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Managing and monitoring hip and groin injuries



By Enda King



Why do athletes get hip and groin pain?

I suppose it's a beautiful storm of I wouldn't even say excessive load, but load recovery and biomechanics or movement. And so you, generally speaking, athletic hip and groin pain is gradual onset, and you do get acute and chronic episodes. But generally speaking, it's a gradual onset. It could be quite chronic in nature and last for prolonged periods of time.

The symptoms commonly begin with transitions in load, so it'll be interesting to see how much hip and groin pain there is after this COVID break, you know, but it comes in sort of at the start of seasons in prolonged, heavy schedules, in athletes who have been injured and coming back from injury in the beginning of seasons or at least if in season, or maybe younger athletes that

are stepping up, very, very common to step up into senior squads and to change their intensity and frequency. So load may not necessarily be the problem, but it exposes the problem, and it certainly brings it to light. That can also be insufficient recovery and that load is a good thing, it's how we get fitter, it's how we get stronger, it's how our tissues adapt.

But if we have insufficient periods of recovery in-between, that can lead to disintegeneration. Pubic bone overload would be a good example. It's very, very normal to have pubic bone oedema, that's been shown in numerous studies that healthy, pain-free athletes have pubic bone oedemas as part of their normal turnover of bone, but it's when that imbalance between load and recovery reaches a certain threshold that starts to become symptomatic. Thirdly, then, is the biomechanics, how we move. So there's the amount of load I have to absorb or dissipate, and there's the way that my body tolerates that in terms of the positions I put myself in and how I preferentially load one or multiple structures more repetitively or consistently that elsewhere in the kinetic chain. Let's say, for any other obvious injury, where that's Achilles, tendinopathy, or paratendinopathy, and so when you're looking at why athletes develop these symptoms, it's very common that that triangle of load, recovery, and mechanics, and if we're to be effective at preventing and rehabilitating these presentations, we need good understanding of all three to have the most successful and efficient outcome.

> **“ Athletic hip/groin pain often stems from load management and biomechanics, especially during season starts or post-injury periods. ”**
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Given how complex hip and groin injuries are, is diagnosis, therefore, an issue?

It's interesting, because by and large, hip and groin issues are seen as being complex. The complexity probably comes from two areas. Number one is where the hell is the pain coming from, and the difficulty in trying to identify specific structure. Then, secondly, is well, why have they developed symptoms and what are the various components to lead with that. From a diagnosis point of view, it's a challenge because, especially in the more chronic presentations, very often there's multiple structures that are painful concurrently. They'll start off by saying, “Look, I have pain in my pubic bone, now it's spread and under more my adductor longus and has come up into my abdominals.” And so what name do you put on the structure if you have

pain in three different areas, is that really just bad luck and you have three different diagnoses, or is it just my anterior pelvis is overloaded and just different tissues are becoming symptomatic the more longer I progress. The second one is that our clinical or our pain provocation tests are sensitive but not very specific.

For example, if we look at the squeeze test, and this was research from a paper from my colleague, Eanna Falvey, when we published on accord of consecutive athletic groin pain patients in the British Journal of Sports Medicine. So when you do a squeeze test at 45 or zero, it's quite sensitive for adductor-related groin pain or for injury to be the pubic aponeurosis, but it's not very specific. So if I squeeze my knees together and I have pain, I have no idea where that pain is coming from. But if I squeeze my knees together and I don't have pain, well, I'm pretty sure I don't have any adductor pathology, I don't have any injury to aponeurosis. And again, it can be how we skew our assessment in that we assume if we squeeze our knees together, that ultimately in a squeeze test that's ultimately the adductors that are primarily loaded. But actually more or less every structure around the anterior pelvis, whether it's your abdominals, your hip flexors, your pubic bone, and the adductor group are all loaded in that activity. So it's very difficult to differentiate. And then our radiology throws up a lot of false positives.

A huge number of athletic populations will have asymptomatic labral tears, will have asymptomatic cam lesions, will have asymptomatic pubic bone oedema, and micro tearing or signsin the adductors. And so if you use any one piece of information, whether that's palpation or pain provocation or radiology, it's very often that you get sent down the wrong path. Then, secondly, is what are you go and do with it. And I suppose diagnosis you give it doesn't really matter unless or what name you put on, unless your treatment changes dramatically depending on what name you put on it. And that's probably the biggest challenge, is where someone calls it adductor problem, someone calls it an abdominal problem, someone calls it another problem. So one does strengthening, and one does rest, and one does surgery for the same athlete.

