Academy of PHYSICAL MEDICINE

Transcript

The Hamstring Insight With Matt Wallden

Cast List

Steven Bruce	SB
Matt Wallden	MW
Emma (Model)	E

SB: I have back with me in the studio for the sixth, seventh, eighth time, I can't remember now. We keep getting him back because he is so popular with our viewers. I've got Matt Wallden. Matt, summarizing quickly, he's been an osteopath for a very long time. He's very active in the osteopathic training world, the physical therapy training world, he is an associate editor of the Journal of Movement and Bodywork Therapy, and he's come in here to talk to us this evening about the hamstring. Matt, it's brilliant to have you back with us.

MW: Thank you.

SB: Thank you for coming in. Last time you were in, we talked about the TMJ and its connection to the hamstring, and now we're going to talk about the hamstring again. What's this obsession you've got with the hamstrings?

MW: Well, the hamstrings, I do have a bit of an obsession with, because I did my master's thesis on hamstring strain in professional footballers. So one of the things I was always so keen to do as an osteopath was to work in professional football. I did my thesis looking at lumbopelvic associations with recurrent hamstring strain in professional footballers. Then having done that, of course, I've kept an eye on the literature as I say since then, and run a few webinars

and presentations on the hamstring and published a paper on it. So, always had a kind of fascination around it.

SB: I mean, speaking as an osteopath, I can't recall when I've seen hamstring injuries in anyone who's not a sportsman. But you've got more experience with that than I have. Do you see it as not necessarily as a sporting injury?

MW: I think you're right, primarily it is a sporting injury. Of course hamstring strains tend to occur under significant loads, and that's because the hamstrings take a significant amount of load, especially when we're sprinting and when we're kicking as well.

SB: What about those stretching things that people do? Whether it's yoga or Pilates or general stretching?

MW: That is another injury mechanism for sure, and actually they often seem to be worse injuries. Ballet dancers often get hamstring injuries from overstretching, and those injuries tend to take longer to heal than a sprinter who, you see them pull up and they might have a Grade 2 tear, or something like that. It's a quite significant injury, but they seem to heal quicker than these overstretching type hamstring injuries.

SB: The two primary mechanisms of hamstring injuries, stretching and-

MW: Yeah.

SB: ... and actually the muscle contraction itself.

MW: To be honest, there's still a lot of confusion as to exactly what causes the injury, but it's known as an eccentric phase of the muscle loading. Some people say it's the end of the swing face, and in fact there's a paper which says, hamstring injury occurs in the last portion of the swing phase of gait.

SB: How do they know?

MW: Because they're using slow motion footage, and kinematic analysis and so on. Then within a year, there was a paper which came out, which was saying exactly the opposite, saying that hamstring strain occurs in the load phasing of gaits. And off course the reality is it can happen in numerous different scenarios.

SB: And a sportsman reporting back that he's had a hamstring injury, are unlikely to remember the precise millisecond at which that injury occurred.

MW: Exactly. Yeah. He just knows, on that sprint or that moment roughly. But yes, it's very difficult to delineate exactly. I guess part of the reason, or part of what inspired me to look at hamstring strain, was right around the time I was doing my master's thesis, was when Michael Owen was the star in the

England sides, and in the season that I was doing my master's thesis, he had I think seven or eight hamstring strains. And he was this young new superstar and had scored an amazing goal against Argentina in the world cup, and everyone was saying he's the hottest new property in world football, not just British Football. And then suddenly he's getting this terrible hamstring strains, and recurrent hamstring strains. And so, I became intrigued at that point, to look into it. And then there's a slide actually, which I'll show you if... do you mind?

SB: Mm-hmm. I want to. Which one do you want me to look at?

MW: The first one there. And so this slides is really just... the graph on the right hand side of the pie charts are showing, the Olympics from 1996. And what the top one is showing is that 55% of injuries went to the legs, and of course 45% to the rest of the body, trunk, arms, neck, et cetera.

But the bottom one is showing that 51% of injuries treated in the medical center, were to the hamstrings. So we essentially, when you're looking at it, so this is the lower limb. So we know that most injuries occur in the lower limb, 55% of injuries occur in the lower limb, and of those 51% of those to the hamstring. So essentially you've got a platform where you've got the broadest array of sports, and performance requirements that human beings can-

SB: We've got any more granularity about that? Because we've got three, possibly four muscles in the hamstrings, haven't we? Where I gather the fourth one isn't present in everybody but, that's a lot of muscle, and a lot of length. Is it always mid portion? Is it in the belly of the muscle? Is it at the insertion, the origin? Or do we not know?

MW: ... This is another interesting point, because when you look into the research into muscle strain, then what you find is it always happens at the musculotendinous junction. It never happens in the mid portion of the muscle, in theory. But in reality the tendon runs right through the entire length of the muscle. So you can have mid portion, higher or more proximal tears, but one of the most common areas to get a tear is in the distal portion between the short head of biceps and the long head of biceps. And interesting enough, they have a different embryological origin. The short head biceps actually has the same origin embryologically as the quadricep group. And so there's one school of thought, although I don't think it has ever been tested, that there could be a discogenic firing between the short head and the long heads. And that that's what creates the tear in that region.

SB: Are they innovative by the same nerve?

MW: Yeah, as far as I've been able to ascertain through the anatomy books, they are both innovated through the same nerve, but I'm not sure if that stacks

up. But it is interesting that essentially, because the legs grow out sideways, out of the body, embryologically the front of the leg is facing forward. So the hamstrings are facing forwards. And then the leg rolls round and pronates, and comes down to this and the hamstrings are at the front, end up turning round and becoming back muscles. But it's like the quadriceps, as they accelerate round to the front, they leave the biceps femoris short head behind. They kind of accelerate away from it.

SB: Okay.

MW: So that might be some of the reason why there's increased stress there, but I think there's more to it than that.

SB: Yeah.

MW: Yeah.

SB: You said, before we came on air, you said that there's a lot of physiotherapy interest in hamstrings. Do you see that, maybe osteopathy and chiropractic are less concerned with injuries like this, or is it just that all of the videos, all of the publicity, everything else talks about physiotherapy treating hamstring injuries? Is there a reason or a role for this, I suppose it's the number that-

MW: I think there's definitely a role for us, and that was really what I was looking at and my thesis was that what I found at the time, all the research that I could find, was talking about to rehabilitate the hamstring, you need to stretch the hamstring, you need to rub the hamstring, you need to strengthen the hamstring. And some people were saying whether it could be a quads, hamstring imbalance. So we need to perhaps increase the strength in the hamstring relative to the quads, because really they're saying that the quads are overpowering the hamstrings.

I found two papers that didn't just talk about the hamstring, and they essentially were chiropractic papers, and they were looking at the sacroiliac joint in the lumbar spine. And saying that perhaps something going on here could be driving a hamstring strain. And so from that perspective then yeah, absolutely, we have a role to play, and I think what I was particularly interested in with Michael Owen, was that he had had exactly the same sort of treatment approach, he was being managed by the physio team at Liverpool Football Club at the time, really working quite locally on the hamstring, and not looking outside the hamstring, looking at core function, looking at lumbopelvic function and so on. And I think that's where we've got a role is that holistic way of assessing the body.

SB: We gave this broadcast that title, didn't we? It was on evidence based and a more holistic approach than just looking at the hamstring. Martin, has just sent in a question about hamstrings, "Do you reckon there's a correlation between recurrent hamstring injuries and the SI joint dysfunction?

MW: Yeah, absolutely. That's, if you gave me one tool, to work with in the hamstring strain, it would be to look at the SIJs, that's for sure, that's where I'd start. Of course, then you want to know why the SIJs are behaving the way they are. But very typically what I find is a pattern a lot of my work has been done with footballers, but footballers just have the same patterns as everyone else, just slightly exaggerated, because they tend to reinforce their laterality pattern, or their footedness pattern. A right footed footballer typically will have a tight left sacroiliac joint, it will be very hypomobile, and relatively the right, or the kicking side is hypermobile, and normally they'll come in with symptoms on the hypermobile sides.

That's a little bit counterintuitive, because we might think or restriction is where we need to work, and that's where there's going to be perhaps the hamstring injuries on the restricted side. But it seems with the sacroiliac joints, and we'll look at some practical example of this later, that the hamstrings and in particular biceps femoris are involved in stabilizing sacroiliac joints. So if you've got a joint that's hypermobile, in this instance, a right footed football we just described, well then it's more likely they're going to get a right sided hamstring strain. Because-

SB: It just occurred to me when you were talking about Michael Owen, I was wondering whether what you had said about him, indicated that once you've had a hamstring strain, you're going to get lots more hamstring strains. Is it just one of those things that's going to happen, or was it just that he was not getting the right rehab or he wasn't doing the rehab... wasn't following through the rehab part of...

MW: ... Well Michael Owen has been a fascinating case because, he went on to develop a cruciate ligament injury, and I've got a slide on that which maybe we can come back to in a moment. But to answer your question, I think his recurrence of injury was, partly because the physio team were looking primarily at the hamstring itself, and not outside of it. And I'm aware also from speaking with the Football Association Medical Center, that Michael Owen eventually was referred actually to a Pilates instructor, and he gave Michael Owen a series of core conditioning type exercises which did help him to get through that space of hamstring strains.

