise prescription is similar to younger patients with the following adjustments:

i) Longer recovery, warm up and cool down periods
ii) More variety and less repetition in training and activities
iii) Increased proprioceptive training – 2 min, twice daily
iv) Flexibility with static stretches - 10-30 secs, 3-4 times/region, 10 minutes, twice weekly
v) Careful increases in volume or intensity - <10% / week
vi) Early introduction of aquatic therapy. Generally very safe. Care with rapid hip abduction movements and existing gluteal weakness.
vii) Slow movement exercises that add core strengthening – examples include Yoga (including chair Yoga), Tai Chi and dance.

3. Specific Circumstances (these will be case presentations)

Many patients commence vigorous physical activity or restart an active lifestyle after they develop health issues. Philosophers call this an 'existential slap'; an awareness of one's mortality. This is a great opportunity to encourage patients to pursue healthier living. This usually includes increasing physical activity levels.

The health 'scare' may a more common condition (e.g. the discovery of knee OA or borderline hyperglycaemia / pre-diabetes) or be more dramatic (e.g.major cardiac event, cancer). Four cases will be presented to outline these points.

a) Cardiovascular Disease

The benefits of exercise towards the prevention and worsening of CVD are massive. At least 35% of patients enjoy a health benefit. The figure is greater in 'at risk' patients. The added considerations include medications (β-blockers, anti-hypertensives, statins); myocardial function (any cardiomyopathy or recent ischaemia) and psychological nervousness following a cardiac event. Generally, a varied exercise program with the ultimate addition of HIIT leads to good results. Liaison with the patients GP or cardiologist is important.

b) Diabetes

All aspects of diabetes management are improved through exercise. Improved muscular sensitivity to insulin, 60% reduction in the incidence of Type 2 diabetes and the added benefits of weight reduction on medication use. Specific consideration in diabetics includes the increased risk of hypoglycaemia (avoid isolated, remote training), altered thermoregulation (requires greater cooling time and strategies), foot care and neuropathy (more frequent footwear review and nail assessment) and retinopathy (care with exercise causing severe hypertension).

c) Cancer Survival

There are currently over 700,000 Australians who are cancer survivors. As mentioned (1b) physical activity has been found to play an important role in the prevention of certain cancers with improved survival rates by 30%. The mechanism may be anti-inflammatory. Some specific considerations when treating patients with cancer, or patients who are cancer survivors includes – post-treatment fatigue and relative infection risk (monitor fatigue and recovery; ensure good hygiene with shared equipment), lymphoedema (observe for skin abrasions and consider lymphoedema therapist), reduced bone density (assessment of BMD and care with rapid increase in WB exercise) and tendinopathy following chemotherapy (as with older patients, avoid sudden load increases and avoid loading tendon to fatigue in the initial 3 months).

d) Depression

The role of exercise to improve a number of mental illness conditions has been widely studied. When focusing on depression, exercise is an effective treatment strategy. Regular exercise protects against new depressive illnesses with low physical activity in childhood being associated with an increased risk of reporting depression in adulthood. The mechanism is considered to be a combination of biochemical, social and possibly anti-inflammatory. Overall 30% of patients with depression report moderate to significant symptom reduction with regular exercise. All types of exercise are valuable. In patients with associated anxiety, HIIT training is most effective when added to the exercise protocol. The barriers to the prescription of exercise include de-motivation (consider a training buddy or personal trainer), medications (some have the side-effect of dizziness so balance exercises should be carefully performed) and the addition of outdoor exercise with sunlight exposure will improve the neurochemistry (particularly serotonin).

4. Summary

The evidence for the health benefits of increased physical activity is overwhelming.

- Low fitness kills 8 times as many people as obesity.
- Low fitness kills twice as many people as smoking.
- The benefits are widespread over multiple health areas, medical conditions and age groups.
- The older patient can obtain great benefits by commencing and maintaining exercise, even in their later years.