We had a guy come over from the U.K. a couple of weeks ago, and he was told he had three main problems, he had weakness in the posterior abdominal wall, he had pubic bone oedema, osteo publis as it's called sometimes and had adductor-related groin pain. And he was told he needed a strengthening programme for the adductors, he needed an injection for his pubic bone, and he needed an operation for his posterior wall, even though he had one graduate onset of symptoms and more or less a point of view the exact same symptoms since onset. I think diagnosis is important because it's important to say is this for rehab or is it not for rehab. So, if you have a stress fracture of the neck of the femur, it's not that doesn't need rehab, but it wouldn't be the first port of call here. If you have some rheumatological condition, that's something that's going to need medical interpretation and management, whether x-rays forms part of that overall global strategy, it may do afterwards. But if, say, you have abdominal-related groin pain or pubic-related groin pain, or adductor-related groin pain, that doesn't tell me anything about what I need to do rehab-wise. And so if you have four athletes with adductor-related groin pain, does that mean that they all move the same way and they've all developed symptoms for the same reason that the strengths and weaknesses, or have they a common structure that's ended up symptomatic but for different reasons?

And therefore, if I pull my adductor programme out of my back pocket, that might be what one athlete needs, it might be a bit of what another athlete needs, and it might be what another athlete needs at all. And they're the guys and girls that they failed rehab, but did they fail rehab or did rehab fail them? It's trying to identify, A, where is the pain coming from, as in is it for rehab or is it not for rehab? And then, secondly, once I've decided you're for rehab, well, then I kind of need to start from scratch again and go back and say, "Right, why have you developed your symptoms around that triangle of load, recovery, and biomechanics, and then obviously we can load manage you and begin to navigate that side of things." But then how can I break you down biomechanically to identify where your weaknesses are in the chain, and then how I can bring you back into the type of activities that have provoked your symptoms.

> **"Diagnosing hip and groin issues in athletes is tricky due to multiple pain sources and non-specific clinical tests. Even radiology can lead to false positives, complicating diagnosis"**
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How do you decipher which part of the triangle is the issue?

I suppose when you're coming in the beginning, you're trying to say, look, we want three things from today's interaction. Number one is we want to be happy. We know where your pain is coming from. Number two is we want to know why you're developing symptoms there. And number three is what the hell we're going to do about it. It's almost like we split it into two, as in where is the pain coming from? Right. Okay, you're for rehab, that's fine. So let's bucket all that off to one side. Now, how can we develop a profile of you to identify why you've developed the symptoms the way you have. And that'll be, again, we're fortunate enough in Dublin to have two 3D biomechanics labs, so we will do full biomechanic, will work up on jumping, landing, and change direction, and running mechanics. We'll do strength and power measures, we'll do measures of plyometric and reactive strength. And then we'll do assessment of more of control around the hip and pelvis and thorax through compound movements like squats and lunges and deadlifts and various hip assessments.

By the end of that profile, you can say, well, look, here's where your strengths and here's where your weaknesses are. We're fairly happy if we bring you from A to B, and we gradually increase your load, again, in parallel, that should get us into the areas that we want to go. Because commonly in assessment of hip and groin pain, assessment tends to be on single muscles and

single planes. So how strong are my hip flexors? How strong are my adductors? How strong is my lateral hip or my hip extension or my abdominals? But those individual muscle groups are incredible important, but also then how I begin to express or the type of force I can express with speed, whether it's plyometrically or explosively, and then how I execute what coordination about mechanics I have running and change direction is going to further influence those things. And so if I look at someone's change of direction mechanics, you might infer where they have strengths and weaknesses, but you have no idea why they're choosing the strategy they're choosing. It may be because they have insufficient quad strength, or they have insufficient lateral hip strength, or they have a poor ability to produce force eccentrically at high speeds, or they might be quite good at all those things and that's just a mode of strategy that they have for change of direction because of an old ankle sprain or an old ACL or maybe the position that they play on the field. And so how can I be, if they're telling me, look at this, when I go to sidestep or push off, that's where I develop my groin pain. If I don't examine them doing those movements, how can I identify whether that's an efficient strategy or inefficiency strategy, B, where the gaps in the chain are that are leading to that, and then, C, does my rehab programme make any difference?

