

**KEVIN WING:** Certainly I'm going to share with you the technique that I like in my hands in many situations and also share a few observations of, I guess, things that I believe and things that I don't believe about what's important with hallux valgus surgery. Everybody in the room is familiar with the problem. This is a very typical case seen at my institution with large IMA, large hallux valgus. And really, a profoundly unstable first ray.

And you know the patients who-- I can't manage this condition with shoe modification-- present with the increasing pain at the medial eminence. Sometimes associated pathology at the second MTP joint. And of course-- and my population are the main population I'm talking about here-- is adult onset condition.

So I think the observations about rotation are interesting. But we'll talk about that a little bit as we look at some of the pictures of the anatomy and whether that's a real thing or a secondary thing. If the patient tells you at 25 they were running around and their foot was normal-- and if their other side is still normal-- and then they've got this adult onset of this condition with instability of the MTP joint, to me, that drives a lot of my thought process around what I think I need to do to realign and rebalance and improve the function of that foot with a surgical correction.

So again, everybody's familiar with the radiographic measurements of hallux valgus angles and IMA angles. But I think there is going to be more attention to the sesamoids. And I guess when you look at the normal kind of picture on the one side and then this kind of subluxed degenerative one, I don't have any problem saying that there is significant secondary change to the metatarsal head. And that that remodeling of the head may give this impression of a torsional element to the MTP joint.

I'm not so sure that, when I debride the first TMT joint that I see as I open it up, that the TMT joint is rotationally unstable. But nonetheless, in getting a satisfactory surgical result, I think what's happening with the sesamoid, what's happening with the toe, and dynamically what can happen after your reconstruction is going to drive your results to a large extent.

And we mentioned that if the first ray completely gives up its functional status, then other parts of the foot can cascade, start seeing degenerative changes as a result of that. It's a great introduction from Chris. And this is just something that's coming out of our institution. Hasn't been peer-reviewed yet but will be shortly.

We looked at 75 patients. The data for the patients is actually collected independently from one of our PhD statisticians in our public health institute at our university. And so 75 patients like pictured on the slide undergoing primarily kind of a lapidus reconstruction of a large IMA bunion procedure. This PEG pain instrument is validated in the Canadian population, as it is I think down in the US as well.

They're presenting with an average pain score of 5.2. And in the Canadian population, if you're over 3, that's severe pain. So it really gets the policy people's attention that FAOS is somewhat validated in forefoot surgery in a reasonable scale, a bit like the FAM that we just heard about.

And not surprisingly, these patients who are signed up to have surgery are well-selected between the patient and the surgeon. They have severe pain. They're markedly disabled on the functional scores, on the FAOS.

And interestingly, at the same time as the PhD statistician looked at all of these other foot-specific things, they also looked at-- there's this other measure, EQ-5D, which can be converted to a utility analysis. And it turns out that a Lapidus procedure on a patient like this compared to other surgical procedures is highly cost-effective, coming in at like \$5,000 per utility or whatever, compared to like a \$50,000 threshold. So there's some really good data coming out about the nature of the problem and whether policy people should care about it.

The problem of the unstable big toe is one we're familiar with. So our goal is to try to rebalance and correct those underlying problems, dealing with the IMA and the hallux valgus problem. This is an intraoperative X-ray. But I do this exact same procedure when I'm seeing the patient in the consult clinic.

For me, you can manually reduce the IMA. You can get a sense of how much degenerative change there is in the first MPT joint. But also you can get a sense of-- how tight those sesamoids?

Can you get functional range of motion that isn't the pathological range of motion they're presenting with, right? They present with extension toe pronation and lateral deviation and that medial thrust of the metatarsal head. And that's the problem you're trying to deal with. For some of the patients with really large IMAs and really poor extension, I think you start thinking about-- can you actually salvage this with a re-alignment procedure? Or should you just be thinking about first MT fusion?

So we'll move into more kind of the technical talk of what I like to do in my OR. We've talked about how we're going to deal with the IMA by fusing the MTP joint as Lapidus described. And how careful rebalancing for the first MT joint is going to be a soft tissue portion of this.

Pretty standard set up in the OR-- regional anesthesia. Calf tourniquet is the most common at my institution. If I need to do a gastroc slide, I'll still do regional. But I'll just do the gastroc slide without a calf tourniquet. And then put the sterile tourniquet on the table.

And so I like now to start off with the first web space dissection. It turns out that, if you're careful, you can usually see those branches of the DPN in the first web space and not hit those. And then, really trying to look at that Netter diagram.