If all inactive persons were getting 150 minutes of physical activity per week, 16 lives would be saved per 100 persons. If all smokers were non-smokers, 8 lives would be saved per 100 persons. We cannot afford not to pass this information on to not only our patients, but to our communities in general by engaging in any educational opportunity that may arise to spread this message regarding the benefits of physical activity.

Resources:

a) *Exercise in the Age of Evidence Based Medicine: A Clinical Update. Dr Stephen Blair et al http://www.medscape.org/viewarticle/549398*
b) *Exercise in the Older Adult: From the Sedentary Elderly to the Masters Athlete. Concannon et, al. American Academy of Physical Medicine and Rehabilitation, Vol. 4,833-839, November 2012.*
c) *National Ageing Research Institute www.nari.net.au/*
d) *Exercise for Coronary Heart Disease Patients. Little is Good, More is Better, Vigorous is Best. Eijsvogels et al, Jnl Am Coll Cardiology, 2017, Oct 3:70 (14):1701-1703.*
e) *Impact of Resistance Training in Cancer Survivors: A Meta-Analysis. Strasser et, al. Med Sc Sp Exer, May 2013 (ACSM).*
f) *Exercise and Treatment of Depression : a review of the exercise program variables. Stanton R, Reaburn P. Jnl Sci med Sport, 2014, March; 17(2):177-182*

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Enhancing repair and recovery of connective tissue with diet

Mechanotherapy
Many of the conditions we treat in sports medicine are related to disorders of connective tissues, of which collagen is a major component. The concept of mechanotherapy in managing these disorders has been in existence for many years, but was not widely appreciated until recently. This includes Wolff's law relating to remodelling of bone (first described in 1892), and Davis's law relating to remodelling of soft tissue (described in 1867).

It is now well understood that controlled loading of a tissue can lead to strengthening via structural adaptation, with a growing understanding at the molecular level. Mechanical perturbation of cells such as tenocytes (tendons) or chondrocytes (cartilage), leads to a cascade of cellular signalling which results in structural adaptation of the tissue by way of altered synthesis of extra cellular matrix.

To optimise the response to mechanotherapy, loads and recovery must be considered. Loading initially leads to structural weakening of the tissue prior to the structural adaptation. The effects of mechanotherapy are most visible with respect to muscle hypertrophy in response to resistance training. Equally important but less visible are the adaptations in other connective tissues including increased tendon stiffness, improved bone strength and increased vertebral disc resilience.
Excessive load with regards to recovery however can be deleterious where the damage caused by loading is incompletely compensated for by the adaptive response. This is well illustrated by the example of a runner who sustains a stress fracture. The role of recovery is thus apparent.

Low carbohydrate diets
Many different factors influence the biological response of tissue to load. This includes obvious factors such as the duration of recovery, but also factors amenable to nutritional intervention. Low carbohydrate diets have been shown to influence the recovery potential of connective tissues in several ways. That diabetes triples the risk of tendon related disorders, and significant improvement in the pain of osteoarthritis can be seen with small amounts of weight loss illustrates the impact that metabolic health has on connective tissues.

Matrix metallo-proteinases
Matrix metallo-proteinases (MMPs) are enzymes which breakdown collagen. MMPs are normally secreted at a baseline level by the liver. Poor liver health which is common in both diabetes and obesity leads to an increase in the amount of circulating MMPs. It is likely that this elevation increases the catabolic breakdown of articular cartilage connective tissues, with MMP-13 particularly implicated. This contributes to our understanding of why a 10% reduction in body weight is associated with a disproportionate 50% reduction in knee pain. In the early stages of weight loss seen with a low carbohydrate diet, visceral fat, including liver fat is lost first. This is evident from both imaging of the liver, and blood tests indicating liver health.

Non-enzymatic glycation
Glycation is the process by which sugar molecules attach to proteins. This is a normal process, and occurs at much greater rates when blood sugar levels are elevated, such as in diabetes. The resultant 'glycated proteins' can then form 'advanced glycosylated end products (AGEs)' which has been shown to lead to abnormal cross linking of connective tissue. This cross linking impairs normal function and turnover, and has been associated

with pathology such as tendinosis and plantar fasciopathy. Control of blood sugar levels, such as occurs on a low carbohydrate diet, leads to a reduction of tissue glycation, and reduced formation of AGEs.

