The Complicated Foot Made Simple

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- [Calista] It is my pleasure to welcome and introduce Paul Drumheller to physicaltherapy.com. Paul has been the owner and practicing PT at Three Dimensional PT and Sports Conditioning in Tacoma, Washington, since 2003, where he specializes in the lower extremity and the foot and ankle. He is board certified as a clinical specialist in orthopedic and sports. He is also a certified strength and conditioning specialist through the NSCA. Paul is the owner and speaker for the updated continuing education courses When the Feet Hit the Ground Everything Changes, and When the Feet Hit the Ground Running. He has lectured locally and nationally, including APTA's CSM meetings on several orthopedic and sports-related topics, including youth athlete development, rotational athlete running injuries, ACL prevention and treatment, and training for sprinters. He also co-developed and produced an instructional DVD, titled Exercises for Runners, which is geared for PTs and other medical professionals. So thank you so much for presenting for us today, Paul. And at this time, I'm gonna turn the microphone and the classroom over to you.

- [Paul] All right, thank you. I guess all those things I've done just means I'm getting old. Anyway, I've been around for a while. I started, like Calista said, about 17 years ago. I started this primarily to build my niche, my private practice in Tacoma. I took this class called When the Feet Hit the Ground Everything Changes. There was nobody in my area doing feet at the time. And I figured that was my niche to get in. So I took the class. It's almost three days at the time. I came home confused as heck. Hopefully that's not how you're going to feel after this. Confused as heck, and I went back in practice. And I tried these things. And the more I found out I knew, the more I found out I didn't know. So I befriended all eight of the instructors of the previous course. And I lab assisted for those guys for several years up and down the west coast. And I stood next to them, and I heard the questions they were getting asked, and I saw how they answered them. And I learned a lot just from my mentors, from those guys. And I really appreciate that. About the last two years of the course, I was asked to come on to be a

primary instructor. When I did that, I was not given any slides. They just said, "Here's the title, and go." At the time, we had a manual that was 10 years old that had never been updated. So it was easier, but still tough. And then once I tried to present new things, the audience, you guys, basically ripped me apart because I didn't follow the manual. So I had an issue with that. Dave Nolan, a friend of mine out of northeastern Boston, and I taught the last class. We sat down afterwards and said, "We have to make a change. "We have to bring this course better, "bring it back to life." Long story short, about five years ago, I was able to buy the title of the course, then reassemble the team and put it all together.

So that's kind of where the class is at now, completely revamped. We update it at least once a year, if not twice a year, just to see what's out there for you guys to keep you updated. So that's kind of my background with the foot and how it came into fruition. I still treat patients three times a week, three days a week, about 10 hours a day. About a third to half my patients are foot and ankle. But there's five therapists there. We all see some foot and ankle mix. That's how this course came about. As you can see there, it says my clinic in Tacoma, Washington, Three Dimensional. It's done well. We mainly see the active population.

So we don't see a lot of neuro. So hopefully you guys don't have a lot of neuro questions for me because I am not the neuro guy. You can take an athlete or a person as high as you want, but we'll take it from there. So learning outcomes, what I want you to be able to do. I heard you have a test coming up, so that's okay. All the questions are answered within this talk. After the course, you guys should be able to identify subtalar joint and neutral positions in prone and standing. That's important because we have nothing else to go with. I've talked to professors. I've talked to university professors, one locally, that want to take out the finding of subtalar joint neutral in his orthopedic class because, he said, the students are struggling with it. And they only have about an hour and a half, of the whole PT class of three years, they

have about an hour and a half to cover this, which is a little frustrating. But he's contemplating some other ideas on how to find it or how important is it. And again, if you're going to read journals, if you're going to do some research, if you're going to do orthotics, this is still the gold standard. And I know it came out in the 1950s, but it is still the gold standard. The next thing we're going to do is assess gait and identify if rearfoot has normal motion and timing during the stance phase. And why we're gonna focus so much on the stance phase is because this is when things happen. This is typically when things go wrong. Assess gait ...

Again, we spend two days of going back and forth and revisiting it during class. Now, I have two hours. But we're gonna get there. We're gonna keep it simple, as the title of the course says for this course, and look at just rearfoot and see what happens. We're going to identify at least two aspects of normal foot motion during the stance phase of gait. So what should happen? Should it go through neutral? How many toes should we see? How many things simply can you look at while you're watching someone walk? And a lot of the time, you don't need to video tape this to begin with. And then also, describe how the first ray position and mobility can affect gait pattern.