SB: This is not the first time on this show, somebody has said that Pilates is really, really good for helping maintain rehab or for being the rehab in itself in some cases.

MW: Yeah, yeah, absolutely.

SB: The last speaker had said that they're doing osteopaths and chiropractors out of business, because they can be very effective.

MW: Yeah. Well the thing that Pilates does is it offers an active component to what we do passively, and that's not to undermine what we do passively, because it can be very important if you've got someone with a tight sacroiliac joint, then Pilates is going to struggle to really be effective at mobilizing the sacroiliac joint. Whereas an osteopath could be extremely, or chiropractic can be extremely effective very quickly. But if you've got compromised motor control, then Pilates is going to support that obviously quicker than a manipulation. But there is research that when you manipulate the sacroiliac joint, I've actually got a paper on this, which I may have to send you the details to afterwards because I can't recall the name of the author, but it is a 2014 paper, and it was looking at sacroiliac joint manipulation, and showing that it improves activation of the deep abdominal wall.

MW: So essentially manipulation can help core stability, which is a little counterintuitive in some ways, but it's something that some of the people that work at the top level in motor control, like Diane Lee for example, she said that since the early 2000s, that maybe when we manipulate, we actually improve function of these deep intrinsic muscles.

SB: We might be getting a bit ahead of ourselves with a question from Vlad who is asking about exercises, and we haven't already got onto the rehab stages as yet, but he's asked, "What's the effectiveness of single stiff-leg deadlifts for helping the hamstring stay longer or looser?"

MW: Okay. The effectiveness of single leg, stiff-legged deadlifts. I don't have a specific study, but I would say that that's a very good conditioning exercise. The beauty of a deadlift is that the leg is in a very similar position to the position it strikes the ground in, and especially with a stiff-legged deadlift.

For people that aren't familiar with that term, a straight-legged deadlift is as described, the leg is straight, the knee as extended, a stiff-legged deadlift is sometimes called a Romanian deadlift, and it's where you've got slight flex at the knee and slight flex at the hip. So normally about 20 degrees of flex at the knee. If you imagine doing that on one leg-

SB: Can we just got a bit further than that because people who aren't familiar with these wonderful bodybuilding terms, weight-lifting terms, actually a deadlift is a weight in the arms, and forward flexion of the hips, isn't it?

MW: Yes, exactly..

SB: With a straight back or neutral back?

MW: Yeah. In the CHEK system, we call it a bend pattern as opposed to a squat pattern.

SB: Now you're going to have to explain what the CHEK system is.

MW: Oh, sorry. Okay. Okay. The CHEK system is system that I've done a lot of training in, and I teach for, which is creative, holistic exercise, kinesiology. And so the very brief explanation of them, I see them as a kind of bridge between what we do as osteopaths and manual therapists, and what people are doing in the strength conditioning world. So it's really showing you how to integrate effectively the two worlds in a holistic manner. But so, the deadlift, yes, it's essentially a bend pattern from the hips. And so you don't typically bend your knees much, if at all, but a stiff-legged deadlift, you do bend the knee to about 20 degrees, and then everything else comes from the hip. The beauty of it is that the leg is in a position that's almost identical to the position that it's in when you strike the ground when you run. And so for conditioning, for runners, the deadlift is far superior to something like a squat or a lunge, because it's far more representative, and has greater carryover to the kind of loads that a runner would be putting their body through.

Depending who you're working with, and how they either injured their hamstring and/or how they want to prevent their hamstring from being injured, that would be a great exercise. So it'd be great for runners. Anyone that does a running sport and especially someone like a rugby player, or a basketballer, who might have to stoop, to pick up the ball whilst in motion, then that's a perfect conditioning exercise.

SB: Okay. What about stretching? You mentioned that earlier on. Is there a role for stretching either pre or post-exercise in maintaining hamstring health?

MW: Well, this is this a very controversial area because in fact even today, I saw something about scientists say... This was-

SB: The papers always say, I don't know, scientists-

MW: ... Well, this was this more of a news story. I'm sure they're probably referring to a paper, but they were saying scientists-

SB: ... No, sorry, I mentioned the newspapers.

MW: ... I see, I see. Yeah, yeah, yeah. It was saying that scientists are questioning whether there's any benefit to stretching. And I think in terms of the hamstrings, and really in terms of any muscle, there's a benefit to stretching a muscle, because you want more range of motion at a joint in terms... if we take gaits, for example, running gaits, then the further the range of motion you can move through at a speed, then the quicker you move. So if you've got a short strides, because you've got tight hamstrings and you can only move at say, move your leg at say 20 miles an hour, or how many degrees per second, then you're going to run slower than someone who can get a full strides.

SB: But equally isn't there a paper, and we're going back some years now, a paper that said most hamstring injuries occur in people who've either got

very tight, or very flexible hamstrings, and it's the ones in the middle, in the Goldilocks Zone in the middle that don't get the injuries. Now, I can't give you any-

MW: Sure. I don't know about that. I haven't seen that paper and I don't recall that paper. But what I can share, is that I was at the Football Association medical conference around 2005, and there was a guy there called Glen Hunter who's a physio, that was involved with the Football Association, and he had done a prospective study of all the premiership teams. And he'd gone around to all the teams preseason. And he had this clever contraption, which essentially measured the stiffness of the hamstring muscle. What he did was he put a degree of load through the hamstring, and waited for the resistance that was applied to measure on the screen.

Anyway, the interesting finding was is there was a prospective study, because he was looking at stiffness at the beginning of the season, and then asked the team physios to report back any hamstring strains that occurred during the season. What they found by the end of the season, when they collected all the data in, was the players with the stiffest hamstrings had the least hamstring strains. Which is counter to almost all sports injuries books up to that point, because everyone says, "Oh, you need to have the flexibility or you'll strain your muscle." Well, one of the fascinating things about that, is that what creates stiffness in a muscle, is the series of elastic components and the parallel elastic components, that run alongside the sarcomeres. If you think of a muscle fiber it's made up of all the sarcomeres and within the sarcomeres you've got the acting myocin interdigitation.

But between each of those sarcomeres, you've got a series of elastic component, and alongside the sarcomere you've got a parallel elastic component. Those elastic components behave like springs. So the more that you have of them, the harder it is to pull that structure apart. So, if you've got someone with a hypertrophied or a particularly strong dense muscle tissue, then they're far less likely to have those sarcomeres pulled apart, or the muscle fibers pulled apart. Equally, if you hypotrophy then you get bigger springs. so whichever way you slice it, if you train the hamstring, you're less likely to strain it, but it is going to get stiffer. It's an interesting conundrum because really you want range of motion to be able to... and I should also just clarify, stiffness isn't the same as range of motion, it's the resistance to motion. That's quite an important definition to understand. So it doesn't mean you haven't got flexibility if you've got high stiffness. You can still... And what they've shown, actually I saw a paper with rugby kickers. The guys that kick the field goals.

And what they found is that these guys, when you assessed them on the treatment table, they've got very poor hamstring range of motion. But when you watch them kick a football, and I think it was something like on the treatment table, it was like 70 degrees. So that's a bit shy of where it should

be, but even might have been less than that. But when you watch them kick, they get up to 110 degrees every time. So they kick, and then follow through, and their leg comes right up to 110 degrees. And that's an example of the kind of loads that the hamstring is undergoing, when you kick something like a rugby ball or a football. But it's enough load to actually stretch out those series of elastic components, towards the end of their range of motion. But the therapist's hand can't do that.

SB: Yeah, I do remember reading also, this is years ago, so I could be way out of date with this, that... how they assessed it, I've no idea. That the bulk of hamstring injuries occur in knee extension, rather than in the acceleration faze. So it's well the hamstring using eccentric contraction, trying to slow down the movement of the leg.

MW: Yes.

SB: Is that still thought to be the case?

MW: It is still thought to be the case. Really that seems to be the only way that you can traumatize a muscle, other than an impact injury is through the eccentric loading of it. And so one of the things that interested me and interested the Football Association, was that hamstring strain is the most prolific injury in professional football as well. And it costs these premiership teams huge amounts of money, because when you think how valuable each player is, if they're out for say six weeks, with a hamstring strain and there's a massive expenditure for the club.

So they were very interested to try and understand, why the players are getting this. And what you find with football of course, is that not only do you have a lot of sprinting, but you have a lot of twisting and turning, and the hamstrings are highly involved in that. Because one of the things that I don't think is discussed so much, certainly not in the anatomy books, but if you were to perhaps go to the functional movement class, or something like that, you might might hear it discussed. But if you think of the tibia like a horse's face, and the biceps femorals on the lateral sides, and the semimembranosis and tendinosis on the medial side, as the reins, where they control medial and lateral rotation of the tibia. So when you go to spin and turn-off of your tibia, it's the hamstrings that are controlling that fine motor control at the knee, which is what protects your meniscus.

SB: Yeah, and the movement is so small compared with the extension flexion of the backs. It's unlikely to have an effect.

MW: It's incredible, isn't it? But also where you've got to bear in mind is that the muscle system is broken down into different components. So you've got your slower twitch fibers, which tend to be condensed deeper in the muscles, and closer to the joints. And you've got your more phasic fast twitch fibers, which

are more away from the joints and more superficial. So the ones that are generating the power to power you forwards are elsewhere in the muscle. And the ones which are in close to the joint, which are actually controlling how the... let's say the femur and the tibia are interacting with the meniscus, those ones are highly intelligent, and actually have a very high spindle cell density. So essentially they're providing huge amounts of information back to the nervous system as well.