Leucine
Protein, made up of a number of different types of amino acids, and the variable make up of different proteins influences their biological effect. While several amino acids have been shown to produce a small anabolic stimulus, one in particular stands out. Leucine, is an essential amino acid, and the most abundant of the BCAA's. It provides an anabolic stimulus via the mTOR pathway. The benefit of leucine for muscle hypertrophy is well known, however it is also likely it leads to an anabolic stimulus in other tissues, such as tendons. Blood leucine levels have been strongly correlated with tissue anabolism. In addition to leucine, a broad range of other amino acids are needed as the substrate, or building blocks for formation of new tissue in response to the anabolic stimulus. Whey protein has repeatedly been shown by research to provide both high levels of leucine for this anabolic stimulus, as well as a balanced mix of other amino acids which forms the substrate for the new tissue formed.

Nutritional intervention can enhance serum leucine levels through two main pathways. One is the regular supplementation of a suitable amount of whey protein. An alternate method involves the nutritional state of ketosis, derived from being on a very low carbohydrate diet, where the blood level of a ketone called beta-hydroxybutyrate is increased.
Leucine is one of the preferred energy sources utilised by our mitochondria for energy. Beta-hydroxybutyrate is one of the few sources of energy preferentially metabolised by mitochondria, with elevated levels leading to sparing of leucine. This likely explains why studies that look at muscle mass following weight loss of ketogenic diets find no evidence of muscle loss.

Inflammation
A biochemical process called the eicosanoid pathway uses polyunsaturated fatty acids to produce signalling molecules. The fatty acid substrates used in this process are either omega 3 or omega 6 fats, both of which are essential in our diet. The signalling molecules produced from the omega 6 fats are highly inflammatory in contrast to the products from omega 3 fats which are much less so. In fact, several medications such as the NSAID class of medications, aspirin and Montelukast directly target enzymes relating to omega 6 processing.
Increasing the balance of omega 3 fats compared to omega 6 fats (known as the omega 3 index) has been shown to be beneficial in reducing the pain from inflammatory conditions, including rheumatoid arthritis. It is therefore beneficial to ensure that dietary fats while on a low carbohydrate diet are selected to ensure an optimal ratio.

Summary
Low carbohydrate diets have several potential benefits with respect to enhancing connective tissue response to mechanotherapy. Adequate carbohydrate restriction can lead to the generation of ketone bodies from fat stores. These ketones have a hunger suppressing effect, leading to reduced caloric intake and weight loss. Beta hydroxybutyrate can also lead to increased serum levels of leucine, with a positive anabolic effect on connective tissues. Visceral fat loss also leads to improved liver health, and reduced levels of circulating MMPs which are catabolic to connective tissues. The reduction of carbohydrates also leads to a reduction in blood sugar levels (as complex carbohydrates are chains of glucose molecules), reducing glycation and oxidative damage to connective tissues. Low carbohydrate diets lead to an increase in dietary fat. Attention should be paid to the composition of these fats to ensure an optimal ratio of omega 3 and 6 fats to control inflammation.

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ORTHOSPORTS

How to choose a Total Hip Replacement Prosthesis

There is a big choice of THR prostheses on the Australian market. By using different femoral stems and acetabular components, a plethora of combinations can be achieved. The Australian National Joint Replacement Registry reported on the use of 545,831 THRs over the past 16 years. There were a total of 2,844 prostheses combinations, although many of these were used in very small numbers.

This year the Registry focused on the variation in performance of surgeons and on the outcomes in private versus public hospitals. The data clearly shows, both for hospitals and for individual surgeons, that prosthesis choice improves clinical results. Choosing the right implant is most important, when looking at long-term outcomes. Even high volume surgeons with good technical abilities cannot make poor prostheses work.

The Registry records revision as the single outcome measure of a prosthesis. The large numbers and the nearly 100% participation of surgeons and hospitals make the data reliable. The Registry performs many sub-analyses. The National Joint Replacement Registry is funded as a quality improvement initiative. It is estimated, that Registry data has significantly reduced the Revision Rates (RR) of joint replacements, saving healthcare costs to our community in the order of $600 million over the past 15 years.