I feel like most times you can in fact identify the anatomy as you first come through that adipose tissue. You can actually see the transverse metatarsal ligament. But if that sesamoid is flipped up and 100% uncovered, you encounter it quite quickly.

And so not only do you release it to see the whole kind of bursal sac and web space. But where that little tag of the inner metatarsal ligament comes across is invariably the lateral edge of the sesamoid that's flipped up. So that's where you need to know for your lateral longitudinal capsulotomy.

This can allow you to open up the joint. And then, you can see the sesamoid. Then, you can gauge how much of the abductors are released. Or in my case, I like to release of the abductor. So that I'm trying to set that lateral sesamoid free so that it can drop back into position and the metatarsal head can come over it.

But the million dollar part of the whole operation is-- can that sesamoid have excursion? And so for those people who are familiar with total knees, I always talk to the residents about-- it's great if you get everything lined up. But if when you bend the knee, the patella falls off the side-- just like with the big toe. If it's rectus and as you extend it, if the sesamoid just drags the toe back off to the lateral side, I think that's where you're going to see early recurrence of your hallux valgus deformity and problems with difficulty at your clinical outcome.

So for me, if you're a moderate to large IMA patient having a lapidus, then everybody gets quite aggressive, methodical anatomical-based lateral release. And that's coming in below the lateral collateral. So I'm not disturbing that. You can switch over to the medial eminence then. Make a direct medial approach. Elevate that capsule. And that allows you to trim that bulky medial eminence, provide a healthy base for things to stick back down on.

And as you can see there, there is an element of rotation to your cut. A purely dorsal plantar cut ends up in the medial sesamoid articulation. Which I don't think you really want to do. And perhaps also increases your risk of hallux varus.

You can also see the fellow there demonstrating nice saw technique by anchoring the saw and holding the neck of the saw. So you can really get a nice precision, clean cut of the medial eminence. And it really is just an extra articular excision of that kind of wafer of bulky medial eminence. You can smooth your edges with a rongeur, which isn't really a very good instrument for smoothing. But there you go.

And to me now, I haven't even touched the first DMT joint. And this is where I start wondering-- did I select the right operation? Or should I have convinced the patient to have an MTP fusion?

You can see how, with my hands, I've just manually reduced the IMA. I've got the toe rectus. The metatarsal head is back over the lateral sesamoid.

And what I really want now is to see that I can get that nice excursion and a nice extension of that toe without it re-pronating, without it laterally deviating, without a lateral sesamoid dragging it back over laterally. At this point, if I'm still tight, I go back into the first web space. Maybe peel a little bit of the lateral brevis off the base of P1-- sort of the lateral flexor brevis, the distal part of the sesamoid attachment.

Re-look at whether there's any residual abductor left. And just fiddle with it a little bit more until I think I've got it as good as I can get it without completely letting the sesamoid free. And that allows you now to switch back up to just the fusion position of this. The anatomy here is invariably there.

You can see the little branch of the SPN nerve running across the joint. You find it early. You protect it. Then, you take EHL. You find the brevis. You find the other nerve [INAUDIBLE] bundle.

And that ultimately allows you to get into the first TMT joint, where you have to be a little mindful. That you can't just blast through plantarly because there are important attachments plantarly. Having said that, I invariably go through the plantar capsule. Because the plantar lateral aspect of the metatarsal is the one part that there's sort of sometimes a little bit of beaking or a little bit of a ridge.

Or really, you're trying to do a lateral closing, plantar closing debridement to allow that head to swing back over. So you've got a low IMA. But with the first metatarsal even with the second metatarsal. And so this is the part of just being meticulous and careful debridement, right.

You can load up pin distractors if you're struggling. But in a primary case, I typically just jam a Howarth into the side of the joint. It's a little bit fiddly. But as you get used to it, it's fine. It's really nice if your surgery center has sharp osteotomes and not dull osteotomes.

But you peel the cartilage off. And so although you can use a saw, as we have heard, I'd really caution you to avoid excessive shortening through the joint. That, for me, I'm just trying to peel away the cartilage. I'm trying to get two flat surfaces that are going to allow me to get a nice correction.

So after I've irrigated the joint and you've got two flat surfaces that you think are going to heal-- so it's the preparation and biology, like always, in a fusion procedure. Then, I'll go ahead and do the capsular plication on the medial side. For me, that's a straight dorsal plantar capsular plication with 2-0 PDS.