But yes. Trying to think if there was something else I was going to say about the FA. And football. Yes. With football, the thing is that of course these players are striking the football, which is quite an unnatural thing to do. If you think about how we evolved, we evolved to run for sure, but to kick things, as much as a professional footballer does, there's a huge speeds and huge amounts of eccentric control as well, because one of the things that I think... Again, I haven't really seen it written anywhere, but it struck me when I was doing my research is that, the quadriceps are the muscles that will extend the knee to strike the ball. And of course it's much more complex than that as well, but they're one of the prime movers of kicking.

But you can only kick something as hard as you can decelerate. In other words, you can only accelerate the shank of the leg, as quickly as you can decelerate it. Because if you accelerate quicker than you decelerate, you end up traumatizing the knee. You get essentially, you cruciate jammed down against each other, as you hyperextend the knee, and it really hurts. And I think most people that have played football, have experienced that, because you occasionally strike out what they call an air-shot, which is where you miss the ball completely because maybe it takes a wobble, or you just miss-time your kick. And you jerk down on the cruciate ligaments, and it's painful to the knee, and painful to the prides. But that's an example of you've accelerated the knee faster than you can decelerate it, because your brain was calculating for the inertia of the football.

When you miss the football, there's no inertia there to slow down the leg, and therefore you end up swinging right through and jamming down to the passive components of the joints. Point being, the hamstrings are involved in this eccentric control is slowing down and control of the acceleration of the shank, which you get a footballer doing shooting practice, or free kick practice or corner practice, they're doing hundreds of kicks at 1400 degrees per second. This is really fast movements that they're doing. And so that's creating this eccentric stress to the hamstring each time, and as we know, eccentrics damage or traumatize the cross bridges in the-

SB: And there's a pretty well established link between fatigue and general injury, but hamstring injury in particular, isn't there?

MW: ... Mm-hmm. Yep. Yeah.

SB: Do we need to talk about why that happens or should that be obvious? Brain unable to control those fine distinctions between extension or contraction and extension?

MW: Yeah, I think there's some degree of obviousness about it. Certainly the research I've seen the injury rate goes up... they break football match down to 15 minute blocks, and there are very low injury rate first 15, slightly higher second 15, higher again in the third 15, and they have their half-time break. And so then the injury rate drops off after the halftime break, and then it comes up higher, and it's at its highest in the last 15 minutes of the game. So fatigue is clearly an issue.

I think it's so, again, so multifactorial because it's... be things like clumsier challenges, it'll be, like the urgency, because they're heading towards the end of the game, and they might throw themselves in for a challenge because they've got to score a goal or make a tackle. I think there's a few different elements that contribute to that.

SB: It's probably a stupid idea, but particularly in this country at this time of year, with football or with rugby, we are also finding that actually the end of their leg is getting significantly heavier, as the match goes on because it's accumulating more mud and water.

MW: Yeah, yeah, yeah, that's true.

SB: Which, you know, you've got to accommodate that, haven't you? You've already sort of accommodated them.

MW: It is definitely, these are significance... obviously I've had the background with the barefoot running as well. And when you think of the leg, and the way it's structured in any animal, it's got its mass near the hip, and then some mass in the thigh, and then less mass in the shank, and even less mass in the foot. And that's by design, because when you're swinging something back and forth, you want as minimal mass far away from the axis of rotation, and as much mass as you can near the axis of rotation. And so, absolutely, when you start adding a load to the end of the foot, like you say, heavy boot or something and mud, then that's definitely going to impact on those.

SB: Somebody who hasn't given us his name was, "I'll ask about football, association football, not proper football." He says, "Can you give any hope to spur us fans, as to how Harry Kane will recover from his hamstring surgery?" A selfish question, but, "Can an elite sportsman get back to a 100% fitness after surgery?"

MW: Yeah, I believe they can. Obviously it depends on the severity of the injury, and on the rehab team and on so many different factors, how diligent he is with his own rehabilitation, There's so many different things that could-

SB: Which is, most of us won't be dealing with elite sportsmen, but we might be dealing with sportsmen who are quite good, or the recreational sportsmen. When you come in with this sort of injuries, what do you think that they would be absolutely determined to follow their rehab protocols, given that they all know hamstring injuries are a pain in the neck. What stops them? Is there just the overwhelming desire to get back to play, and they think because it doesn't hurt quite so much now that they want to start? And getting back to full time play?

MW: Yeah. I think most of them are very diligent. That's why they reach the heights that they reach, because they will put in the additional work behind the scenes. But sometimes people just won't make the changes that you recommend, and examples of that can be things like changing their diet, because you can see that... for example, one of the players I worked with when I was working at Chelsea, he had quite clear symptoms of gluten intolerance, and I'm not saying that he didn't follow the advice, because I actually don't know whether he did in the end, but his abdominal wall really wasn't doing what it ought to do. For an international footballer, you expect them to have a 100% lower abdominal strength, and a 100% activation of the transverse abdominals and so on, and he had neither of those. And...

So I explained to him how he was obviously getting symptoms of hay fever and house dust allergies and things like this, bloating when he ate gluten or drank beer. And I said, "Maybe you should try cutting out gluten-based foods because that could be affecting your abdominal wall strength here." I think, if I recall, he's at 60% or 70% lower abdominal wall strength. And like I say, for any athlete, that's not good, but for someone playing at that level... But his injury was a hamstring injury, but because the lower abdominal wall works synergistically with the hamstrings, if the lower abdominal wall's at 70%, well, this ties in with your question earlier, now the hamstrings have an additional role to make.

So they are one of our primary muscles that drive us forwards engaged. They control rotation at the knee, they control anterior and posterior tilt at the pelvis, they control retraction of the meniscus as we flex and extend the knee, they've just got so many different roles that they have to play. And so then, if you then take, let's say 30% off of the abdominal wall's function because of bloating and reaction to gluten, that's putting a lot of demand on the hamstrings, and sure enough, he ends up with a hamstring strain.

SB: Martin's asked... I think it's the same Martin. He's asked me a couple more questions. Actually, this is something which probably puzzles a lot of people in terms of the physics of it. If you stretch your hamstring, does that mean you're then reducing its power, its strength?

MW: Well, yes. Yes, you are, but probably not for too long. I don't know whether the question is the instant effects of stretching because there's a neurological inhibition of the muscle when you stretch it for a bit of time.

SB: No, I'm assuming it's because it's a longer term.

MW: You think it's a longer term?

SB: Yeah. You make the muscle longer, and once you've got over the micro tears that led to that or whatever, is it then less powerful muscles simply because you've lengthened it?

MW: It would definitely change the range at which it generates its most power because we know that, from a neutral position, you need to be at about 1.2 times neutral position to get optimal length-tension integration of the fibers, which is where you can generate the most power.

SB: I didn't follow that at all.

MW: Okay, so basically, the muscle has to be 1.6-

SB: That was a question in from someone else. It wasn't me. And I knew-

MW: 1.2 times it's resting length...

SB: Yes. Okay.

MW: ... to generate optimal power.

SB: Okay. Right. Yeah.

MW: So if his resting length becomes longer because you've stretched it, then it would just have to go a bit further to generate optimal power.

SB: All right. So then doesn't that mitigate against stretching muscles for athletes? And coming back to what you said earlier on, that athletes with tighter hamstrings, shorter hamstrings, are less likely to be injured? Or will they just be more effective athletes?

MW: It was stiffer hamstrings specifically-

SB: Oh, yeah.

MW: ... but what I would say with muscle tightness is that what we ideally want to achieve is optimal alignment. So it's been a little bit controversial at the moment, talking about posture and alignment, but when you study the neurophysiology of it-

SB: Why is that controversial?

MW: Well, because there's papers that suggest that posture has nothing to do with pain or injury. And there's plenty of papers that suggest that it does. But in the social media world at the moment, of course, the ones that attract the most attention are the ones that say your posture has nothing to do with pain, and so then people start talking about that. There's some people that just believe in it, and it fits with the narrative at the moment, which is really pushing people towards a greater awareness of the psychosocial factors that contribute to pain, which is important. It's been underplayed in our field for a long time. So I think there's definitely a benefit to that. But yes, I would definitely want to look at the pelvic position, I want to look at the lumbar curve. And based on those findings, if someone's got a very anterior tilt, you don't want them stretching their hamstrings because their hamstrings are already long, essentially.

If someone's got a very posterior tilt, and they've got a kind of swayed posture, like a Pink Panther posture, well then they've probably got tight hamstrings and it would be helpful to stretch them and to strengthen the quads. So that's how I would work with it. And you can measure that, so you can watch the progress.

SB: How do you measure it? You were just talking about the sheer strength that you can lift with the quads, as opposed to the strength you can lift with the hamstrings? No?

MW: No. In that instance, it's more about postural positioning, so it's more about pelvic tilt. So you can measure that with an inclinometer.

SB: I was worried about this, this balance between the quads and the hamstrings, and I think I read somewhere that there should be a 60, 40% sort of ratio in the strength of the two.

MW: Yeah. I think it's 1.4 times the quads.

SB: Is it?

MW: Yeah. So it's probably about that.