Surgeons and manufacturers are encouraged to look at Registry data to improve the design and use of prostheses. The Registry reports are public and results are presented and discussed at the various orthopaedic meetings. Physiotherapists are actively involved in the care of patients receiving THRs. It may be worth explaining some of the principles and facts, which influence a surgeon's choice of prosthesis.

Since 2008 surgeons' names have been linked to individual procedures. Although individual surgeons are de-identified, statisticians are able to study who does what and patterns become clear. The registry identifies prostheses, which have a higher than expected revision rate, when compared to all other implants. In a similar way, surgeons who have a revision rate of greater than 2.5 standard deviations, when compared with all others, can be identified. The single most important factor is choice of performing prostheses, which perform well.

This year the registry looked at 651 surgeons, who did at least 50 THR per year. The surgeons were grouped according to the number and types of prostheses they used. The results show that those who were more consistent and used less variety had better results. Furthermore, when surgeons used prostheses, which have the best 10 year revision rate, the outcomes per surgeon also improved. This finding sends a clear message to surgeons, who are deciding which prostheses to use. When looking at the 15year results there are 13 prostheses combinations with a revision rate of less than 6.5% and 6 combinations with a RR of less than 5%, which is an excellent outcome for patients.

Total Hip Replacement continues to increase in Australia. In 2016 we did 47,171 hip replacements, which represents an increase of 5.5% over the previous year. When choosing prostheses, multiple factors have to be considered, such a fixation, the shape of the stem, the bearing surface, the head size, and the approach. The Registry has only recently started to record the approach. There is not yet enough direct information about the merits of the anterior versus the more common posterior approach.

In patients under 65years, there is no long-term difference between cemented and non-cemented prostheses. In those patients over 65years, and especially those with poor bone quality, cemented hip replacements do better. Some mini stems have recently been introduced. The idea is to preserve femoral bone stock. There are 11 such prostheses on the market, but their use represents less than 1% of all hip replacements. Whilst the overall RR is similar, there is a higher rate of femoral loosening.

Femoral components with exchangeable necks were advertised to give surgeons a greater choice of angles and offset. However, the junction between the neck and the shaft of the prostheses is the weak link, often leading to fretting and corrosion. The RR of these stems is significantly higher.

The bearing surface of THR is most important. Ceramic on ceramic or ceramic on cross-linked polyethylene are both good options, although many surgeons will prefer ceramic on ceramic for younger patients. Non-cross-linked polyethylene is now rarely used. Furthermore, the use of larger femoral heads has reduced the incidence of dislocation.

There are a number of additional considerations in certain patients with a steep acetabulum, an abnormal femoral neck, a narrow femoral canal, abnormal bone quality or previous surgery. In these cases, specific prostheses may be required. In some cases price becomes an issue, as the costs can vary enormously. On a worldwide comparison, Australians pay some of the highest prices for joint replacement prostheses.

THR is arguably one of the best operations, as it relieves pain and restores function. Surgeons can achieve better outcomes for their patients by noting the results of the National Joint Replacement Registry. Consistency and choice of better performing prostheses, as well as specific considerations in regards to age and bone morphology, can result in further improvements in patient outcomes.

The registry also provides Surgeons with reports of individual outcomes, which is a tool with the potential for improved patient care.

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ORTHOSPORTS

Anterolateral Ligament and Medial Patellofemoral Ligament Reconstruction

ALL

ACL reconstruction is a very successful operation with the majority of patients returning to sport. There are a small number of patients who, despite seeming to have a successful ACL re-construction with excellent tunnel position continue to have symptoms of instability in the knee.

In these patients adding another structural stabiliser usually cures their symptoms of instability. This operation can be undertaken with autograft, allograft or by using a strip of iliotibial band. The goal of AnteroLateral Ligament (ALL) reconstruction is to eliminate any residual rotational laxity and also reduce the risk of ACL graft rupture.