And you can see-- one person is tying the sutures that have been laid in while somebody else is manually reducing the IMA and holding the toe in the rectus position. And so think about what's going on. You've got your head back where you want it. You've got your sesamoid sitting underneath. And that capsular is just-- you just snug it down in that corrected position.

You're a little bit at the mercy of what's going on with the remodeling of the metatarsal head and the cristae or the absence of the cristae and all that kind of stuff. But that sets you up nicely for this. Where I haven't put any fixation and my first TMT joint is prepared. But you can see how, on the left there when you support the foot, the toe is already sitting rectus. And the IMA is already reduced just based on the soft tissue rebalancing at the first metatarsal.

And so this moves into the position of-- now I just really want to stabilize this flat on flat fusion so it'll heal. So I like to go with a lateral screw from proximal to distal. And that simple screw sets your fusion position and does everything you want, right. Closes it down laterally, which supports your reduced IMA.

I work with residents and fellows. So this is kind of a two-person thing. I think that a scrub tech or anybody else is perfectly capable of providing you the little bit of help that you need with respect to doing this operation. But for me, it's all about the millimeters-- or even fractions of millimeters-- and degrees of keeping the IMA well-supported, a little bit of axial load so that the two flat surfaces have been well-prepared.

And you're visually looking at this. If the two surfaces don't look very good, then you do a little bit more debridement. You do a little bit more preparation with your osteotome until you feel like you have two flat surfaces that are well-opposed. You can put the K-wire in. If I'm happy with the way it looks, I just go ahead and drill it.

A nice trick to avoid the c-arm here is just pull the wire out. Countersink it. And use your regular depth gauge so you don't have to fiddle with fluoro at this stage. Usually it's 32 or 34.

But it's nice to measure. It's nice to make it just right. You put the screw in. And now, you've kind of set your flat on flat fusion position.

And the nice part about this is that there's a simple step that you can repeat. If you're unhappy with what the screw did, you can change it. You can still bail out to going to plate-only. But it's a step-wise approach to getting the result you want without feeling like you have to wait till the very end to find out whether it's a good correction.

So I purposely put the screw out of the plate laterally. Because it's a single screw that sets my fusion position. That has me feeling like I'm doing a good job with the case. And then, I go to a dorsal neutralization plate to give me the support I want.

But the plate is not changed in the position of my correction. The entire time, the IMA been supported in the reduced position with somebody holding the metatarsal heads. Plates come a little bit contoured. But as we know, that mid-foot anatomy is a little bit variable. So I tweak it a little bit if I need to make sure that the plate sits nice and flush.

I like just the small 2.7 locking screws. Put them in flush. Don't put them in-- I tend not to deflect them. Because the heads sit down flusher if you just put it that way.

And so there you go. A large IMA now reduced to a nice low IMA. And a meticulous soft tissue rebalancing of the MTP joint gets you back to where you want to go.

The construct is robust. And I think that, with this kind of construct, we've been happy that we can go to a short walker boot in the OR. And instruct the patients that heel weight bearing is OK to some extent. Still scare the bejesus out of them that in the first two weeks they've got to manage their wound and keep the foot up and not really be very active.

You see them at two weeks for a wound check. You switch them to the toe spacer as opposed to your bulky dressing. Because you still want to support that healing medial collateral ligament.

Between two weeks and six weeks, I still give him the riot act that you can't be doing your 5,000 steps. You shouldn't be walking your dog. You should really be taking it easy. If you let them be too active, it's just asking for trouble.

So I've found this a very nice step-wise, technically reproducible-- I guess you can be in the major leagues if you bat 300. I think we all know that in bunion surgery that's not going to get you there, right. You really want to see 99 patients out of 100 with an excellent technical correction.

You can't fix some of the biology. You can't make up for some of the degenerative disease that's happening at a sesamoid articulation. But you can do a good job in the OR in making sure that every one of your patients has a nice technical re-alignment.

So I've found, in my hands, this procedure gets you where you want to go. And of course, it's incredibly powerful with respect to-- I mean, there isn't an IMA that's too big for this procedure, typically. And I think adding in heel weight bearing is nice.

Clearly, there's costs associated with this with respect to the implants. You do see some hardware removal with respect to the dorsal plate irritating at shoes at a year. There's not a good study prospectively looking at this or even retrospectively looking at this with respect to-- what is the actual non-union rate with this plate and screw construct? I think we know historically from crossed screws that the non-union rate is still actually low for this procedure.

I think in Vancouver over the last three or four years, Dr. Penner and myself have been happy that the procedure is working well. Thank you very much.