SB: Yeah. Okay. And that would simply be how much weight can you lift in a knee extension, as opposed to how much could you lift with a knee flexion?

MW: Hamstring curl. Yeah. And one of the problems with that research was that it was all done on isokinetic machines, which bear no relevance to-

SB: What you actually do.

MW: ... engaging the field of gravity.

SB: Yeah.

MW: They bear relevance for swimmers and rowers because when you're pushing against water, then it's an isokinetic environment. But when you are pushing against gravity, it's not isokinetic, so it has some degree of carryover, but obviously not a fantastic level of carryover to someone running. Yeah.

SB: Another one from Martin, actually, and this was something I actually was going to bring up myself, or a slightly similar question. He's talking about hamstring stretching and power. Does static hamstring-stretching reduce its power? And working in rugby, he says it's not encouraged before a match, anymore.

MW: Yeah. There's been some hiccups over the years, where people have gone heavily into their stretching before a match or before a sprint or something like that, and they just have a terrible performance. And that's partly because you're inhibiting... It's quite well-documented now, that you inhibit the neural drives to a tissue when you stretch. Now if you've got a facilitated tissue, if your hamstrings are facilitated and you've got a posterior pelvic tilt, then it may not be a bad thing to stretch them a little bit before you train, possibly before you compete. But you wouldn't want to do that on everyone. You want that to be quite specific to the individual, and you want to know whether or not those muscles seem to be facilitated. So there are ways to test for that.

SB: It was about 10 years ago that I was working with a rugby club, and I'd looked into stretching for hamstrings at the time because I wasn't really happy with this whole idea of doing static stretching of any sort. And I ended up trying to get them to do some ballistic stretches, which of course means flexing the hip and then extending the knee and doing that in a sort of a second. And that was supposed to be more beneficial, but I do wonder, actually, whether it's actually just more of a warm-up exercise for the muscles, rather than a stretch for the hamstrings.

MW: Yeah. Well this is one of the issues with static stretches, is that what it does is it sedates the nervous system, but also, the cerebellum is constantly registering the length-tension relationships in the muscles. And when you're static and sedating the nervous system, then it doesn't really re-register the new length-tension relationship. But when you're dynamic, like with the ballistic stretch, or if you use a balance device like a Swiss ball or Bosu or one of these things that requires more balance to actually stay from falling over, then what that does is it switches on the cerebellum more effectively. Also contract and relax techniques because you're contracting the muscles' cerebellum stretch, "Where are you're going? A what's going on here?"

And then you stretch and the cerebellum's taking account of the new length-tension relationship, so then you're far less likely to get injured. So we

generally, again, in the CHEK system, we would generally recommend a contract and relax type stretching, if you're going to use any stretching at all before competition for the brain to know the new positions of the muscles, effectively.

SB: And I've now got some long stuff coming in.

MW: All right.

SB: Paddy Doherty says... This is an observation, not a question. Contralateral SI problems and hamstring problems make sense. I always thought the SI joins first, and many hamstring problems resolve. Nice to have you confirm what he's experienced. Personally, he stretched hams in kung fu for three and a half years with no effect, but once he had deep tissue on his glutes and lumbars, the hams were no longer a problem. And at the time, ballistic stretches seemed more effective than static, and he can still kick at head height, much like rugby kickers, as he says.

MW: Yeah. Yeah.

SB: So that's nice from Paddy.

MW: Yeah.

SB: Okay.

MW: Don't pick a fight with him.

SB: Sorry? No. Should we get into something practical? Do you want to do some of those stretches?

MW: Yeah, that would be good. Yeah.

SB: So let's move across and meet Emma, shall we?

MW: Excellent. Yes, let's do that. Hi, Emma.

E: Hello.

MW: Hi.

SB: Emma, good evening.

MW: Nice to meet you.

SB: Now, Matt, I don't know what you want to do here. We're going to treat Emma as though she's come to you with a hamstring injury-

MW: Yes.

SB: ... and then go through an assessment process and then maybe some ideas for rehabbing or-

MW: Yeah, we could do that. Yeah, let's start with the active straight leg raise test. So that's with you on your back. So this is a nice test because it tells you a little bit about the length-tension of the muscles, of the hamstrings in particular, but also what we're interested in here is the effort that's required for you to lift your legs up. So there's a bit of watching the range of motion, and you could even measure it with a goniometer if you want to, and then also getting feedback from the patient or the client and saying, "How does that feel to you?" So for some people with hamstring strain, of course, as they pick their leg up with an active straight-leg raise, they'll be nervous about it and they'll feel a pull in their hamstrings.

Now, before we do this, could we see your tummy? Because this gives us a little bit of information as well. So if you can see the umbilicus, and what that allows is for you to understand a bit more about how the sling systems through the trunk are working. So you've got this anterior oblique sling system from the right shoulder, the left hip, and the same from the left shoulder to the right hip. So Emma, if you could just pick up your left leg straight up into the air there, and we can watch the umbilicus, and then just pop that back down again and just pay attention to how that feels for you. And then the right leg. And then back down. And we'll just alternate a few times, so left leg. Good. And then right leg. Good. Okay.

SB: Alternating because?

MW: I'm guessing you don't have a hamstring strain at the moment? Okay, good. Good. But if you did then possibly, imagine it's your right hamstring, you might get up to 30 or 40 degrees, and we see this one's not getting so high. You might give us feedback to say that's getting painful or tight or feels uncomfortable, so then we've got a bit of information. We've got 40 degrees here, 80 degrees there, but what I was looking at there was the umbilicus to see if it stays central. And what we saw with Emma is that when she picks up her right leg, the umbilicus deviates slightly to the right, and when she picks up her left leg, it stays fairly central. So what that's telling us is that the sling on this side, from the left shoulder to the right hip, is slightly inhibited or decreased.

So in other words, you're getting the movement there because as the leg lifts up, it's creating a pull on your abdominal wall and it's shifting it. That side is not shifting it. So if I was thinking about corrective exercises for you, or rehabilitation style exercises, I'd be thinking about this sling here and how can I activate that sling. So it could be something like... We could do a lot of abdominal exercise, where we alternate the legs. So if you just bend up the

knees like that. And quite frequently, I would use a blood pressure cuff or some other biofeedback device, but if a patient hasn't got that or doesn't want it to buy one, then you can use the hand. So you can pop your hand under your low back so that the knuckles are in the mid line, yeah?

E: Yeah.

MW: So that's the kind of thickness. That creates, essentially, a neutral spine, so Shirley Sahrmann's work suggests that that's the right depth, anthropometrically, for your lumbar curve. But what we want to do here is get you just to compress down against your hand with the back, so it's like you're trying to squash your own hand with your back.

E: Okay.

MW: And then just maintain the same pressure there, but pick this leg up off the treatment table. Yeah, like that till it's vertical. Perfect. And then back down, and try and maintain that exact same pressure so it's not fluxing there. Okay. Then try it with the left leg. Okay. And back down. And did you feel it was easier or were they similar?

E: They were similar.

MW: Similar? Yeah. Okay. That's good. That's good.

SB: And if we had a blood pressure cuff, you'd be looking at the, the gauge?

MW: We'd be looking at the control and see if there's any flux on that needle. But what we could do with you, because we've identified that this side is slightly more de-conditioned, we could give you a right-right-left exercise format. So I might say... Okay, pick up the right leg, and then back down. So you can do that. And then back down, and again on the right leg, and back down, and then the left leg. Okay. And then we'll go back to the right leg, and right leg twice.

E: Yeah.

SB: And all the time, trying to keep the pressure constant-

MW: Exactly. Exactly.

SB: ... lower half will engage.

E: The thing is, I put my leg down, it's harder. It's just there, it's harder to-

MW: To control it.

E: Yeah.

MW: Yeah. Yeah. Okay.

E: So it's a length thing, I guess, of that chain.

MW: Exactly. Yeah. Yeah, it is. It's sort of an eccentric control as you're lowering it down. Yeah. So that's just one little element of this test, so it's got multiple facets, this test. So that's using the umbilicus as a bit of feedback. If you want to put your legs back straight and you can relax your hand, what we can also look at here is, did you find that quite easy to lift your legs up? Or was there any resistance or any sort of heaviness in the legs, that kind of thing?

E: Yes. Yeah.

MW: It felt quite easy for you? So again, a lot of people that are symptomatic, they may get hamstring pain, they may get lower back pain, they may feel that one leg feels heavier than the other. And so if that's the case, then what you can do is you can go in and, essentially, do the job that the transversus abdominis should be doing, and that's to put a little bit of pressure... You find the ASIS and you just push across just with a few pounds of pressure, they say about three to four pounds of pressure, so it's not a lot of pressure. So we're going to push across like that, and then I'd like you just to lift up your left leg again, and back down, and then the right leg, and back down. And did that make it easier or harder?

E: Yeah, it was easier.

MW: Yeah?

E: Yeah.

MW: Yeah. Okay. So you're always looking for the subjective feedback, but you can also look slightly more objectively at how far they're moving the leg. So that essentially suggests to me that if we gave you some transversus abdominis exercises that that might also help with your range of motion there, because what we haven't really discussed so far is that one of the elements of hamstring tension and hamstring tone is that it will increase when there's lumbar pelvic instability, or let's say motor control that's suboptimal around the pelvis.