Segond first described an avulsion fracture of the proximal-lateral tibia in 1879. This fracture is pathognomonic of an ACL tear but not all ACL tears have this fracture. This also happens to be the site of insertion to the tibia of the ALL. The ALL is NOT isometric, it is loose in flexion and tight in extension.

There are probably 4 grades of ALL injury:

- I – stretching of anterolateral capsule
- II – Haemorrhagic injury of both anterolateral and posterolateral capsule
- III – Complete rupture of ALL
- IV – Segond Fracture

The exact criteria of when to add an ALL to a standard ACL reconstruction are still being worked out but the following is a list of potential criteria which, if present, require a very careful examination of the knee after the ACL reconstruction has been completed. If the pivot shit remains positive then almost certainly an ALL reconstruction is appropriate.

1. Injury to the ALL substance seen on MRI
2. Segond fracture
3. Pivot-shift grade III
4. Lateral femoral notch sign
5. Ongoing instability with a technically successful ACL reconstruction

Since the ACL and ALL have very similar biomechanical functions the rehab protocol is determined by that needed for the ACL reconstruction. I do not alter my rehab if I add an ALL reconstruction to an ACL reconstruction.

MPFL

Recurrent patellar dislocation is a disabling condition commonly occurring in healthy, young and active patients. Biomechanical studies have identified the medial patellofemoral ligament (MPFL) as the primary medial stabiliser of the patella, contributing at least 60% of the restraining force to prevent lateral dislocation. Recurrent patellar dislocation is often associated with abnormal bony anatomy, particularly the position of the tibial tuberosity. This deformity manifests as an increased quadriceps (Q)-angle or tibial tuberosity to trochlear groove (TT-TG) distance in cases of excessive lateralization. The Q-angle is an index of the lateralization of the tibial tubercle measured clinically. It is the angle formed by the anterior superior iliac spine, centre of the patella and the tibial tubercle but has been superseded by the TT-TG distance.

The TT-TG distance is a xray measurement made using CT or MRI to measure the lateral position of the patella tendon insertion on the tibia with regards to the trochlea groove.

Normal TT-TG distance is defined as being between 10 and 15mm, with 20mm normally set as the threshold for increased risk of lateral patellofemoral instability.
Treatment options range from conservative measures to surgical procedures aimed at restoring the function and restraining force of the MPFL, such as the MPFL reconstruction, plication of the MPFL or bony procedures such as the tibial tuberosity transfer (TTT).

Reconstruction of the medial patellofemoral ligament (MPFLR) is an increasingly popular surgical management option to treat recurrent lateral patellar dislocation. It is a smaller operation with faster recovery and is proving to be as reliable as the larger procedure in most cases.

Rehabilitation varies greatly between surgeons and with the type of reconstruction.
My protocol is generally:

Weeks 0-2	Swelling reduction & regular icing Compression with tubigrip, regular rest and elevation, encourage calf and quads contractions Hamstring, calf and ITB stretches Static and inner range knee contractions (0-30°), calf pumps, hip coronal and sagittal resistance exercises. Full Weight Bearing with crutches until balance and gait pattern normalises Active and passive ROM (0-90°)
Weeks 2-6	Medial PF glides to commence (no lateral glides) Daily scar massage Progress to eccentric WB quads sets (with hip in neutral and internal rotation only) Employ biofeedback when appropriate Stationary bike Low resistance squat and leg press (0-45°) Gait re-training aiming to optimize heel strike and toe off Gradual restoration of full active and passive ROM PF brace over tubigrip (optional)
Weeks 6-12	Commence lateral, superior and inferior PF glides Foam roller for ITB, gluts, calf and HS releases Progress to gym-focused program Leg press and squat (0-60°), calf raises, hip abduction, hip adduction, hip flexor, HS curls Proprioceptive re-training eg wobble board and mini-tramp No open chain exercises, deep lunges Add elliptical trainer / rower machine. Freestyle swimming to commence PF taping during rehabilitation; PF brace during all other activities if needed for proprioception
Weeks 12+	Progression of gym-based rehabilitation as above with increased resistance Discard PF brace during normal activities; PF taping during sports for 1 year Commence jogging and swimming with flipper 2 -3 months proprioceptive retraining program including lateral movements, single leg hops and landing techniques. Return to sports once all milestones met.

