

## **Exploring Patellofemoral Pain Mini Series**

**Session Three: Patellofemoral  
Latest Research - Making Sense of  
It and Evolving Practice**

**Claire Robertson BSc(hons) Physiotherapy,  
MSc Physiotherapy, PGCE**



## PFP-Latest research. Making sense of it and Evolving Practice.



Claire Robertson MSc PGCE MCSP

Consultant physiotherapist, (PFP), Wimbledon Clinics.

[www.clairepatella.com](http://www.clairepatella.com)

## Learning Outcomes

- ▶ Be thoroughly aware of emerging areas of literature in PFP field.
- ▶ Understand practical application of available literature.
- ▶ Competently blend concepts to understand advanced case study.



## History of the Research

- ▶ VMO. Size then firing then architecture.
- ▶ Taping-McConnell
- ▶ 2000's much more on proximal work-Powers .
- ▶ Stretching-inconclusive.
- ▶ Foot-limited but improving body of literature, Collins.
- ▶ Movement. Becoming more sophisticated.
- ▶ Running.
- ▶ Pain Sciences-need more!

Be cautious as the volume of literature in certain areas is not reflective of their importance, but sometimes just the chronology.

## Patellofemoral Research Retreat.

- ▶ Very housed in biomechanics.
- ▶ Poor representation of pain science/ behaviour adaptation and education.
- ▶ Lots of emerging work around PFJ morphology, bone oedema and OA.
- ▶ Lots of work around running.

Given that this patient population often have long duration symptoms I feel very strongly that we need more information on pain and education in this field.

# Morphology and Instability

- ▶ Area of growth, why?
  - ▶ Imaging improving.
  - ▶ More sophisticated surgery.
  - ▶ More understood about subtleties.
  - ▶ Warwick patella instability consensus group.

# How unstable?

- ▶ Stable
- ▶ Dislocated
- ▶ Potential for dislocation
- ▶ Subluxation
- ▶ Poor engagement
  
- ▶ +/- PAIN!!!!

A patella doesn't have to be dislocating to give problems around stability. Instability in the absence of dislocation can still overload the parapatellar soft tissues, the fat pad, cause accelerated chondral wear and create a loss of confidence in the knee.

## Where is the pathology?

- ▶ Trochlea
- ▶ Patella alta
- ▶ Lateral retinaculum
- ▶ Medial structures
- ▶ Tubercle
- ▶ Patella degeneration!!!

## Clinical presentation acute injury?

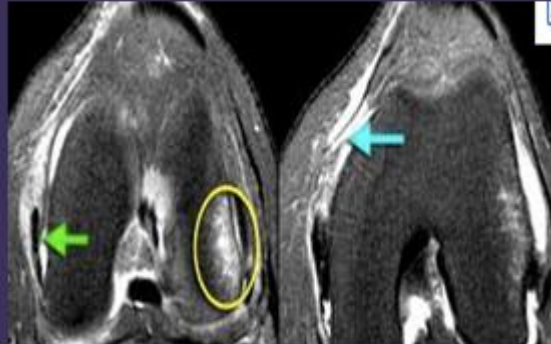
- ▶ Usually non traumatic
- ▶ They fall to ground
- ▶ May see patella out or feel relocation
- ▶ Tender medial retinaculum and LFC
- ▶ May have generalised laxity-Beighton score helpful
- ▶ Differentiate from extensor rupture and ACL

Quick ie immediate self-relocation may be better for the patient but may indicate more gross instability, ie goes in and out very easily.

Dislocation in the normal knee unusual but offers better prognosis.

## Imaging?

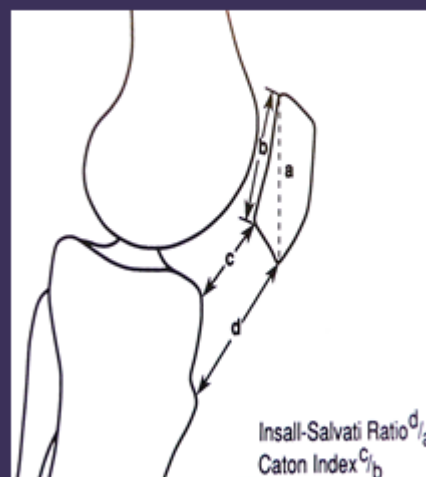
- ▶ Xrays-traditional
- ▶ MRI
- ▶ USS
  
- ▶ Loose body
- ▶ LFC bruise
- ▶ MPFL rupture
- ▶ Trochlear



Early imaging recommended when someone has dislocated to check for loose body and or avulsion injury, ad assess extent of dysplasia and damage.