So Barbara Hungerford wrote a paper in 2004 where she showed that when people have pain in the sacroiliac joints, they get a relative inhibition of the lower abdominal wall, so from the ASIS downwards, this portion here, and she could show that with EMG. But what she found is that the hamstrings increased their tone as well, because essentially they're trying to do the same role of stabilizing the sacroiliac joint via that sacrotuberous ligament. So then, if I can then do the job that the transversus should be doing, now your hamstrings don't have to work nearly as hard, so now it's much easier for you to lift the leg up. Does that make sense?

SB: Yeah, absolutely.

MW: Yeah.

SB: And what exercises would you be giving to them?

MW: So a very sort of basic one for the transversus abdominis is a four point, and anything that's in four point is good for the transversus abdominis. And so, is it okay to do that on the table, do you think?

SB: If you're happy to do that on the table?

E: Yeah.

MW: Yeah. So you'd just get into a crawling position, basically.

SB: Just keep an eye on the camera shot, that's all.

MW: Yeah. So that's that four-point position. And just by being in this position, the viscera are falling forwards towards the floor, and so then the transversus is trying to hold them back. And because the transversus is the deepest layer of the abdominal wall, it's getting what's called interoceptive stimulation. So the viscera are touching it and, essentially, encouraging it to switch on. So just being in that position is actually quite a good exercise for the transversus abdominis. But what we can do is, we can add load to this, or add complexity by lifting opposite arm and leg. So again, for Emma, what we found was it was the left shoulder to right hip sling was slightly down.

So what we wanted you to do is if you pick up your right hand and your left knee, just enough to slide a piece of paper underneath. Okay. Then that anterior oblique sling from the right shoulder to the left hip is having to stabilize, and can you feel that working there?

E: Yeah, I can. Yeah.

MW: Yeah? And that's probably going to be slightly harder to go on that side than to go... Try the other side and see how that feels.

E: Yeah, it's definitely harder the other side.

MW: Yeah. And that would generally be what you'd expect, is that the one that's shown up as being slightly weaker is-

SB: But is there a progression for that as well, as she gets better at lifting her papers width them, would you start doing those-

MW: Absolutely, yeah.

SB: ... flying dogs or whatever they're called.

MW: Yes, exactly. So then you can do a full... We call it horizontal. So you're taking the arms up to horizontal, and leg up to horizontal. You can-

SB: When we talked about these before, in the other studio, I think you were using your clever-

MW: The neutralizer. Yeah.

SB: ... to try to make sure there was no movement of the spine at the time, wouldn't you?

MW: That's right, yeah.

SB: So how is your patient who's not an osteopath? And Emma is an osteopath, so she's created all these connections, how do you brief your patient to try and keep this bit stable?

MW: Well, I normally would either give them a neutralizer or dowel rods when I'm showing them the exercise. So dowel rods are quite good actually because the thing with the neutralizer is it's strapped to your back so it doesn't fall off, and that has its advantages, but it also has disadvantages. So the advantage of a dowel rod is it's circular. So you put it on the back, and if they have any slight rotation through their trunk, it just rolls off, so it's actually a really useful tool to train people to keep completely neutral as they're lifting their arms and legs. And also because it's longer than than the body, if you're under a spotlight, you can actually see the shadow here in the shadow between your legs, and you can keep it straight and not let it deviate off.

SB: Very useful. Yeah.

MW: Yeah.

SB: A nice cheap tool as well.

MW: Very cheap. They're very good.

SB: And tell me, when you mentioned the neutralizer, we won't get into detail because it was on, I think... Was it the program we did on core stability where you first demonstrated it?

MW: Yeah. Did we do one on a neutral spine? I can't remember. Yeah.

SB: Yeah. We certainly did one on a neutral spine, but it's there for people to look at if they want to at it.

MW: Yes. Yes.

MW: Yeah, absolutely.

SB: ... and how it works. Okay. So we have exercises for the...

MW: Yeah. So that was for the transversus. Do you want to lay back down on your back? So there's a little bit more to do with this active straight-leg raise as well. So another thing that we can do is, we can reinforce the multifidus and what the multifidus would normally do in stabilizing that lumbar pelvic region. So for that, you want to reach around the back here and you want to be at, just roughly, the ASIS level, and you've got to reach around to the back towards the midline. So your fingers aren't right on the midline, but they're just, just either side of the midline. You're going to push upwards with the fingers, and then just draw outwards slightly.

So, essentially, you're doing up and out, kind of there, up and out like that. So we're here, up and out, and then if you just try picking up the left leg and see how that feels, and then the right leg, see how that feels.

E: I'm sorry.

MW: You have to jump out the way. Right. No, that's right. And then try it without. See if there's any difference without. Sometimes there is, sometimes there isn't, but it helps with the diagnosis.

E: It's actually a bit harder without.

MW: Do they? Yeah. Yeah. And sometimes people will be worse with the reinforcement, so it doesn't always work that it makes them better. You could do this, and if they've got an inflamed pubic symphysis, it might make it harder for them to lift the legs up because there's now a pain input.

SB: And then again, obviously I'm going to come back to what you're going to do about it if that last test is positive, so you'll find that's a multifidus problem, so-

MW: Yeah. Well actually, the previous exercise that we did, that four-point kneeling, as you lift up and just create a small amount of rotation through the lumbar spine, that's where the multifidus will switch on. And it tends to co-contract with the transversus abdominis anyway, so being in that position, it's what we call a big bang exercise. It covers lots of different bases. It does the slings, it does the transversus, it does the multifidus. You can't get much more specific, so you can do an isolated multifidus exercise, but the objective is always to go from isolation up to integration, and so that four-point one is somewhat integrated. It's what an infant does when they crawl. That's how they get their system ready for bipedal gait.

SB: Mm-hmm.

MW: So on that note, when I used to do a workshop with the CHEK guys, actually at the BSO, and we used to do this once every few months, and I said to them, "You can bring in clients if you've got clients that are struggling with injuries." And one of the guys was working with one of the England basketballers, and this guy was getting recurrent hamstring injuries. He knew I was interested in hamstring strains and so he brought this guy in, and so you're there standing in front of this whole group of people trying to work out what's going on with this guy. And I thought, "Well, I'll try this active straight-leg raise test, and so did exactly what we just did, did the transversus abdominis, didn't make any difference to him. But what he found was that when he's getting to about 40 degrees, something like that, he could feel the strain in his hamstring.

He was like, "I can't go any further. That feels like it's going to tear it." So I thought, "Fine. Okay." So then I did the reinforcement of the multifidus, and he nearly kicked me in the head, and he just looked at me as if to say, "What just happened? You just got rid of my pain. It's like you've unstrained my hamstring." And I said, "Well, that's not a hamstring strain. Essentially, the hamstring is over-contracting to try to stabilize the pelvis because your multifidus isn't doing what it should do. So the moment I do what your multifidus should do, now your hamstring can relax and you can lift it right the way up." So that was an amazing example of someone who had an inverted commas hamstring strain, but actually it wasn't at all. It was a multifidus issue.

SB: Because his sensation of strain and stretch is in the hamstring itself.

MW: It is, yeah. And it's because it's overworking there. So that was that one. Then we've got, for this lot, the same test, we've got another assessment we can do, and that is that we can essentially facilitate that anterior oblique sling by asking you to push your shoulder up towards the ceiling against my hand, and then pick up your left leg like that and back down. And then let's relax and try again. Any difference there between the two?

E: A little bit. Maybe a little bit.

MW: Can we try again?

E: Yeah.

MW: Just push up against me. I’m not sure you pushed up against me.

E: Oh, sorry.

MW: Push up. That's it. Yeah, that's it. And then back down. And then without. Any difference?

E: It's easier if you-

MW: A little bit easier with the... Yeah? Okay?

E: Yeah. I felt a little bit of resistance, so I could-

MW: Was it this?

E: Yeah.

MW: Right, right.

E: Yeah. Yeah.

MW: Yeah? I think, for most people, that's going to be a little easier, but we're looking for a discernible difference there. And so then we can try this side as well. If you just push up with that shoulder towards the ceiling and then pick up the right leg, and back down. And then try without and see if there's any difference there.

E: I definitely find it easier pushing up.

MW: Yeah. Okay. And again, that would be tying in with that sling that we thought was perhaps needed more conditioning, as it were.

E: Yeah.

MW: Yeah. So those are some ways of working with the slings of the system and the stabilization around the pelvis that can either masquerade or can generally be part of a hamstring strain scenario.

SB: Well this is actually quite useful, I think, because it's quite hard to diagnose a hamstring strain accurately, isn't it?

MW: Mm-hmm. Yes. Yeah.

SB: Because you are having to rule out all these other things. And I remember, again, people used to talk about true hamstring strains, and I think they called them neural or neurogenic hamstring strains, whether it's coming from the cord or the spine or the nerve roots. But now, of course, you're adding in a load of other factors which you can test for.

MW: Yes. Yeah, absolutely. Obviously you can get adverse neural tension, as well, which would be more sort of a neurogenic.

SB: And this, if you have a hamstring problem, this is really nice because you have a very nice diagnostic thing here which you can see yourself, can't you?

MW: Yeah.

SB: It's not some orthopedic test which only we can determine.

MW: No, that's right.

SB: You can feel the difference.

MW: Yeah, and that's exciting because, obviously then, it motivates the client to do the exercises, and they felt the benefit, so that's good. Now I also had a couple of treatment techniques. Have we got time for those?