NOTES:

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ORTHOSPORTS

Posterolateral Corner Injuries

Posterolateral corner injuries are usually sustained in conjunction with other ligament injuries. Most commonly associated with either the ACL or PCL or both in the case of a knee dislocation; with isolated PLC injuries occurring only 28% of the time. Common peroneal nerve injury occurs in 1/3 of cases.

High grade PLC injuries do very poorly with non operative management and failure to treat them when reconstructing an associated cruciate ligament will significantly compromise the reconstruction.

The PLC is the primary restraint to varus force, recurvatum and also external rotation of the tibia w.r.t. the femur (the PCL is a secondary restraint), it has a secondary role in A-P translation and in conjunction with the ACL a secondary restraint for internal rotation (popliteus tendon).

The major stabilisers of the PLC are the fibular collateral ligament, the popliteofibular ligament, and the popliteus tendon.

Secondary stabilisers are the mid third lateral capsular ligament (menisco femoral and menisco tibial ligaments), the coronary ligament, the lateral gastrocnemius, the fabello fibular ligament, the long head of biceps femorus and the iliotibial band.

Mechanism of injury:

Usually hyperextension, a varus force, or a combination of both. It can also be injured by a posterolaterally directed force on a flexed knee

- Grade 1 or 2 injuries do well with non operative management
- Grade 3 injuries require surgery.

Patients with PLC injuries present with:

- pain,
- varus instability,
- difficulty with stairs and uneven ground,
- inability to run and
- often a varus thrust during the stance phase of gait.

Clinical tests include:

1. The varus stress test at 30 and 0 degrees of extension. Opening of the lateral joint at 30 but not 0 indicates an isolated FCL opening at both angle indicates both a FCL and PCL injury.

2. The Dial test – patient prone external rotation of both tibias compared at 30 and 90 degrees of flexion. An increase of greater than 10 degrees compared to the other side at 30 but not 90 indicates an isolated PLC. If it occurs at both angles this indicates a PLC and PCL.

3. The external rotation recurvatum test – pick up patient's legs by the feet, if PLC injury the effected leg falls into external rotation recurvatum.

Imaging:

Imaging of choice is MRI. If chronic will also need long leg standing films to exclude a varus mechanical alignment.

Treatment:

Either repair or reconstruction

- Repair has to be performed within 3/52.
- Reconstruction involves reconstruction of the FCL, Popleteus tendon and popliteofibular ligament, either with autograft or allograft.
- Direct repair has a higher failure rate than reconstruction
- Reconstruction after failed repair has same success rate as primary repair.
- In chronic cases with varus mechanical alignment a valgurising high tibial osteotomy must be performed prior to the PLC reconstruction otherwise it will fail.
- Surgical treatment of grade 3 PLC injuries results in normal or near normal knee function in 77% of cases.

NOTES:

