

**JAMES VOOS:** We'll move on from our-- move on to our second type of injury that can occur in our female athlete when we see that picture of someone laying on the ground holding their knee, moving from the ACL to the patella. We've gone over the epidemiology portion of things and we'll touch on that here very quickly.

What I really wanted to come back to is this slide here, where half of all patients who have undergone-- or had a patella instability episode have difficulty returning to sport. If you think about it, that's a pretty significant amount. And you take a high school female volleyball player, basketball player, soccer player, who, one, enjoys playing, and two, maybe considering wanting to go to college or wanted to continue to progress their lifetime desire to play soccer for a long period of time, and one half of those people can't return. It really creates a challenging problem.

So every patient I see that has a patella instability episode, it really is a team approach where it's the physician, their parents, the athlete, our physical therapists, and the athletic trainer all working together and committing, effectively having a contract together that this is a long-term process that we're all going to work on together to get you back to playing. And the fifth person involved in it is their kneecap. So they have to talk very nice to their patella and utilize all of our rehabilitation mechanisms to get them back.

So that's really what we're going to focus on. And that's really what I wanted to hit, is this is a real problem. We've actually done a very nice job addressing our ACLs, being able to figure out what are our risk factors, but our patella instability really remains a tricky subject matter for us to address. And particularly in our female athletes.

We've all seen what happens, particularly in the videos with our first-time dislocators, when you see that dramatic-- the kneecap slipping in and out of place-- that's usually a very dramatic event where the player is unable to return back to sport. What we see more frequently is the recurrent dislocations, or the recurrent subluxations where the athletes just don't feel right. Every time they plant, they feel that little shift or that little wobble. Sometimes they have a hard time describing what's going on. And that's often what we see quite a bit.

But in particular, when we have bony abnormalities, or as we just spoke about from the ACL aspect, when our glutes, when our quads, when all of our muscles aren't working in concert together. So that's often one of our most challenging groups to take care of, are those recurrent subtle-- recurrent, subtle patella subluxators.

Our physical exam with our patella is a critical portion of this. And this is one where the patients need to have a of shorts on. They have to stand up. I have them get out and walk in the hall. And particularly in our female athletes, who may have anteversion of the shapes of their femurs, may have hyperextension when they stand, just like the picture that Dr. Hannafin showed.

It really is important to get a dynamic exam with our patients that have patella instability. Often you'll see pictures like this, where we stand a little bit in-toed, where we call it a winking patella, where the patella is sitting just outside of its typical rotation. So really, even though we talked about the kneecap being the problem, really the kneecap is effectively staying put. It's everything else around it that's not working.

So it's the version of your femurs. Are your feet flat or not flat? How tight are your hamstrings? Are your glute muscles working? So we really work carefully with our athletic trainers and physical therapists to determine those. So a lot of those we can figure out in the office. But I rely heavily on our therapists to do some of these dynamic exams even in therapy, things that we can't tease out in the office setting.

Similar things, sitting on the edge of the table where we watch the patella track. There are often cases sitting in the office where as you flex and extend the knee, we can watch the kneecap jump out of the groove as you flex and extend. When you see that, it makes your diagnosis very easy. But again, often it takes our therapist to really help us out with that.

I won't go in a lot to our radiographic analysis, but the one thing I will say is getting you high quality x-rays-- particularly when the kneecap is an issue-- our merchant view down there on the bottom where we see how the kneecap sits in the groove, and a good lateral view, really help us to assess where does the kneecaps sit. And we really divide this into a bony problem and a soft tissue problem. And often, people have a little bit of both.

But that's really what we want to figure out what this is. How much of this is soft tissue? How much of this is from the bony aspect? So there's a whole series of radiographic measurements. So if we wanted-- anybody had questions about those afterwards, we can certainly talk about that. To really assess where it is their kneecap sit. Is it too high? Is it too low? Does it sit off to the side? Is their bony architecture abnormal?

One particular study that we found on our more advanced imaging CT scans and MRIs is really a means of assessing how close-- where it is the center of our trochlea sit in relationship to the tibial tubercle. And that distance-- you'll often hear us talking about the TT to TG distance-- has really helped us to determine when we're looking at a surgery, do we need to do just a soft tissue surgery, or do we need to do a more extensive bony surgery? And so that distance of greater than 20 millimeters tells us that a soft tissue surgery may not be enough. And we may have to add one of our more extensive bony procedures to address things appropriately.

MRI certainly helps us in these cases after our acute events. And what we're really looking for with our MRIs are when the kneecap slides in and out of place. It can shear the articular cartilage off from below. And you see the bony bruising there where the kneecap hits over on the side of the femur.

So what we're really looking for are other loose bodies. Did we knock off a piece of cartilage? How significant is the injury to the ligament, the medial patellofemoral ligament, that's our check rein. But really, it's the articular cartilage that we're looking at. And so we pay close attention to getting that high-quality MRI there afterwards.

We always try to treat people-- I don't want to say always-- but frequently try to treat our first-time dislocators conservatively. Really focusing on their soft tissue swelling. Getting their knee moving again. Appropriate weight-bearing without limping. And really working on all their other supportive structures around their kneecap-- their glutes, their hamstrings, their VMO.

And really, those first-time dislocators, if they have not sheared off a piece of articular cartilage, or have a more significant injury where they just can't-- or they continue to subluxate regardless of your conservative mechanisms-- we really try to give everybody a chance to rehab this on their own before jumping to any type of surgery. And this is what we often see.