## Imaging Xray

- ▶ Medial avulsion on skyline
- ▶ Patella alta



Look for a rough ratio of 1:1 for patella length:patella tendon length. You can do this crudely with your fingers to get a guide of whether there is a patella alta.

## Non Op treatment?

- ▶ Redislocation rates are 15 to 44%
- ▶ Non op 1/3 will fail
- ▶ (Cofield, McManus, Larsen, Hawkins, Cash, Garth)
- ▶ Repair /reef 25% still sublux (Sallay, Vainionpaa)
- ▶ Op if have an osteochondral fragment

Loose body warrants urgent arthroscopy to stop chondral damage.

## Jacquith et al., 2015

- ▶ 266 knees
- ▶ Who is most likely to re-dislocate?
  - ▶ Under 14
  - ▶ Contralateral dislocation
  - ▶ Trochlea dysplasia
  - ▶ Long patella tendon

This paper really helps us guide the patient and their parents as to the statistical likelihood of a redislocation.

## Chronic complaint ?

- ▶ Redislocation
- ▶ Subluxation/loss of confidence
- ▶ Pain.

Even in the absence of the feeling of instability, subtle instability can create issues of pain.

## Assessment?

- ▶ Morphology of trochlear
- ▶ Length of patella tendon
- ▶ Medial structures
- ▶ Tibial tubercle vs floor of trochlear



## Aim?

- ▶ To achieve consistent smooth engagement and place the patella in the groove and keep it there through range
- ▶ Regain confidence with functional movement.

Due to the complex causes of PFJ instability, try and seek out surgeons who can offer the whole spectrum of PFJ surgery so that the patient really is offered what they need.

## Elmslie Trillat

- ▶ Good reports (Cox, Reigler)
- ▶ TTTG > 20mm
- ▶ Beware medial facet Degeneration



Post-operative protocols vary hugely for this. Liaise with your surgeon!

## Patella alta

- ▶ Insall-Salvati Index
- ▶ You can informally eyeball this in clinic,
- ▶ Tuberosity can be distalised with surgery.



Distalising the tubercle will reduce the patella alta.

## Non-Operative Management Of Large TTG

- ▶ Large valgus moment overloading lateral facet and providing lateral force.
- ▶ What femoral dynamic movement is to be avoided at all costs?
  - ▶ Adduction
  - ▶ Internal rotation
  - ▶ Adduction with internal rotation.

## Non-Operative Management Of Large TTTG

- ▶ Are they anteverted-Craigs test?
- ▶ If dynamic control the problem are they aware, eg knees knocking when they run.
- ▶ Is it weakness or poor NMS control?
- ▶ In endurance athletes is it as they fatigue?
- ▶ Can they correct? What cues work best?
- ▶ What angle of hip flexion does rotation problem come in, eg cyclists vs runners?
- ▶ Is the 'medial collapse' driven from foot?

If the tibial attachment of the quads is lateralised, the last thing you want is a medialising femur.

If the femur is medialising then you need to ascertain why.

Is it femoral neck anteversion-use Craig's test to help.

Is it poor femoral control and they are just dropping into femoral internal rotation.

Is it the foot excessively pronating driving the whole limb medially.

## Craigs Test

- ▶ <https://vimeo.com/63363312>

This is very difficult on someone with a large BMI as it is hard to accurately feel the trochanter.

## Rotational control. Stood



Look at ability to comprehend and feel the task, ability to perform, are they compensating, and can they hold, (ie endurance).

If they find it difficult to feel and perform, using a mirror can help.

## Eccentric control-Sat



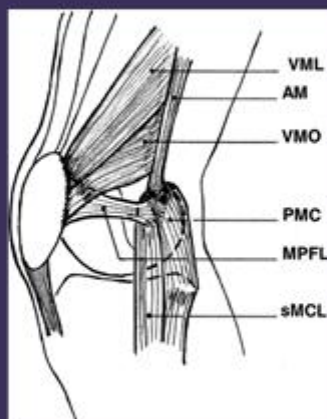
This is very useful for cyclists or people that have pain getting out of a chair.