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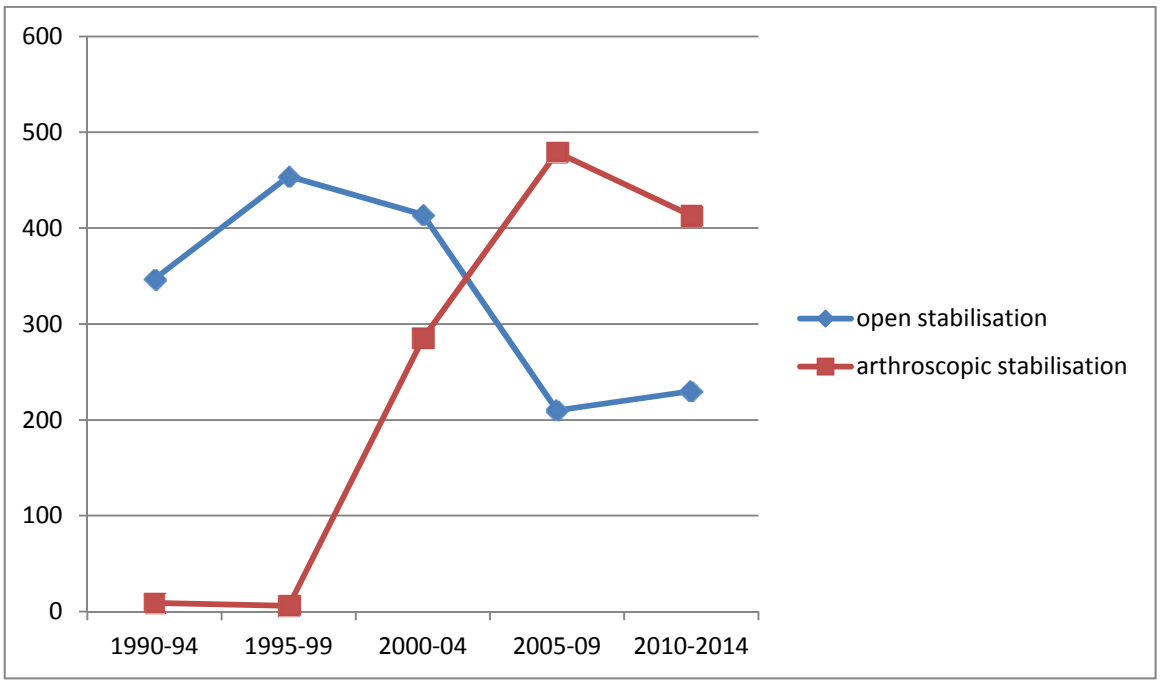
Shoulder Surgery

ORTHOSPORTS

The evolution of shoulder instability surgery - which operation is best?

Surgery for shoulder instability has evolved over the last 30 years. Initially an open shoulder stabilisation was the treatment of choice. Early this century arthroscopic shoulder surgery became extremely popular in treating the unstable shoulder, mainly because of technical improvements and advances in arthroscopic instrumentation. After an initial honeymoon however, it became clear to researchers that arthroscopic stabilisation surgery gave inferior results in contact or collision athletes, and those patients who had bony damage to either the glenoid or humeral head or both.



The diagram above shows my experience over a 25 year period and over 3200 cases. One can observe a trend over the last five years with increasing open surgery as opposed to arthroscopic surgery. It should be noted however that the majority of procedures done are still arthroscopic.

The surgery however must be tailored to the pathology present.

After deciding that a patient requires surgery one can decide the appropriate procedure by getting the following investigations:

- plain x-rays - helps indicate whether there is bony pathology.
- an MR arthrogram - determines the extent of the labral tear and whether there is a capsular lesion.
- 3-D CT scanning if there is bony damage - one can assess the extent of the bony damage to both the glenoid and/or the humerus.

I use the following paradigm and group the patients as follows:

- labral tear alone in a non-contact patient
- labral tear alone in a contact patient
- HAGL lesion
- SLAP lesion alone
- capsular stretch alone
- mild bone loss +/-other pathology
- major bone loss +/-other pathology

Classification of contact or active patients:

- rugby
- AFL
- water skiing/snow skiing/snowboarding
- basketball
- soccer goalie
- heavy weights and body building
- heavy manual workers
- overhead workers
- rock climbing

SUMMARY

	NON CONTACT	CONTACT
LABRAL TEAR or ALPSA ONLY	Arthroscopic	Open (except in season)
HAGL	Open	Open
CAPSULAR STRETCH ONLY	Arthroscopic	Open
SLAP	Arthroscopic	Arthroscopic plus plication
MILD BONE DAMAGE	Arthroscopic with remplisage	Open
SIGNIFICANT BONE DAMAGE	Latarjet	Latarjet

There is a greater trend to open surgery especially if:

- Contact athlete
- Very active
- Even mild/moderate bony pathology
- Consider transosseous labral repair in open surgery

A latarjet procedure is not a benign operation and is not the only open procedure available.

NOTES:

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