There's a lot of things to do with the first ray position and stability of it that can affect your gait pattern and also affect other things in the forefoot. So we'll look at that. Then finally, identify at least three treatment strategies based on foot findings. Again, for the time of this class, we're not going to go into a lot of treatment strategies. I'm hoping, if this thing goes well, that we will put together a second one that goes into more treatment strategies. But for the sake of this, I just want you to get comfortable looking at the foot, not being afraid of it, and then hopefully make some decisions from there. All right, I guess the biggest thing, why I wanted to do this webinar. I could say my friend Dave Nolan talked me into it, but that's not really true. I've been wanting to do this for a while. He presented me with Physical Therapy Education, physicaltherapy.com, I should say, that has given me the platform to introduce this and

try it. I've been watching therapists in my clinic. I've been watching the students coming through in classes for several years and just kind of struggle on being comfortable with looking at the foot. For years, we've always said that it's just an ugly hand. But it functions pretty similar. So don't be afraid of it, is the point I want to get across. If you're coming here looking for protocols, if this happens with the foot, you have to do this, you're probably not going to find it. There are very few specific protocols for foot conditions. There are guidelines. There are clinical practice guidelines out there. There's two of them that we can still go with with the science behind it. But then sometimes the science doesn't always work and you've gotta fall back on your art a little bit.

And that only comes with practice. You have to put your hands on feet, a lot of feet, to find out what's normal. There are very few measurements that we're going to make today, maybe two. When I first took this class 16, 17, 18 years ago, everything was a measurement. I remember my front room here, sitting with Brian Hoke and going through video gait analysis and describing and looking at every single measurement. And it just, to me, it was more confusing.

Now, I think that we've gotten away from that, stating what happens, how does it function, and is it normal or not. And that's another complex question we'll get to here in a minute. Yes, the foot is complex. But we can try to simplify it, and that's what we're doing today. If I could just get you to make a few key assessments, get you thinking the right direction, and just get you more comfortable with it, the challenging stuff will come later because, if you go back and you start getting decent, or you start not being afraid to put your hands on a foot, you are going to get more patients than more other therapists sending to you foot patients. In my clinic, pretty much 99.9 percent of the people that walk in my door have two feet. We see a lot of lower extremity injuries. You can't look at the knee without looking at the hip and the foot. That's out there all over the place. The knee is just a dumb hinge joint. Gotta keep it

interesting. The more challenging stuff for the foot, that's what keeps me going. I like the quick ... Other therapists will say, "Hey, can you take a look at this for a real quick second?" Well, I only have two minutes to make an assessment, not so much a decision, but I talk through the decision process with them after making my assessment. I think, a lot of times, my therapists just want a confirmation of what they found was correct and then kind of the direction they're going 'cause they actually have been with me for a while and I trust them. They're very good. Again, over the years, not get caught up with so many details. And that's what we're gonna go through today. Keeping it simple if we can. But always refer back to foot mechanics, basic foot mechanics. The rearfoot should do this. The midfoot should do this.

The forefoot will do this. And if you can get those three concepts after today, that would be huge. We're not going to talk about the influences of the lower leg, the hip, the knee, and the lumbar or spine, all those things that can influence. That's for the two-day class. Today, we're just keeping it simple, talking about the foot. If someone comes to you and they have fusions or amputations, chronic pathologies that they've developed compensations for for years, you're not gonna make the foot perfect or normal again.

But I think a little bit of change, whether it's with a piece of tape, whether it's with an exercise or orthotic or something, to give them small adjustments can have positive results that will go a long way with these people. The other part about ... I'll get off my high horse here in a second. Finally, if you can keep people on their feet, that's the key for life. That's a longer life. There's several studies out there, mainly through bunions, that if someone has foot pain, they don't want to stand on it. They don't want to walk on it. Because of that, they're decline in life comes, they don't last as long. And if we can help someone take that extra trip or get out of the chair more often, to feel comfortable on their feet, that's why we work. That's what PTs are for, to help people live a better life. Sorry, let's get off that. Let's get off that soap box. So definitely I'm

passionate about this. You can see that. So starting the process. When someone comes in to you, I want you to complete a subjective eval. And I mean listen, not just hear them. We get students all the time, we have a few new grads starting, but the biggest thing is, don't be concerned with writing things down, getting your notes done, all that. Just listen. And they will lead you to what the problem is. They will lead you to why they're here to see you. That's what we gotta look at. I think the subjective eval, people always talk about special tests and developing a diagnosis. I think subjective is the most important part of the eval. So just listen. You listen to some of the questions. How long have the symptoms been present? If it's an acute situation, that's a little easier treatment, actually.