One of the beauties about having a biomechanics lab is you get to test your work very, very frequently. And there's nothing more humbling than having a retest and seeing that some of those issues you identified initially may not have accelerated or changed as quickly as you wanted. That's a fantastic challenge for your exercise selection, for your coaching, for your programming and your periodization, because you're getting feedback all the time. And just because, I know, that worked for one athlete, does that mean it's going to work for another athlete? And I can do all the coaching drills in the world but if I'm down in reactor strength or down in my eccentric greater force development or my quad strength, there's going to be a ceiling to how much I can change mechanics within a given coaching session. But conversely, I might have all the strength in the world, but unless I'm constraining those drills to try and get an adaptation or a change in your motor pattern, you're just going to go back to what you were doing before as well. And so it's a challenge to keep … it's not that everyone needs all of these things, but if you don't assess all these things at the beginning, how do you work out what each athlete individually needs?

> **“ Athletes may struggle with rehab if all contributing factors aren't identified. Success depends on tailored exercises and addressing each athlete's unique needs ”**
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What are the biggest reasons that an athlete may not succeed with rehab?

I think two of the major challenges from a rehab point of view are trying to identify all the contributors from a strength point of view, from a coordination point of view, from a running and change direction mechanics point of view. And if I don't identify them all at the start, how do I know, six weeks later when the training load comes back up again, that they're just not going back to do what they were doing beforehand? The second thing and more humbling is that I have identified the factors but my exercise selection or the way I'm coaching those exercises or programming them over time is not affecting change. And so the analogy I use is, I play a little bit of golf very badly, not too much at the minute, but if I go on the driving range and I hit 50 golf balls, I'm never any better at golf because I hit them exactly like I hit them yesterday and exactly like I hit them last week.

Hitting a golf ball is a motor skill in the same way running a change of direction is a motor skill. And so doing the same thing repeatedly doesn't necessarily mean I'm going to be any more skilful at that given activity, in the same way like strength training and going to the gym regularly, you know, not only that I'm not training intensely enough but the way I'm executing those exercise are not targeting the specific muscle groups that you want. Only to realise that when you go to retest that actually there wasn't a huge change in the metrics from pre to post. The main reasons athletes fail rehab is because all the contributors to the problem have not been identified, and because my programme has not taken it from A to B as efficiently as possible, and so either because it's easier to measure or whatever, it's easier to quantify, load gets the majority of blame in all injuries. It was a load problem or GPS, adductor GPS and done. It's load is exposing the problem rather than causing the problem, and so if we want to improve their mechanical efficiency, A, it should have athletic performance benefits, but also, B, if the training load goes down, their symptoms might reduce, but if I haven't changed the way they transfer this load and the training all comes back up again where symptoms just reappear.

It's interesting, the biggest risk factor for any injuries, particularly groin injuries is previous injury. And is that because of reduced tolerance of that specific tissue that was injured previously or painful previously, or is it because I haven't really changed or adapted the reason that that structure became overloaded in the first place? And you'll see this high core prevalence of those with their morphological changes at the hip, in particular cam lesion, and the presence of muscular tendonis groin pain at the front of the hip and the pelvis, and so many of the mechanics around how I control my pelvis especially anterior pelvic tilt, how I control my centre of mass, around my stance leg, and how I lean and sway and go into abduction, that's going to lead to particular motor loading patterns across the hip joint and increased impingement dynamically over time. And it's going to lead to a lot of extra stress and strain through the abdominals, the adductors, and the hip flexors as well.

You see that this common path mechanical model of loading the anterior hip or groin, and if I don't step in there and intervene, especially in older athletes or maybe those athletes with larger cam lesions, they're ruined forever. You see lots of people with anterior tilt or poor running or change of direction mechanics, they never get groin pain. But is that that they won't in the future or that the load just hasn't been high enough to expose their individual deficits? And so, again, that's where, again, if you put all your eggs in one basket and say it's all load or it's all mechanics, you're less likely to have a successful outcome. I think that ability to approach it from both spheres. But unfortunately, it tends to be very much a load management sphere, that I develop groin pain, I train a bit less. Play matches, I develop more groin pain, a little bit less, until the point where I can't play at all. And then I rest for six weeks or four months, as recommended in some places, and then I go back training and the symptoms just reappear. And is that a new injury or is that just the same injury that just lay dormant until the load was sufficient to reproduce the symptoms again?

> **"In sports rehab, skill improvement isn't just repetition. It requires specific training targeting the right muscle groups and movements, much like perfecting a golf swing"**
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What is the criteria for surgery and why would you go down that route as opposed to rehab?