SB: Oh, yeah. Yeah.

MW: Yeah? We do that?

SB: We would definitely want to see those.

MW: Excellent. Okay. So I'll come around this side because... In fact, before I do that, we hadn't looked at some slides yet that I've got, which would explain this in more detail, but-

SB: Do you want me to do that now? Then we can come back and do this.

MW: Okay. Maybe we'll do that because then we can-

SB: You stay there for a second and-

MW: Yeah. You have a rest.

E: Okay. I'll have a lie down.

MW: We'll be back.

SB: We should rehearse this, shouldn't we?

MW: It's seamless.

SB: So where are we going now? What...

MW: So I'd like to find the slide. Let's see. Let's see if I can get through to it now. Well this slide here is at least just showing the sling systems fairly basically, of course. But you've got this anterior oblique sling, which we were just working on the guy, on the right side there. And you've got the posterior oblique sling-

SB: This looks, to me, more like adductors than hamstring.

MW: Well, absolutely. Yeah. So it's the adductors, the internal oblique on the same side, and you've got the external oblique and actually the pec minor and major, on the opposite side, form the sling.

SB: Yup.

MW: But in terms of how the body moves during gait especially, but also other movement patterns as well.

SB: Mm-hmm.

MW: And it's a means of storing energy and recalling from that stored energy. On the other side, what you've got is the posterior oblique sling, and that's going from the left glute, in this instance, to the right lat. And what Vleeming showed was that the glute and the lat are on the same layer of the thoracolumbar fascia. I'm trying to remember what it is. I think it's the superficial lamina of the posterior layer of the thoracolumbar fascia.

SB: Okay. So we're talking, now, about glutes here-

MW: Yeah.

SB: ... moving up to the lats there.

MW: Yeah, exactly.

SB: And at the same level, you're saying, in the fascia?

MW: So they're in the same... And so what he did was, he took hold of the glutes on the cadaver and pulled on them to see much excursion it would create in the opposite lat, and vice versa. And he could show that there was a direct transfer of force. So we're going to look at how you can apply that in treatment, in a moment. But the other slide I wanted to show you, or a couple of slides, this one is actually Barbara Hungerford's work, and what she's showing here is that-

SB: I guess, again. As always, just to reassure people, you're not going to be able to read the detail of this on whatever screen you're using in all probability. But it is part of a slide pack which will be available for download afterwards, so just bear with Matt while he explains what's going on here.

MW: Let's see if we can get it to work. Yeah. So this here, this is the biceps femoris, and what it's showing... So the guys in black are the controls, and the guys in the stripes are the sacroiliac joint pain group. And what you're seeing is essentially... In under normal circumstances, you're getting some activation of Obliquus internus and multifidus. We can get that right?

SB: Yup.

MW: There. But when you've got sacroiliac joint pain, what you end up with is a whole bunch of biceps femoris activation or pre-activation. So essentially, when you're in pain, your multifidus and deep intrinsic muscles of the abdominal wall shut down and your hamstrings are up-regulated. So that's quite important. That ties in with what we were just talking about.

SB: They only looked at biceps femoris there. Is that-

MW: Yeah.

SB: ... because that just happened to be convenient? Or is that the only way of getting up-regulated?

MW: There's a bit of history behind it, I think, and some of it has to do with the fact that biceps femoris consistently attaches into the sacrotuberous ligament, and in fact, in some cases, doesn't even attach into the ischial tuberosity. So really, the sacrotuberous ligament is the tendon of the biceps femoris, but there's a bit more to it. When you look into it, you do find that semitendinosus also goes into sacrotuberous ligament as well. But for a long time, there was a lot of excitement about biceps femoris for various reasons. Then when we look at the abdominal wall, we can see, in this left hand diagram, that in green, you've got the internal oblique fibers coming up. The red line is the midline, so it's the linea alba. And in blue, you've got the external oblique fibers.

SB: Yup.

MW: And this is it kind of schematically on the other side here. And so, essentially, what it's showing, because this, of course, is scanning a micrograph, I believe, or at least a photograph of the abdominal wall, but it's showing the warp and weft of the fibers and how they integrate with each other from side to side, so the forces can cross the midline there. And what you would see, and we're about to see this on another image, is that if you've got someone with, let's say, a right sided hamstring-

SB: You'll need to use the pointer, if-

MW: Do I just do...

SB: Just press that top button. Yeah.

MW: Yeah, I'm not. Oh.

SB: We can highlight. We're looking at-

MW: Is that you? Is that you?

SB: That's me, yes.

MW: Okay. I'll stop there, let you do it.

SB: We're looking at this bit on here.

MW: If you imagine it's the right hamstring, so that person's facing us. Imagine it's the right hamstring that's injured. The hamstring goes into the sacrotuberous ligament on that right side. That goes up towards the midline and it actually inserts into... the sacrotuberous ligament inserts into the thoracolumbar fascia on the same level as the internal oblique. Let me just... I'll show you the next slide, because this might show it better. The next slide, what you see here is this is in pink down the bottom there, you see the sacrotuberous ligament. Okay?

SB: Yep, so I'm going to bring that one up. We've got sacrotuberous ligament up here.

MW: That's the sacrotuberous ligament, so this is going to be coming from the right hamstring. They're facing away from us. It's coming from the right hamstring. It's going towards the midline. And what Vleeming said in his research was that it goes up and into the opposite multifidus, which is the black arrow you see just above the pink arrow there. And this is a very interesting little test you can do. You can actually get people to stand up. Should we do this quickly?

SB: Yeah.

MW: Yeah. Stand up and you palpate your multifidus. Essentially you find the spinous process, slip off either side of the spinous process. I don't know which way I should face here, but like that maybe?

SB: Yeah.

MW: You're beside the spinous process, then you're going to put one foot forwards, which might be tricky for you, and you rock forwards onto the leg that's in front. You should feel the multifidus on the forward leg switching on. And there will be a little bit of activation on leg you're stepping from, but primarily the activation is going to be on the leg you're stepping onto.

SB: I get it the other way around.

MW: Then you can switch sides, try switching sides and see what happens. Go onto the leg that's in front, and you should feel that multifidus switching on as you load that front leg. Okay, so you've got the right way around that time, but the wrong way around the first time, which might mean that the multifidus on which side was it? Left side is a bit facilitated on you. Then we can go in and palpate for tender points or trigger points or look in the history for why that may be, et cetera. It's quite a useful diagnostic, but this is really the kind of anatomy of what's going on in there.

MW: You're loading that front leg, the biceps femoris is taking load. It's pulling on that sacrotuberous ligament. That's creating force into the opposite multifidus and that multifidus is switching on. That's, essentially, as far as Vleeming got with his discussion. But what he also shows in this diagram, but doesn't comment on at all, is that on that same layer, so this is the deep lamina of the posterior layer of the thoracolumbar fascia-

SB: Trips off the tongue, that.

MW: Yeah, and the internal oblique also is attached to that layer. That's in green on top left of the screen.

SB: Oh, got it the wrong way. Go back again. We're actually going from the pink arrow up there, all the way-

MW: Pink arrow, the line of force is going straight up towards the internal oblique, and actually on the same direction as the internal oblique. Then we know that the internal oblique swings around to the front. It crosses the midline, it goes into the opposite external oblique and external intercostals, which interdigitate with the pec major and up into the arm. On the next slides, which you can flip to for me, here, someone's striking a football. What this is supposed to be depicting, although the arrows look slightly out, it's supposed to be depicting the biceps femoris down the bottom, on the dotted line, coming up through the sacrotuberous ligament on their side.

SB: We're starting up there-

MW: That's biceps femoris, sort of seen through the body, up through the sacrotuberous ligament, into the thoracolumbar fascia, there across and into the internal oblique on the opposite side. It wraps around the front of the body.

SB: This bit here is going around the front of the body-

MW: Around the front of the body, into the external oblique, up into the pec major and into that arm. And what you see in that right arm is that is even ulnar deviated. Fascially, the whole system is stretched right the way around in a loop, and that's allowing him to decelerate his kick so that he can strike that ball with incredible power. It's a whole kind of spiral of connection that allows him to decelerate. Earlier, we were saying you can only accelerate as fast as you can decelerate. Really, deceleration is your rate limiting factor in how hard you can kick a football.

SB: Right. Now, before we go back to look at Emma again and do some of the exercises you were talking about, can I deal with some of these questions?

MW: Yes. Let's go for it.

SB: Right. Oops, what are we doing? We've got David, he's asked about hamstring curls. He'd like to ask your thoughts on hamstring curls, prone and/or sitting in a gym environment. He's not a fan, himself.

MW: Yeah, I'm not really a fan for a number of reasons. Everything has its place. One of the things that Paul Chek says is that there's no such thing as a bad exercise, just a badly prescribed exercise. I think that's an example, is that you can certainly use hamstring curls to target the hamstrings. They're good for bodybuilders, if you want to get hypertrophy, they create isolation in the muscle, but in terms of functionality, they're not hugely functional for sports, for example.

SB: And someone who's remained anonymous has just asked us to go back a little bit to when you talked about gluten intolerance and how does that affect muscle function? Is it just the mechanical effects of bloating?