You can make big results quickly, or basically take the easy route and calm things down. If it's a chronic condition and they have a really unstable midfoot, then this is when I might jump to more external support, such as an orthotic or something right away because their foot is that way a lot of times because they're not an exerciser or they want the quick fix or something like that. And I'm okay with that. My use of orthotics is not as often as it used to be because I think we have a lot more things in the toolbox to use now. But if needed, we still have a great relationship with our orthotic company.

And they do as well. Also, previous injury. If you're talking to someone, and this is the first time it's been hurt, a big one with that is ankle sprains, kids with ankle sprains. If there's a previous injury, that is the number one reason by far to have any injury, not just a foot injury, but any injury, is a previous injury. That's where my passion with kids working, trying to get normal movement patterns, landing patterns, jumping patterns, things like that, so we can hopefully prevent that first injury from happening. But if you've got a previous injury and you get someone now with a third-time ACL or the fourth-time ankle sprain, it's a little bit difficult to work with. Previous treatments-wise, what do they do? You don't want to be the person that does the exact same treatment

as the person before you and expect different results. Also, I think you're going to be surprised about, when you ask what was done, what they had done for this ankle sprain, let's say, you'll be surprised at how little quote-unquote PT is being done. And I hear it all the time. We rode the bike, and we did ultrasound, and we put him on Game Ready or something, put him on ice bag. In the back of my mind, I'm thinking, "That's PT?" That is such a bad name for PT. But hopefully you have a lot more things to do with this and at least get a better idea of what to go at, what's causing the pain. Then, once you get that done, the first thing you need to do is watch them walk. Once you watch them walk, then you've got to see what's normal. What's normal, what's not normal, and we're going to get there fairly quickly in the next few minutes. Again, I think just to watch people walk, it takes more than once.

You've got to watch them walk, watch several people walk to find out what's normal. Normally, when someone's going to walk, you don't have to put skin lines. If you can see on the slide on the right, you can see down here that I've put lines on the lower leg and the calcaneus, which we're going to do here in the lab in a minute. But you don't need to do that.

Once someone, after you talk with them, definitely have them take their shoes and socks off and then watch them walk. So let's go to the video on the left. Basically, when someone's walking, I just have them walk about half way across the clinic. I'll get to play that. Maybe, there we go. So I'm just having them walk across the clinic and then turn around and walk back. That's all we'll do. We'll watch them forward, walking backwards. I'm looking at big elephants here. I want to see if they are ... What the arm swing's like, what their hips are doing, are they guarded, are they afraid to take a step or put weight on their foot. And then, you can look at some of the details down later, the details, you can look closer at their foot here. The video's playing on my end. There you go. You can look closer to the foot. And what I'm looking for at the foot is kind of how many toes do you see? When they walk away from you, are you seeing two toes,

four toes? How many lateral toes, the fourth and fifth toes, am I seeing? I should see about two. And also how close their feet are. If the line that we put, or imaginary line at this point, on the heel, does it go through neutral or does it not go through neutral? Meaning does it go straight up and down, and does it go into pronation? She first takes her first step on the right. Does that line on the heel go through into pronation or not? The video's not playing as smooth as I want. That's all it is. It's just forward and backwards, forward and backwards like that in the clinic. And what you're going to look for, more importantly, when they walk, you're going to look at the right foot all the way down, come back, and look at the left foot going all the way down. If you go back and forth, like a tennis match, you're going to get confused like you never knew tennis rules. So you have to watch one foot at a time. That will take it from there. All right, let's go to the next slide. Uh-oh, I know what's by it. All right, there we go. So the primary function of the foot.

You're looking at lateral calcaneus, medial calcaneus, the fifth ray, or basically the fifth metatarsal, and then the first ray. And the first ray is basically the first cuneiform and the first metatarsal, but for all practical purposes, let's say big toe. So it's keeping it simple. So lateral foot, medial calcaneus, fifth ray, first ray. Once this happens, the foot has done its job. That is the function of the foot. Whether the big toe takes a long time to get to ground or it's there quicker is going to influence what happens in the rearfoot. The rearfoot is going to have to pronate as much as it needs to, to get the big toe to the ground.