Again, it comes back to the challenge with surgery in athletic groin pain is the number of different procedures available. You could have an individual athlete who will be advised that they need to release tension in the area, so they'll release inguinal ligament or they'll release the adductor longus and maybe to the same athlete who said they need to reinforce the area. So they need a repair, posterior wall, or they need a mesh repair, or they need some kind of reconstruction of the anterior pubic aponeurosis. And so it's quite challenging for clinicians and for players when they're told there's multiple different answers, quite different answers to the same set of symptoms. And then you also get this high prevalence of those who have signs for surgery but completely asymptomatic. You see it's very, very consistently those are told post your inguinal wall weakness is that the other side is just a matter of time before you develop symptoms there. And so when you look at specific things that need repair, I mean a direct inguinal hernia needs to be repaired. That's a large protrusion of your intestinal content through

the posterior wall in the inguinal canal, but that's incredibly rare in athletic population, much more prevalent in older male populations.

The other part that's a challenge with those populations is that the majority present completely asymptomatic. They come to see you because they think they've developed a cancerous lump or their third testicle has dropped or something. They don't actually come because they're presenting with symptoms. And so you have this large, large protrusion coming through the inguinal canal, and they're completely asymptomatic. And yet subtle weaknesses on ultrasound or whatever else are suggested to be a source of chronic pain in these athletic populations. In terms of who's your goal for surgery, again, we would send very, very few for surgery. We don't think that there's repair needed because we don't think that there's a specific pathology to be fixed. But my point around surgery should be if it needs surgery, it needs surgery. It doesn't need surgery because it's failed rehab. If it's failed rehab, is that because there's something structurally wrong that should have been repaired in the first place, or is it because I haven't identified what needed to be fixed and now talking about, you know? Sometimes you get athletes who have quite difficult groin pain coming to us, and I'm not saying it's certainly better if they had surgery, but it takes it off the table straight away and immediately you have their buy-in, that, "Well, okay, I went and had that done and it didn't help." So, they buy in now to, "Okay, well, I can see my mechanics, I can see what I need to do, let's go and tick these boxes."

My rationale to them is if you go from A to B and you still have symptoms, well, then there's something to discuss. But if you look like this in six weeks' time and you're wondering why your symptoms are the same, if it was true back then, why is it not still true now? The second part with that thing would be around femoroacetabular impingement and hip arthroscopy. And I suppose in the last five to ten years there's been a real prolific increase in the amount of athletes going for hip arthroscopy. And that's probably been tempered greatly in the last two to three years, in particular, whereby there's some really robust research showing that asymptomatic labral tears are present in about 75% to 80% of the athletic population and that the presence of cam lesions is quite common in asymptomatic athletes. And so it's whatever about having a soft tissue repair, whether it's needed or whether it's not, for athletic groin pain, when you go into someone's joint, any joint, you're fundamentally changing that joint going forward. And it's only when you go to look at different parts of the body, so you look at the knee joint, you look at the history of knee arthroscopy, it kind of starts with I'm going to take all the meniscus out, and then I'm going to take a little bit out, and then I'm going to trying to repair it, and then actually it's even if there's a tear there, I'm going to try.

If you look at a natural history of how management of those things has evolved, so it's interesting over time that, again, these pendulums tend to swing aggressively one way and then aggressively back the other. And it's, again, trying to get them in a good position before they start to develop chondral wear. Because once they started to develop chondral wear, that's obviously the beginning of a different journey for that joint. And that's all it could be, again, a combination of anatomy, load, and mechanics. And again, what drives hip impingement anatomically is going to be influenced greatly by your pelvic position when you're running and your pelvic position when you change direction. You can make huge improvements when you're squatting as

well and deadlifting. I think we can be incredibly proactive. But there are some who, especially in muscular tendinous groin pain, there are some who benefit and feel better after surgery, whether that it was another reinforcement to the area to alter, whether the area became symptomatic or not, some surgeries do a nerve resection, so maybe that offered some symptom relief. Ironically, a lot of professional teams that you would chat to would say that it's not necessarily that they feel that the athlete needs surgery, but often, surgery offers a defined period of rehabilitation. The coach and the player and et cetera will give you six, eight, ten-week window, then, to really go back and put things back better that you found them.