## Non-Operative Management Of Patella Alta

- ▶ Patella alta results in the patella taking longer to enter trochlea.
- ▶ Therefore relatively more unstable in first 40 degrees of knee flexion.
- ▶ It takes longer for stability to be offered from trochlea.
- ▶ So what range do we need to target with our dynamic stability?
- ▶ 0-40 !
- ▶ We want to make VMO architecturally favourable ie. increase fibre angle and insertion ratio, (Benjafiel et al., 2014).

Patella alta is due to a long patella tendon. Although formally assessed on MRI the ratio of patella tendon length to patella length should be approximately 1:1 and you can get a feel for that by placing your fingers on either end of the patella, and also the tibial tuberosity.

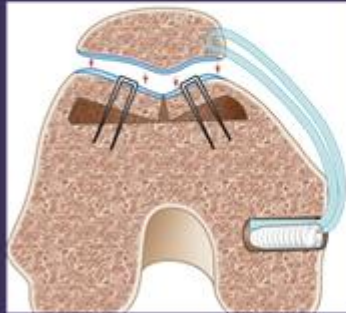
## Surgical Advances-MPFL



Look at the VMO originating lower off adductor magnus, and the VML off adductor longus.

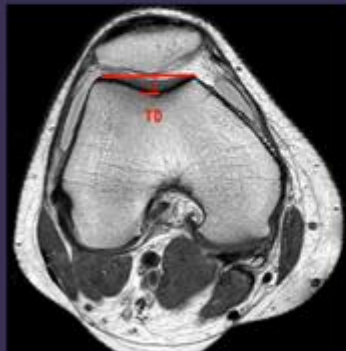
## Medial patella femoral ligament

- ▶ Only addresses the ruptured ligament
- ▶ They will still have patella alta
- ▶ Increased TTTG
- ▶ Trochlear dysplasia
- ▶ Subluxation



## Trochlea shape-depth

- ▶ Depth
- ▶ Can be a dome at its worst.
- ▶ On a spectrum
- ▶ Pt analogy with saucer vs soup bowl.
- ▶ Look out for 'shallow trochlea' on MRI report



I personally think that there are a lot of patients who present to physio who aren't shallow enough to dislocate but they are shallow enough to have subtle instability that can create pain.

## Trochlearplasty

- ▶ Addresses trochlear/Q angle and TTTG
- ▶ Addresses to effect of long patella tendon
- ▶ Addresses the stretched medial structures
- ▶ No OA at ten years

This is a big op! Adequate mental and physical preparation is advisable!

## Trochlea shape-non-operative concepts

- ▶ Can have multi-directional instability, and not always dislocating.
- ▶ Look out for patients using words like 'slipping'
- ▶ My experience is that often associated with small patellae and hypermobility.
- ▶ Need to try and establish if problem subluxing/ dislocating/ general excess mobility.
- ▶ My experience that multi-directional instability they are often very puffy in their parapatellar soft tissues.
- ▶ Consider bracing (see next slide)

When there is a shallow trochlea you want to eliminate all unwanted movement from the limb as they are going to find it too difficult to cope with that.

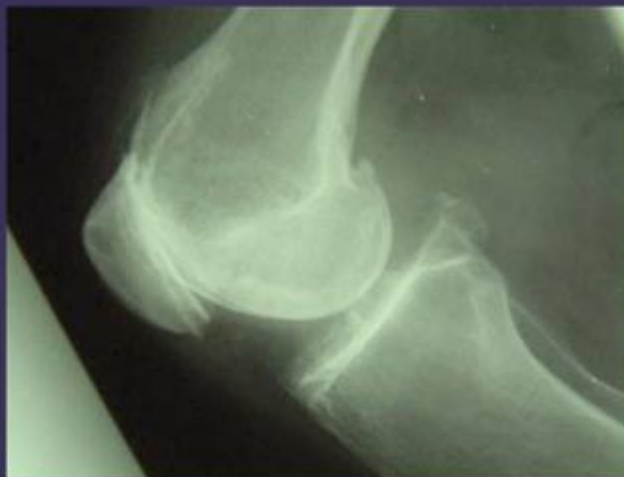
Tape and brace can be used for more stressful scenarios like training. Ensure the patient can replicate the tape so that they are not reliant on the physio.

## Trochlea shape-bracing

- ▶ Use clinical reasoning;
- ▶ -any chondral damage/bone oedema? If yes, where.
- ▶ If lateral facet/ lateral trochlea then consider Q brace, (Callaghan et al., 2015)
- ▶ If no damage or widespread then consider patella stabilising brace.
- ▶ Tape-McConnell for lateral pathology/J tape for stab

Bone oedema correlates tightly with pain but is reversible when offloaded-that is a good motivating factor to tell patients.