Hopefully that makes sense. We're gonna come back to this as we watch. Keeping it simple as that. Again, if there's questions along the way, definitely shoot questions on the way. Like I said, we have time. I'll answer as many questions as we can and definitely get through this thing within your time frame, and hopefully answer all the test questions. Gait mechanics, looking at basic gait mechanics. We're looking at the right, the shaded leg on the right. Initial contact for walking, we're gonna hit lateral

calcaneus. And then, as it goes loading response, or your foot goes flat, that's when you should almost have maximal pronation at this point. Then, when you're from between loading response and midstance, as the left leg starts to swing through to the right heel, that's when the line on the calcaneuses start to resupinate. And by resupinating, what it does is give you a stiffer foot to help push off to the next step. Then, at terminal stance is when you need the most amount of ankle dorsiflexion. We'll think about, at terminal stance, the most amount of ankle dorsiflexion, but your rear foot is also in a supinated position. And that's where you need the most amount of ankle dorsiflexion. We'll come back to that in a second. And then pre-swing is just as your toes are coming off the ground, your foot's lifting off the ground. That's basically what we're going to talk about, the foot steps. I know that is Rancho's Scale, which was a little more detailed for neuro patients. But that's one of the ways that we'll talk about.

This other one, ideal normal gait graph. This one always cracks me up because we did this, I've been hearing this and seeing this graph discussed for almost 20 years. And looking at the graph, I'm saying, "Okay, where's my normal video?" And for years, we tried to put a normal video in our presentation so we could have a normal video and then what's an abnormal video so you can compare side-to-side, right? I've talked to countless people around the country that present national levels, worldwide levels, instructors in school, podiatrists. I've talked to several people. Not one person can send a quote-unquote normal gait video. So anybody that has it out there, there's your million-dollar offer right there. That will go viral if you have that. What the graph looks like here is, you've got the vertical bar on the left with the four, zero, and four. With that four above it, that is the subtalar joint. It's in a slight inverted position. And then below the horizontal line, that's an everted position. So basically you're going into pronation. So supination above, pronation below the line. When you hit the ground, let's say the line that's moving, the line that's going up and down from left to right, that's your initial contact. So the very top, you're going initial contact, loading response, midstance,

terminal stance, pre-swing, all that. The bottom is the way we used to do it, the podiatry way, and keep it simple. It's got heel strike. So in walking, everybody should be a heel strike. In running, that's not the case. So in heel strike, on the left-hand side at the bottom. And then you go to foot flat. And you can see the line go from, at heel strike, in an inverted position, about two degrees of inversion, which is good. You're hitting the foot on the lateral side of the calcaneus. As you go towards foot flat is when your foot pronates. And we're gonna say it's gonna pronate to about four degrees. So from two degrees starting to four degrees there, it's about six degrees of total motion. Then, as your foot goes flat, and your other foot starts to swing through, that's when we talked about it should start to resupinate.

That line on the right, where it says resupinate, starts to go up all the way to pre-swing. And it can go all the way to pre-swing and then, that pre-swing, when your heel comes off the ground, you have to start to pronate again to get to your other foot. So let's say this is a right foot. I hit the ground, two degrees. I go flat. As my left leg swings through, I start to resupinate. But then the very end, I can't keep resupinating or I'd fall off to my right. So I've gotta come back towards my right big toe to get to the left side. And that's what that far little blip into pronation is at the very end. But that's ideal normal.

Again, we use this as a guideline. And I think it's very important to use as a guideline. But you'll never see this in the clinic because if someone walks like this, they're not going to have foot pain. I'm a big ... I like to watch people walk anyway. And if you can watch people walk, I love going to the ... Anywhere I'm at, airports. I'm at airports several times a year. Airports and tourists are, for me, watching people walk. Half the time, I wanna take a video camera. I almost want to wear a body cam just so I can show you guys the difference in things that I see out there because there's some pretty bizarre things. If you start watching people walk, gotta keep it simple. Look at that line on the heel. Does it go in? Does it stay in? Or does it actually resupinate? And when

does it resupinate? Because if it doesn't resupinate, they're pushing off the ground with their foot, let's say, midtarsal joints are in a sloppy or loose position. So they're not pushing off the ground real firm. Otherwise, you'll see some people that stay on the outside part of the heel. Those people don't shock absorb. That's where your itises come in at. Very poor shock absorption. Anyway, we're always gonna come back to, this is what's normal. So keep that in mind. If we go, again, looking at one foot at a time, let's sync the video on the left. Hopefully this one plays better. Now we have the lines. You can see the foot on the right has the lines on the heel and the lower leg, which we are going to get to. The foot on the left does not. It's easier for you, if you're going to show a person on a video screen or an iPad or something, whatever you're recording on, the differences, it really helps to have the lines. When you're first starting out, it definitely helps to see the lines. You can see, paused right there, that rearfoot goes in, and the lower leg is staying where it should. But you're in a pronated position. And she's almost at initial contact on the left side. That's definitely not what you want to see.