MW: Yeah, it's not just the mechanical effects, but I would say that's probably the primary thing. Gluten irritates the gut lining. The gut lining is sensitive, and so the beta afferent nerves from the gut create inhibition of the tonic motor neurons at the cord level, and the tonic motor neurons, you find more in your deep abdominal wall and your deep musculature, as opposed to the phasic motor neurons. Essentially, the deep muscles that are involved in stabilization tend to be inhibited by this row of somatic reflexes, so you get bloating as a result of gluten intolerance. Or it could be anything you're intolerant to, or that creates irritation in the gut, will create bloating. Bloating is inhibition of the abdominal wall, primarily.

There's research on this in irritable bowel syndrome and it shows that 82% of the bloating that people get with irritable bowel syndrome is not due to gas. 18% is due to gas, the other 82% is due to something else. They don't say what it is and this research, but the only other thing it could be is inhibition of the abdominal wall. What else can make your abdominal wall drop out? It's the musculature switching off. And so it makes sense, because if you've got inflammation and irritation in your gut, the last thing you want to do is compress it. You want to let it go. And so this bloating seems to be related to inhibition from the inflammation.

SB: Okay, foam rolling. Another anonymous question, what are your thoughts about foam rolling, particularly with respect, as it says here, to the hammies?

MW: To the hammies? I think it's great. Done appropriately, again, if it's relevant for the individual, then it's useful.

SB: What's appropriate? When is it inappropriate? What's bad foam rolling?

MW: Well bad foam rolling would be on someone who doesn't need to stretch the hamstrings, because essentially someone who's got a typical lower cross syndrome, where the hamstrings are longer, so they're there longer than

they should be, which creates this anterior pelvic tilt, then it's not really a great idea to stretch those people's hamstrings, because they're already functionally longer than you want.

SB: In terms of rehabbing a strained hamstring, are they good for just improving circulation, getting better blood flow to the-

MW: Yeah. This is another thing. The sorts of forces that you can get from foam rolling are extremely high and could be injurious. There are people, I've seen people that have bruised themselves through foam rolling before, because the pressure is very strong. And so a lot of it's through mentality, in the kind of CrossFit, no pain, no gain, pain is weakness leaving the body kind of mentality-

SB: All that male macho bullshit?

MW: Yeah, exactly. Then foam rolling can be a problem. But if you're using it sensibly and sort of with the right profile of person in the right way, then I think it's a great tool.

SB: Liz has asked what exercise you would recommend for someone with hamstring tightness if they have a sway back?

MW: If you've got a sway back, I would use a number of number of different exercises. Prone jackknife... I would use some Swiss ball-type exercises. A prone jackknife on a Swiss ball is one which you could use, because that activates the hip flexors. Essentially you're in a press up position with your feet on the ball, and you draw the knees in under you and then you bring them back out to straight. Essentially you're activating your hip flexors to do that. Obviously the quads have to be involved in as well, as you do that. You can also do, what's often called, a bridge on a Swiss ball. But the clever thing with this is you've got to get the tempo right. I won't say it's clever. It's clever if you get the tempo right.

What you want to do is... a bridge, you've got your back on the ball and your head's rested and your trunk's out straight and then your shank, if you want, or your lower leg is straight down. Then what you're going to do is you're going to drop your pelvis down and lift back up again. First of all, you want those legs, so the lower leg should stay vertical. If the lower leg starts shifting back and forth, that's an indication that you're recruiting the quads.

SB: And the ball is under your shoulder blades?

MW: Ball's under the shoulder blades, yeah. You're recruiting the quads too much and creating what's called quad dominance, which we haven't talked about yet actually, but it's tied in with hamstring injury. If they lower their pelvis down and lift back up again, of course they're working the glutes and the hamstrings primarily, because that's what's lifting against gravity, but what

we can do is we can train them to be stronger in a lengthened position. One of the things with muscle conditioning is you want to think about, am I training the muscle to be strong in a lengthened position or in its outer range, or in a shortened position in its inner range?

And so with that supine hip extension or bridge, as I was calling it, you'd want to train the glutes to be strong in the outer range. You would create a tempo, which means that as the person drops down, they'd perhaps be doing three or four seconds going down, three or four seconds coming up. They're working the glutes in the outer range, and at the top, they wouldn't hold it for any duration at all. They just go straight back into the repetition. That's for someone with a swayed posture.

But if you've got some with a lower cross posture, which is the opposite posture, you can do exactly the same exercise, but you'd do it, perhaps, one second down, one second up, and then six seconds at the top. You're working the glutes now in the inner range as opposed to in the outer range. There's some quite neat tricks you can use-

SB: You might have to try and find a diagram for all this to put up on the recording page afterwards, might we? Because I've got your Swiss ball to demonstrate on, as if we'd known this question was coming in. Somebody who's unnamed says, "What's foam rolling?"

MW: Oh, okay.

SB: They're not really foam, are they? They're bloody hard, those things.

MW: Some of them are foam, but some of them are sort of polyurethane or something. I don't know. Generally speaking, they can be up to 90 centimeters long. They're normally somewhere around six inches thick and you put them on the floor and you can roll your body along them. You can roll your calf. It's like having a massage, but a deep massage. One thing I would say is that I see a lot of people in gyms rolling in either direction, up and down the leg, and of course knowing bit about massage and lymphatics and venous flow, you don't really want to be rolling down the leg. You want to roll up the leg. You want to go with the lymphatic-

SB: Is there evidence to show that that really is an important consideration? Or is that just our instinct that says that we should-

MW: I don't know, actually, evidence on it, but I do know that the pressures that those things exert are significant and could theoretically damage the valves in the veins or the lymphatics.

SB: That makes logical sense. We've not got long left and we need to get back to Emma, don't we?

MW: Let's do it, let's do it. Okay.

SB: Have we said enough from the slide so we can now go on?

MW: How long have we got?

SB: 15 minutes.

MW: 15 minutes? Can I just show you the quad dominance slide? Because I think that one's quite important. Let me just see. I'll get to the slides. This one's quite important, because this ties back into the Michael Owens story. What you can see on this image is-

SB: This is from the school of South Park Anatomy and Physiology.

MW: This is my PowerPoint skills at their best, 10 years ago, 15 years ago. You've got the the biceps femoris, long head and short head illustrated there. And what's nice about this image is that it's showing the knee in a fairly functional position. You see a lot of footballers getting into this position. Runners, perhaps not quite as flexed as this, but the point is is that the biceps femoris there, you can see how it is acting as a dynamic agonist to the anterior cruciate ligament, which is in green. When you get trauma to the hamstrings, particularly the lateral group, and this is one of the things I wanted to convey, is that the lateral group gets injured somewhere between two times as much as the medial group, and as much-

SB: Lateral, meaning biceps femoris?

MW: Biceps femoris, yeah, yeah, yeah, and as much as 10 times as much. It's significantly more injured than the medial group. And so this is one of these questions, why is that? And that's been sort of a part of my whole thought process with the hamstring discussion. But one of the things that I find bizarre, is that when people get anterior cruciate ligament injuries, they'll often harvest the biceps femoris to try and fix the cruciate. And yet, it's the only thing in the body that can actually act as an agonist to the anterior cruciate. It's a kind of bizarre thing, in a way, but then you can see over the top you've got the quadriceps, and so the quadriceps, of course, loop down and over the patella. The patella gives the quadriceps more leverage, as we know, and when the quadriceps pull, of course they create anterior shear on the tibia, which is resisted by the cruciate ligament and the hamstrings, as well.

But if you've got what's called a quad dominant pattern, which a lot of footballers have, for various reasons, but one of the reasons is that if you stay on your toes a lot, it tends to facilitate the quads. We know this through weightlifting. If you lift with your weight on your forefoot, your quads activate more. If you lift with your weight on your heel, your glutes activate more. The more you're on your toes, you get more of a quad dominant

pattern. Footballers are constantly being told, "Stay on your toes," and that's how we move, as footballers.

You find a lot of footballers with quad dominant patterns and then, of course, that creates shear on that anterior cruciate ligament with every step that they take. Then you get someone like Michael Owen, who gets repetitive injuries to his hamstrings, and that could be due to quad dominance as well. The quad's being too strong. And then ultimately what happens towards the end of his career is he ends up with a cruciate ligament injury, from something that was actually a very innocuous situation. He wasn't challenged by anyone. He literally received the ball on low speed, went to accelerate a little bit and kind of fell over. That was him rupturing his cruciate ligament, and that's almost certainly because across a long period of time, he's had quad dominance, which has been creating shear on that anterior cruciate ligament, which has decreased the tensile strength of that ligament and then it ruptures, just like that.

SB: There's probably an element too, isn't it? It's a lot easier to train in the gym. It's easier to train your quads than it is your hamstrings. It's not fun training your hamstrings, because actually quads, you can see them bulging and it makes you feel good.

MW: You can see them bulging, that's true.

SB: Come on, let's go and make Emma do something.

MW: Okay, excellent.

SB: All right, you had a nice rest, Emma?

E: Yes, thank you.

SB: Treatment options?

MW: Yeah, there's a couple of things there. Thinking about the sling system that we were just talking about, the one that I kind of made up, we came up with, it's not an official sling system, one way we can treat that is to get you to reach across... Now actually, if you turn onto your side so you're facing towards me, one way we can activate this is if you reached behind your body there and just hold onto the treatment table at the back, now I can bring your leg up like this and I can get behind the knee here, so we're getting a stretch onto the hamstrings. We could just get you to a point where you start to feel a stretch, and particularly if this is the side of the pelvis that's tight, we could go in and we could mobilize the pelvis as well, if we want to, over the standard sacroiliac joint, posterior mobilization.