The picture on the bottom right, we've sheared off that piece of articular cartilage. I tell people it's like walking around with a rock in your shoe. That piece of cartilage really can wreak havoc there. Sometimes we just have to excise that piece. Other times, more extensively, we can repair that piece of cartilage back. So that's really our biggest indication for early treatment.

There's a myriad of things we can do to treat patella dislocations, patella instability. Often when there's this many surgeries, as you hear people say all the time, we haven't figured out one great procedure to do. But really what it does is it tells us we have to do a very good physical examination, get our appropriate imaging to determine do we need to do just a soft tissue surgery or soft tissue plus bony surgery?

And it really comes down to two things. Our workhorses that we've utilized are our medial patellofemoral ligament reconstructions, where we recreate that ligament that helps to hold the patella in place. And any of our distal realignment-type procedures, the tibial tubercle shifting procedures that change the mechanics of how our kneecap sits in the groove.

Some of our other procedures we'll touch on very quickly are things like trochleoplasty. That's come into conversation more. Where people that have a really flat trochlear groove, where the kneecap can't sit. Even in the best scenario, the kneecap wants to slide out of place. It's a little bit controversial, but there are newer procedures where you can actually deepen the groove to see if that helps to keep their kneecap functioning.

So this is really what's been the mainstay of our soft tissue procedures, is to reconstruct that medial patellofemoral ligament. There are numerous techniques that have been described as to how to secure the graft into the patella and into the femur. And what comes with this, in addition, is when we have to do this on our skeletally immature patients, the growth plate of the femur sits right where-- or very close to-- where that graft secures.

So it often creates a whole other dilemma in our young patients that fail conservative therapy-- how to reconstruct this ligament. And there are several ways that we've learned to do that to protect their growth plates. And it's very important with this as to where we tension the graft.

And so we often have a lot of patients that have trouble getting their flexion back after the surgery. If you secure that new ligament with the knee in extension, it will be too tight. That ligament is just a check rein that stops the kneecap from jumping out to the side. So we really flex the knee up. I flex the knee up in the OR up to 60 degrees when we secure that graft.

And there's data that says anywhere from 30 to 90 degrees, we really want to tension the graft with the knee flexed. That way the patient-- and on the table, I'll make sure I can flex that patient up to 90 degrees to assure that we don't over capture their knee and make their kneecap too tight. Because certainly, people, if you overtighten it, aren't are happy with that either.

A lot of great data that shows a high return to sport with our appropriately indicated patients, with MPFL reconstruction, the big thing is making sure that we've assessed those bony factors, that we address those appropriately.

The challenge with any new surgery is it comes with its own set of complications. And as we've drilled those bone tunnels in the kneecap-- you think of the patella as a little bit bigger than a silver dollar-- and you're drilling tunnels in it, athletes that are landing on their knees on a hardcourt, out on a football field, playing soccer, playing volleyball. And those tunnels there can create a stress riser where it's possible to fracture through your patella. In fact, those cases have been reported.

With that, we've started to shrink down the size of the tunnels we do in the patella. There are a series of other different ways, whether it's with suture anchors, or just in the soft tissue that we can secure our graft to the patella. And that's a discussion we have with the patients, with the parents. What sports do they like to play? What are our at-risk activities? What risk are they-- are we all willing to put up with in order to prevent these types of risks, such as a patella fracture? Certainly we don't want to cause more harm than we're helping.

Any time we're harvesting a graft-- so we can use a patient's own hamstring to make that graft-- there's some data in the patella instability literature that states utilizing allograft in this setting may be OK because of the stresses that go on this graft. We still offer to use a patient's own tissue. Our recurrent patella dislocation can occur. I think that typically occurs with our high-risk sporting activities and when we haven't addressed the bony pathology. And we've already touched on the pain and stiffness factor.

This is our distal bony procedure. So when we see that the bony architecture isn't sufficient to hold the kneecap in place, our workhorse has been to shift the tibial tubercle anterior and medial to take the load off of the patella cartilage, as well as mechanically to help the patella stay in the appropriate alignment. This requires a little bit more extensive rehab, a little bit more extensive recovery afterwards. And we'll talk about that here briefly.

I won't go into this much further, but this is our example of the trochleoplasty. Types where the trochlea is very flat and we can actually deepen it. We don't routinely perform this procedure, but it's certainly available for our failed procedures that are out there. Very good trochleoplasty data starting to come out. But they're very small studies. And I just wanted to briefly touch on it, because it's currently available.

Often, what we have in our practice, we see a lot of these patients with combined procedures. So we're addressing their articular cartilage and their ligaments. So this is what we often see on the under surface of the patella, is really shearing off big pieces of cartilage.

And in our young athletes, we really want to make sure that we restore that articular cartilage to the best of our abilities. So we have a very nice team that does that. And we often do these procedures in concert together to make sure that the patient gets the appropriate treatment to address their articular cartilage as well as their stability.

So I'll end with this, our treatment algorithm. We really try, with our first-time dislocators, to treat our patients conservatively. Really give them the chance to recover on their own. If we have any recurrent instability, if they have mechanical symptoms-- that catching, clicking, crunching-- that's when we get our further advanced imaging. We really will assess all of their bony architecture.

And those patients that failed conservative treatment, have poor bony architecture, continue to show signs of recurrent instability, those are the ones that will move on to surgery. And often those combined procedures are required when articular cartilage lesions are present there as well. I think we'll end there. And we'll move onto our next.

[APPLAUSE]