## PFJ OA



Look at reduced joint space and increased stress in the bone.



## PFJ OA

- ▶ Emerging area at PF research retreat 2015.
- ▶ 44% people >50 with knee pain have tibiofem & PFJ OA.
- ▶ 25% have isolated PFJ OA, (Hinman et al., 2014)
- ▶ PFJ OA is associated with trochlear dysplasia, (Macri et al., 2016)

A real flurry of research in this field at the moment. A lot around imaging and demographics. More needed on treatment!

## PFJ OA

- ▶ Stefanik et al., (2014) showed that lateral facet OA has tighter correlation with pain than medial facet.
- ▶ Callaghan et al., (2015) demonstrate that PFJ OA is associated with inhibition.

Is medial facet change relevant-hard to know!

## PFJ OA-bracing

- ▶ Callaghan et al., (2015) show basic knee support does not cause inhibition or decreased MVC.
- ▶ Callaghan et al., (2015) shows mean use 7hr per day of Q brace decreases bone marrow oedema and pain over 8 weeks.



This second paper of Callaghan's has changed my practice. If they can't access a Q brace or it doesn't fit well then taping can replicate this to off load the lateral PFJ

## PFJ OA-exercise & education

- ▶ Quads & hip strength work plus tape plus mobs plus education give better short term but same long term benefit as education alone, (Crossley et al., 2015).

More research needed on education. Don't be afraid to spend decent time on education!

## Emerging literature on runners.

- ▶ Sudden explosion in interest
- ▶ Useful recent review is Barton et al., 2016.
- ▶ What are the key messages?
- ▶ What can we apply in a clinic setting where we usually don't have access to sophisticated equipment?



Running retraining is very trendy at the moment. The question here is what is relevant and applicable to the PFP field?

## History of running retraining

- ▶ Theory initially tested by Irene Davis, 2005.
- ▶ Despite plethora of literature, (approx 70 papers in 10 years) only 4 papers on pain reduction in PFP.
- ▶ Most papers are on asymptomatics or are not using pain as an outcome measure.



Note only 4 papers on the effects on pain, and these are very small!

## Noehren et al., 2010

- ▶ 10 female runners followed for 1 month.
- ▶ 8 sessions over 2 weeks.
- ▶ 3D real time feedback, verbal feedback to reduce hip adduction.
- ▶ Reduced pain at 2 weeks and 1 month follow up.
- ▶ Reduced peak hip adduction and vertical impact peak at 2 weeks and 1 month.

## Willy et al., 2010

- ▶ 10 female runners
- ▶ 3 months.
- ▶ Mirrors for visual feedback and verbal feedback.
- ▶ Also targeting hip adduction.
- ▶ Pain reduction at 2 weeks.
- ▶ Pain reduction maintained at 1 and 3 month follow ups.
- ▶ Reduction in peak hip adduction and contralateral pelvic drop.

This and Noehren's paper are useful for clinicians as this is something we can really look at in the clinical setting. Interesting to see this change without strength work.

## Biomechanical Rationale for Running Retraining

- ▶ Increase step rate to decrease PFJ stress. May also:
  - ▶ Decrease peak knee flexion,
  - ▶ Decrease knee energy absorption
  - ▶ Reduce knee extensor moment.

This can be a very useful tactic but see what their step rate is like to start with!

Remove medial collapse  
ie IR and adduction.



What is causing medial collapse, ie strength/ foot/habit/comboination!?

## Forwards Lean

- ▶ Limited evidence for this reducing PFJ load, (Teng 2014)
- ▶ Concerns me that it increases load at hip and low back.
- ▶ I would look at causes of PFP before encouraging forwards lean.

## Transition from Rearfoot to Forefoot Strike

- ▶ Some evidence that this will decrease peak and accumulative PFJ stress.
- ▶ Expert opinion, (Barton et al., 2016) wary of this transition.
- ▶ Benefit may simply come from reduced stride length.
- ▶ Experts keener to work on increasing step rate by 5-10%.

# Cues for Running Retraining

- ▶ Unlikely that 1 cue will suit all.
- ▶ Consider:
  - ▶ 'Keep knees apart' or 'Have gap between knees' for decreasing hip adduction.
  - ▶ Tape on floor to avoid cross-over gait.
  - ▶ 'Run light on your feet' or 'run softly' for decreased ground reaction force.

Cues can be very useful. Also getting running partners to check for daylight between the knees!