It's a real challenge as to who should go and who shouldn't go. In our practice, practically no one is ever sent for surgery. And if it is, if an organisation or a medical team felt someone's for surgery, it shouldn't be because rehab has failed. Because if you have addressed all the mechanical features that you felt needed to bring them from a symptomatic place to an asymptomatic place and they still have symptoms, well, then you might have a point for discussion. Or you go back and say, well, actually have identified everything that needed to be addressed in the first place. That's quite a challenging case, but it's interesting, again, we're 10 years we're a groin programme in the Sports Surgery Clinic, and when you get that volume, you begin to see the trends in management over time. And one of the interesting things was in a recent trip to Australia was how when I was going through the various procedures that are available, how the sort of geographical bias, because certain diagnoses don't exist because those procedures don't exist in certain parts of the world. It's interesting. But, again, I think it's over time, it's evolving that this is an issue around load, it's an issue around movement, and when you look at pathology in the area, there's a huge amount of asymptomatic pathology that's completely normal in these athletes, and if you can expand your assessment criteria, you're far more likely to identify. And you can see this in, I was listening to some of your recent podcasts on running injuries, and if you look at biomechanics and ACL, for example, everywhere else in the body there's a huge appreciation of how movement influences especially the development of chronic presentations. I think groin pain is very strongly shifting in that direction.

Could you take us through the assessment that you would go through with an individual?

We would start off with a full biomechanical profile. That would be drop jumps and countermovement jumps, looking at their power plyometric output, but also the mechanics at which they execute those movements. So everything is being filmed in this situation.

this goes for your change of direction, speed, or time, or your running speed. You could be running at X speed, but you could be producing that force very differently across a number of athletes. It's always that combination between the numbers you're producing and the way that

you're producing those numbers. We would do our drop jump, our countermovement jump testing, we would do running mechanics, high speed running on a treadmill, looking at frontal plane mechanics in particular in mid stance, so pelvic drop, trunk sway, hip abduction, forward control, looking at control of rotation in particular arm swing, trunk swing, and swing leg mechanics. We would look at, in the sagittal plane, their ankle Dorsiflexion the ground contact, their pelvic position at mid stance and at toe off, and their over-stride. And again, it's not that any one of these things is causing the problem, but they're all contributing to where load is exacted and transferred and dissipated. And then we do planned and unplanned change of direction, again looking at their foot position. So those that tend to have issues around lateral hip control, et cetera, tend to change direction on more externally rotated foot, which is going to influence how they load their head-neck junction at the femur. They tend to lose control of their centre of mass over the stance leg either by rotating ipsilaterally, either causing impingement around the hip joint or anterior pelvis, or increased sway loading through the abdominals and through the adductors. And then we will go back and do an individual strength profile which will be isokinetic testing most commonly around the hip and around the knee, but also around the ankle as well if they have, especially in footballers who have had a history of ankle sprains previously.

Then we'd look at a global motor control assessment around how they overhead squat, how they lunge, how they deadlift, and what their torque lumbar and lumbar pelvic control is like, because a lot of time the emphasis tends to be, and rightly so, on the pelvic position on the hip, but especially in those that do a lot of strength training, rugby, AFL games, NFL, you get this big steer thorax. And so you can do all these lovely lumbar pelvic work and then you're this big, stiff, immobile thorax that's going to greatly influence, A, your squatting mechanics and how you lower your centre of mass during change of direction, but also, B, influence how you can recruit your oblique muscles and the position or am I going to dominate through my rectus abdominis as is very common in those anterior tilted and rib flare positions. You're going through all of that, and so when we go through it, the way I try and talk the athlete through it is we're doing the assessment, front of the lab all the way back to the assessment planes looking at hip range and individual muscle strength. And I'm going to talk you back up through this now and again, so can you see the deficits here and here, and your strength, do you see how that's reflected in your reduced power output or your reduced plyometric ability? Can you see how those have an influence on that mid stance mechanic? You're less springy and you're more pelvic drop in mid stance and running. You're more anterior tilted in your squat, and you can see that carrying through your change of direction and your overhead squat? He said, right. Can you see how you're complaining of pain when you sprint, when you're complaining of pain when you change direction? Can you see the difference in mechanics left versus right, and how if we coached or influenced those movement patterns that should have a positive effect both from a performance point of view but also from an offloading or an injury management point of view? And so now we need to build a programme that's going to address this anew. And I normally have clips of other athletes who have groin pain as well and show them how even though they have the same pain can present very, very differently. And so and especially with clubs bring multiple players across, will bring that player back, a different player back than the one who had been previously,

and it's fantastic, the contrast, the difference between the two players in how they move and what drives player one versus player two.