But let's just say we're just working more muscularly, initially. I can work until I feel the resistance, and I can ask you just to gently push back with your leg

against me here. Okay? And then relax and then we can move up here. Then I could ask you to pull with your arm against the treatment table. I'm pulling you in this direction, you're trying to pull back. And then relax, and then we'll just go a little further. We're engaging this sling from this shoulder right the way around the trunk and right the way around and into the hamstring here. Then we can do the two together, so you can push back here and pull there at the same time. That's it. And then you take a breath in and out and then we go into the stretch further. That's one way we can actually switch that sling on and stretch it if we feel that needs to be done.

SB: You've got a sort of strict protocol about how many seconds you're getting resistance before you go back into stretching?

MW: I don't have a particularly strict protocol. I generally use about five seconds. The research that I've seen suggests that you can get very little difference if you hold it for longer, but it's statistically not worth holding for more than five seconds, so I normally do that. But what we can also do is... that's more sort of the full sling that wraps right the way around the trunk, which I call the deep posterior anterior sling, because it's going from posterior right the way around to the front.

But for the posterior oblique sling, which is the one from the glute to the opposite lats, what we can do is we can bring the leg up into a fairly standard posterior mobilization of the sacroiliac joint. You can hold onto the treatment table there, so you can pull it, and what I can do is I can get over here and start to mobilize and find the point where we're getting the tissue binding. Let's say about here, and then I can ask you to push back with your knee initially, as if you're trying to push me away. And then you take a breath in and out and as you breathe out, you relax there and I just move up into the mobilization. And I can mobilize a little bit more in that new position. Then we can do the same again, but this time pull with your arm. Pull there, pull, pull, pull, that's it, and then breath in and out. As you breathe out, I will just move further up that way.

Of course, it's the left lat coming in through the thracolumbar fascia into the right glute here, and then we can do the two together. You're using left arm pull and push with your knee and breath in and then out. And then go with the flow there. And again, you can mobilize in that new position. That's just sort of bringing a little bit of the muscular anatomy into the mobilization, which I think is quite interesting as a concept, because for me to try and grab your pelvis and pull your pelvis with my hands from the outside is one thing, but for you to actually use the muscles that attach into the pelvis to mobilize it, is a whole different sort of level of specificity, I suppose. I think that's quite an interesting-

SB: Does that feel effective to you, Emma?

E: Yes. Yeah. I'm just curious if one end of the chain is tighter, I suppose you are dealing with someone who is theoretically injured, but if that end... How do you work on the area, elongate that area that's tight, or shorten, shall we say, stiffer? And it not come from the other end of the chain?

MW: Yeah. And I think this always depends on your clinical findings. If you have identified that there's a tight lat, which is quite an easy test to do, just ask someone to lift their arms up in front of them and to try and take their hands back towards the wall. What you'll find is that... I've got a tight shirt on so I can't go very far, but you'll find that one arm will start to go like that, and that's normally an indication that the lat's run out of room and it's pulling the arm into medial rotation. That's a quick test you can do for the lats to see if the lats are tight.

Obviously you can look at shoulder height, as well, so a low shoulder is often indicative of a tight lat on that side. And then, obviously hamstrings, we can assess as we did earlier, with the active straight leg raise or with a more standard passive straight leg raise to see the range of motion there. There's a number of different tests for the hamstrings.

SB: Enough?

MW: Yeah, I think-

SB: Well, we've got lots more questions, but a couple that we will address before we finish. Emma, if you'd like to come and join us, you'd be more than welcome. There must be a collective term for three osteopaths together, mustn't there?

MW: A gaggle.

SB: Jason says, is there any benefits of the time resting between contractions?

MW: Is there any benefit-

SB: In the time between the contractions?

MW: I don't honestly know. All that I remember seeing at a couple of ICORE conferences was, there was a fair bit of research... I'm trying to think of the osteopath's name, chap from Australia who was very into his MET research, and essentially found that really five seconds on, five seconds off was, from an efficiency perspective, the best combination. You could do other ones and you might get slight benefits, but from a time management perspective, there was no great, statistically significant benefit.

SB: I've already had one question that says they want a demonstration of dead lifts. But you're going to really like this one, because they've asked, is there a preferred method for performing Nordic eccentrics? Which means you're

going to have to describe what Nordic eccentrics are, Nordic curls are, aren't you? Because they're all the rage for hamstrings, it seems.

MW: They are, they are. Essentially, you're kneeling up in a high kneel. You've got your feet either held by a partner or wedged under something heavy, and then you're essentially falling forwards towards the floor in a controlled fall-

SB: Body straight?

MW: Body straight, and so essentially you're extending the knee, using your body as the load that you're resisting-

SB: It sounds potentially quite stressful.

MW: It's hugely stressful to the hamstrings, but if you can do it, then it's good conditioning. I wouldn't say it's... It's not super functional in terms of, it's not really how you use the body, but it is a very good way to get high eccentric loads into the hamstrings, and has a proven track record. As a treatment tool, I think it can be very useful, especially if you're dealing with a well conditioned athlete.

SB: In terms of the preferred method for doing Nordic curls, now that we've described them, what other methods are there? You fix your feet-

MW: I'm not an expert on Nordic curls specifically, because I've never really thought that they're a fantastic exercise from a functional perspective. I haven't used them a lot. I've used them a few times for fun.

SB: Any methods I've seen, other than varying what it is that's holding your feet steady, are the body goes down in a fixed position and alternatively, you use your hands to slow it down. I think you can also do assisted ones with TheraBands behind you, as well.

MW: Yeah, there'll be a number of... Again, with any exercise, you can adapt it to make it more stressful or less stressful. You could have your arms up above your head, it's going to make it more stressful. You can have them at your head, it's going to be less stressful than above your head. You have your hands here, it's going to be less load, because you're just changing the leverage. You have your hands down near your legs, even less leverage. You can flex the hips. It's going to be slightly less leverage. There's all kinds of different things you can do.

SB: You were nodding then, Emma. Do you use them? Do you prescribe them for people?

E: No.

MW: They're quite brutal-

SB: Good for practicing your DOMS, I gather?

MW: Yeah, yeah, absolutely. They're really kind of putting a lot of eccentric load through the hamstrings, and therefore, stimulating both hypertrophy, but also perhaps an awareness of how to control eccentric loading through the hamstring.

SB: Robin has asked about whether you think that the posterior sling would explain the frequent presentation of TLJ low thoracic pain on the opposite side to SIG and/or hamstring injuries?

MW: Yeah, I think so. I think so. It makes sense that it would do. It's also just reflective of the movement patterns that the human body takes. When the right leg goes forward, the left arm goes forward, so quite naturally you're going to get that TLJ. It's going to be the area where a lot of that movement occurs.

SB: Gilly wants to know what influence the feet have on hamstrings? Speaking to the man who is, even now, in his bare feet shoes.

MW: That's it, that's it. How long have we got?

SB: We've got a couple of minutes.

MW: Okay. Well, one of the things that I think is really interesting about the the feet is that when you're running, of course you toe off. Same in walking gait as well, but you toe off. The toe off is what helps to keep you moving forwards in a straight line, let's say. If you've got pain in the big toe, or hallux valgus, or for some reason you can't generate power through the big toe, then what it's going to mean is you're not going to be able to push from the right leg across to the left leg efficiently. It's that momentum going across the left leg that allows the hamstrings to essentially keep the knee tracking effectively. If you're not getting good push off of your right leg due to foot pain, or in particular first MTP pain, then what's going to happen is you're going to push yourself forward somewhat gingerly. If you think of the midline, your body's going to be slightly more to the right of the midline than you want it.

As you land, what's going to happen is you're going to be going essentially into a pronation pattern on this left leg, because your central mass is too far this way. And so then what prevents you from rolling in this way is your biceps femoris. This is, perhaps, a nice way to finish up, because part of the reason I think biceps femoris is overloaded and strained far more frequently than the medial group is that it's resisting the pattern that gravity is trying to take us into, which is pronation.

Gravity is trying to take us into pronation of the foot, medial rotation of the hip, anterior pelvic tilt at the pelvis. We have musculatures set up to

counteract that. When we are either de conditioned or we have something like bloating, irritable bowel or whatever or a foot injury, then we can't effectively counteract gravity, and therefore the biceps femoris smarts ends up trying to do a role that, really, other muscles should be doing, like the lower abs, like the glutes, et cetera. And so then I think that's why we get a much higher instance of of biceps femoris injury compared to medial-

SB: Finished beautifully on time. Thank you.

MW: Good. Excellent.

SB: There's one question. It says TMJ and hamstrings, is there any evidence for TMJ dysfunction and hamstring injuries? You'll have to look up Matt's previous broadcast. He answered that question. We spent a whole evening talking about that. Matt, that's been brilliant. I've always loved this holistic concept that we have, but it's quite nice when somebody puts the mechanics into sort of simple terms, the way you've done this evening. I'm sure you found that helpful. I found that very useful and I hope the audience has as well. It's brilliant to have you back on the show. Thank you-

MW: Thank for having me.