# Running with Pain

- ▶ Experts either say no pain or no more than 3/10, (Barton et al., 2016)
- ▶ However running with pain can make it easier to see the effects of retraining!

## MONITORING PAIN AND LOAD RESPONSE

Pain during exercise  
0 = no pain 10 = worse pain imaginable



Adapted from Thommeé (1997) and Silbernagel (2007)

Monitor symptom response for 24-48 hours post exercise  
Pain should settle quickly post exercise with no increase in symptoms or EMS the next day

## Running Fatigue

- ▶ Care with lack of endurance leading to increased hip adduction/IR as miles increase.
- ▶ Look at runners fresh and when fatigued.
- ▶ Photos from finish lines very helpful!
- ▶ Teach patients how to self assess fatigue in key muscle groups.
- ▶ Can use fatigue to make easy exercises harder!

Looking at runners when fatigued can be very revealing.

Teaching them to use one of their standard exercises as a check after their run will help them realize if their gluteal muscles have become very fatigued.

## Adolescent PFP.

- ▶ Same or different to adult PFP?





## What do we know so far?

- ▶ Vast majority of PFP literature on adults, (95%)
- ▶ Difference in success rates between adolescent and adults with PFP.
- ▶ Population prevalence in adolescents is 6-7%, (Rathleff et al., 2013).
- ▶ Adolescent females x2.3 more likely than males, (Rathleff et al. 2013).
- ▶ Two thirds are very active (at least x5 per week), but one third not active at all.

This large group of patients can be tricky to treat.

## Outcomes with adolescents

- ▶ Van Linschoten et al., 2009 67% success at 1 year, (age 18-40).
- ▶ Same paper also analysed 14-18 year olds separately and found 53% success at 1 year
- ▶ Collins et al., 2010 73-81% successful outcome at 1 year, (age 18-40).
- ▶ Adolescents with poor adherence were x4 less likely to be recovered at 1 year. (Rathleff et al., 2014)

It's really worth focusing on adherence. Keep the number of exercises as small as possible, and help the patient find ways of building in the exercises e.g. whilst tooth brushing/ using phone reminders etc.

## Adolescent symptom duration

- ▶ Despite young age adolescents had symptom duration more than 3 years! (Rathleff et al., 2014).
- ▶ Long symptom duration associated with poor outcome after treatment, (Collins et al., 2010).
- ▶ Adolescents report higher incidence of bilateral pain, (70-79%), compared to 55-60% in adults. (Natri et al., 1998), and may predict poorer outcome.

## Adolescents and strength.

- ▶ In adults reduced strength is common in PFP.
- ▶ Limited available evidence in adolescent PFP suggests weakness is consequence and not cause, (Rathleff et al., 2014).



## Adolescent PFP-Areas Particularly Needing more work...

- ▶ Reasons for loss of adherence.
- ▶ Growth!
- ▶ Loss of neuromuscular control.
- ▶ Morpholgy.



I ask all adolescents with PFP to track their growth to highlight vulnerable times for excess loading.

Map out the activity across the week as often very high levels of load when partaking in several sports.

## Conclusions from this webinar

- ▶ Understanding trochlear dysplasia will help you to become more bespoke and sophisticated with your treatment plan.
- ▶ Lots of literature around running retraining but surprisingly little on effect on PFP.
- ▶ Reducing stride length may in some cases be effective and easy strategy.
- ▶ Adolescent PFP may need a different approach.
- ▶ PFJ OA education and possibly bracing look useful.

## Case study

- ▶ PC. Male 35, Pain vague distribution around patella. No swelling, no giving way.
- ▶ *Thoughts: typical of PFP. Nothing to make me suspicious of meniscal pathology.*
- ▶ Agg. Stair descent, prolonged sitting, turning with foot fixed.
- ▶ *Thoughts: stair descent and cinema sign typical, turning on foot fixed makes me suspicious of joint pathology, (tibiofemoral), or shallow trochlea.*
- ▶ Ease. No pain after cessation of aggravating movements.
- ▶ *Thoughts. No inflammatory component here.*

- ▶ HPC. Insidious onset 2 years ago after increasing volume of salsa dancing to 5 x 2 hour sessions per week. No other exercise. Pain increased, forced him to stop. S/B physio who gave him squats and lunges. Pain worsened. Sleep disturbance but not through pain. S/B orthopaedic surgeon.
- ▶ MRI: Mild superficial changes on retropatellar surfaces but shallow trochlea with small angle to slope of lateral edge of trochlea. Referred to me.
- ▶ *Thoughts. This is a lot of exercise with no s&c alongside. Unlikely to be weak in quads as no swelling and came on at a time of lots of exercise. Repeated loading of PFJ through squats and lunges have worsened pain. Sleep disturbance may be from stopping exercise. This is likely to feed the possibility of central sensitization.*