Because commonly you'll find, you'll copy and paste a programme that worked for that athlete and just give it here, and then you can't work out why it's not having the same effect. That goes to suggest that the programme is the key here, and the programme is not the key. The assessment is the key and the to do list is the key. You can pick any exercise you want. Like the daily part of our job is there's fantastic ways of coming up with new exercises, new strategies. When it comes to motor learning and how we manipulate drills to influence running mechanics generated, that's incredibly enjoyable side of work. It's not there's a right way and a wrong way, there's where you are and where we think you need to be. And one of our, actually, a couple of our findings from our research intervention when we took a core of these athletes and managed them in the British Journal of Sports Medicine, managed them specifically on how they move, not on where their pain was coming from, so dumped in adductor, dumped in iliopsoas, pubic, et cetera, abdominal, and we found there was no relationship between commencing the programme and pain-free return to play, no relationship with your anatomical diagnosis, so just because your pubic bone or adductor, it made no difference in how quickly you recovered. And the influence of how long you were symptomatic had no relationship with how quickly you recovered. You could be symptomatic for six weeks or 16 weeks or 60 weeks. So if where the pain is coming from doesn't matter and how long you're sore for doesn't matter, well, then is it how quickly I can bring you from where the way you're moving now to where we think we want you to go, and sensibly, load manage across that period, is that what's going to successfully get us from A to B, because my adductor programme might work for one but not work for another.

So it cannot be that the programme is specific to you get lots of athletes who come for review and that have done weeks of core work and weeks of adductor strengthening, and test extremely good and extremely strong in those areas, and have no symptom change because their adductor strength was not what the problem was. And that's not to say all athletes have good adductor strength, but one of my colleagues, Sam Baida, is currently doing his PhD. He's repeating our study on segmental control and athletic groin pain, and he is looking at handheld dynamometry changes pre-imposed. And it's really interesting how quickly those measures recover despite the fact that there's no specific adductor strengthening within the programme. I think that's something that is getting through that need to be it's not that this is the programme you need to do, it's not that this is the exercise you need to do, it's your groin's changing. And you only have to go on Twitter these days and you see 101 different home exercise programmes, and I wouldn't mind shares in Joe Wicks' Body Coach.

Is there anything we can do to screen athletes and catch those that are susceptible for hip and groin injuries?

I think there's several strategies you can take. Number one is who are your high-risk groups? So, your athletes with previous groin pain are more susceptible to groin pain, and those coming back from longer term injury, ACL, ankle fractures, endosmosis, whatever, and your younger athletes coming into the squad.

I mean if you could pick the three buckets there, they're the big three buckets. And within your overall playing squad, Kristian Thorborg has a really nice paper on the squeeze test at zero and a traffic light system around that, which will, where the squeeze test at zero is really useful is that it is a good pain provocation test. It really loads, especially in the long lever, really loads the area. It doesn't tell you where they're sore, it doesn't tell you why they're sore, but often they become symptomatic in a zero squeeze before they report pain when they're playing. That can be quite provocative. Thirdly, then, is again, not only as part of your athletic development, but your hamstring programme, your ACL programme, your patellar tendon programme, screening your athletes on the big movements, so how they change direction, how they look when they're running and sprinting, and are the group trending in the right direction? At the end of the season, are you happier with the overall average of your group's mechanics doing all activities than you were at the beginning of the season?

Particularly in academies. If you have a player in the academy for three years, take rugby as an example, or the collegiate system in the U.S., if you have them in the system for three to four years, how do they look walking in the door, and how do they look walking out the door? And obviously, that's hugely weighted from a technical and a tactical point of view specific to their sports. But biomechanically, how do they look, knowing that their efficiency when they run or they're first doing the change of direction is going to have athletic benefits and certainly going to have injury benefits. I think trying to pick out those high-risk athletes and doing a really in-depth analysis in them while monitoring the entire group and having the mechanics trend forward, I think, are probably the best approaches.

It's just having the skillset within yourself as a conditioning private practice or in the club or within the club department to have the skillset to carry out all components of that assessment in that if an athlete's repeatedly pulling their hamstring running around, I never look at their running mechanics, and all I look at is their hamstring strength. It's not that hamstring strength isn't important, it's incredibly important, but I can pull my hamstring and still have strong hamstrings. It's the same around groin, in that if I have a narrow assessment in what I can look for and intervene on, that's going to limit … you end up with far more outliers, when in fact the outliers are what I crave now because are they something … is there something specifically wrong with them or am I missing something? No, it's missing something. And so it really broadens and evolves your assessment in terms of how you break that, I think, down to profiling to put them back again. And so how whether it's as a team, having various skills within the department that can assess each of those components or individual conditions who can do it all, it's a key aspect to getting ahead of the problem and staying ahead of the problem.

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