- ▶ PMH.x2 ankle arthroscopies on ipsilateral side 5 years ago. Great recovery from ankle and not aware of any ongoing issues.
- ▶ *Thought. Need to look at ankle ROM/stability and gluteal function as ankle problems can inhibit gluteus medius.*
- ▶ SH. Office worker who drives to work. No issue with work/commute. No exercise for last 18 months. Has put on 8 kg.
- ▶ *Thoughts. This man has gone from being an intense exerciser to very sedentary. He has lowered self esteem, has lost a major part of his social life and is low in mood. He now cannot imagine getting back to dancing. We need to explore other avenues of exercise as a preliminary stage.*

- ▶ O/E.
- ▶ Obs. Overweight, no effusion. Small patella.
- ▶ *Thoughts. Increased BMI means greater systemic inflammation. Small patella can indicate hypermobility.*
- ▶ ROM full, 20 degrees hyperextension. Little pain.
- ▶ Beighton score: 9
- ▶ Palpation. No tender areas. Patella highly mobile. Negative apprehension sign.
- ▶ *Thoughts. Patella easily becomes malaligned due to shallow trochlea and global hypermobility.*

- ▶ Quads: bulk reasonable, no obvious deficits.
- ▶ *Thoughts. Not going to be great as very sedentary but not convinced they are primary problem but will need improving as part of later stages of rehab before return to dance, especially with a shallow trochlea as dynamic stability more important.*
- ▶ Gluteal assessment. Poor firing and force generation of gluteus medius in frontal plane. Compensating massively through TFL.
- ▶ *Thoughts. Probably a legacy from the ankle problems as very one-sided. Rotational strength fine.*

- ▶ Length. Modified Thomas test reveals pain provoked by hip adduction and a subluxing patella. Very tight. Tightness perceived by pt down lateral thigh and he comments that he often gets a sense of tightness in lateral thigh with walking
- ▶ *Thoughts. Tightness through ITB complex, ie TFL shortening and immobility of ITB itself lateralizing the patella that will move easily due to trochlea shape and hypermobile patella. Comment re walking tightness suggests gross overuse in simple tasks.*

- ▶ Standing double stance swaying side to side. Huge bracing of lateral thigh and VL making ITB bow out.
- ▶ *Thoughts. Excess inappropriate high tone on low level activities. Need more strength proximally and retrain VL to decrease in tone.*
- ▶ Ankle assessment normal.
- ▶ *Thoughts. Ankle itself may be fine but its left a legacy of gluteal inhibition.*

## Impression

- ▶ PFP from lateralizing patella creating excess contact pressures between trochlea and lateral patella. Cause is insufficient strength proximally, driven initially by ankle injury and compensation by TFL that has got tight, and overactive bracing from VL.

## Plan

- ▶ Stretches x2 daily to TFL.
- ▶ Firing work for glut med in frontal plane to be progressed to alternate day endurance training.
- ▶ Rolling to lateral thigh, STM and practicing initially swaying weight without massive tensing of VL.
- ▶ Medialising tape to help in short term with discomfort.
- ▶ Swimming x3/ week crawl or back stroke for min 20 mins to help with weight, self esteem and sleep.
- ▶ Graduated increase in exercise as proximal strength improves, and ITB complex softer and lateralizing patella less.
- ▶ Long term restoration of dance with appropriate stretches and conditioning alongside.

## Now you have completed the webinar....

- You are bang up to date. Keep up to date with further advanced teaching, see:

Website: [www.clairepatella.com](http://www.clairepatella.com)

Don't forget my pick of the bunch-it's free!

Email: [clairerobertson@wimbledonclinics.co.uk](mailto:clairerobertson@wimbledonclinics.co.uk)

Twitter: [clairepatella](https://twitter.com/clairepatella)

Facebook: [Claire Patella](https://www.facebook.com/ClairePatella)

Linked In: [Claire Robertson](https://www.linkedin.com/in/ClaireRobertson)

– Thank you.

– Any feedback welcomed!!



If you would like the references from this talk please just email me.

Similarly if you have any questions after the event or you are stuck with a patient just drop me an email and I'll see if I can help!