This is a good bad example I gave you right here. That line should stay out, but it doesn't. It comes in. It should go back out. Doesn't go back out until the heel's definitely off the ground, probably right there, right there. So that's what should happen. And again, you're not looking at this point on the videos. This is the third video that we'll do. We'll normally do a full body, and then a hips down, and then this view to look at the foot and looking at all the influences. But right now, just pay attention to what happens to the foot. I hear all the time, when someone goes into the running stores, the running shoe stores, they have all the pronation shoes on the wall, and then the neutral shoes over here, minimal drop over here, whatever, minimalist shoes. And they put someone on a scan or something, and they say, "Oh, you're a pronater." Well, if you walk through, if you walk on a forced platform, you should pronate. Your foot should get flat in midstance. That is normal, that's what should happen. But the bigger question is, when do you resupinate? And that's the thing you've got to start asking

yourself and ask your patients, when do you resupinate. Because if you're staying in that pronated position, again, your midtarsal joints are getting trashed because they're stretched out every time that you take a step. You may do that for various reasons, whether it's a tight calf or some other things we'll talk about here in a minute. Anyway, looking for ... What do you see when she hits the ground? Let's see if I can play this again. When she hits the ground, is she hitting with her lateral calcaneus first? If we get it to play. It's a process of converting videos from my format to their format. And we're gonna get through this. Yeah, let's go to the next video. From the rear view, what were you looking for? Same thing we talked about, the calcaneus, does it hit the ground laterally?

Do you see the lateral two toes? Does the rearfoot go through neutral? And when does resupination occur? Those are the main factors you're looking at. Side view, I don't normally do a lot of this with my walkers. Mainly, what I want to look for here is an early heel rise. So I'm looking for lack of ankle dorsiflexion for some reason or another, which I don't know what the reason would be yet. But it would be there or not. So if someone ... Let's take this example. The right foot, just before it hits the ground, right there where it's paused nicely, the left heel should barely come off the ground. And that's about the right time you want the heel to come off the ground.

If the heel comes up a lot sooner, then it's an early heel rise position. But we don't know why it's doing that until we look more at the ankle and do a little more assessment of where we're getting at. I definitely do a lot of side view recording for running because we're looking at a whole lot of different things with running. But you can look at arm swing, symmetrical arm swing, which hopefully you saw walking away. Stride length, with this, you can measure from one toe at terminal stance to the heel at initial contact, right there. There's a lot of evidence out there that shows even one inch difference in stride length can be detrimental for other things up the chain. So you really want to focus on that. It takes a little sophisticated videos. We use Dartfish in the

clinic at times. Mainly, what we are videotaping on is Hudl or Dartfish Express. Do you have to have those? Those will allow you to draw the angles and the numbers and really get technical if you want it. I can tell you right now, my patients that we videotape, and we videotape on a big iPad, the 12-inch iPad, whatever, they don't really care what we know and all the details we want to show them because we know this. They want to look at it, and they want to see the differences, the asymmetries, and they also want to say, basically, "Fix me. "I don't care what it takes. "Just fix me and make me feel better "when I walk out of here."

So again, that's another reason why we've gone away from using Dartfish and the numbers and a lot of those concepts, because we're finding out it's not as useful. They want to keep it simple too. All right, let's go to the next slide. Again, what are we looking for? The lateral calcaneus hits the ground first with walking. That's the key. How many toes should you see? You should see just the two lateral toes. If someone's turning out, their toes, you'll see three, four, five toes. Sometimes we would see up to seven, eight toes if they had them. What that does is, it drives your body over your midfoot. And the line of advancing gait is through the midtarsal joints. And you're just going to collapse your midfoot the whole time, which is going to lead to different things on the medial side of the foot.

And does the rearfoot go through neutral? Again, starts with a slight inverted position at initial contact. And then it goes to as most amount of pronation it's going to very quickly. And then the biggest thing, when does it resupinate? As your swing leg starts to come through, that's when it should start to resupinate. And that's, quote-unquote, your ideal, normal gait. It's amazing what people will do just walking. Again, walking through the mall and seeing how people advance forward. Sometimes I see people walking, I just appreciate the struggle that they go through just to move forward. They, somehow or another, they do it. They compensate somehow. Okay, let's play the ... Again, there's things to review right there, the lateral calcaneus as it hit the ground,

how many toes, rearfoot go through neutral, and when does resupination occur. So let's look at the video on the left. Again, look at the right foot only. Does that line on the back of the heel, does it ever go through neutral? Does it pronate? Let's look at it again. We'll play it a couple times. It's a little tricky. This is what you'll see with this type of a foot. The line basically stays in an inverted position. It hits the lateral calcaneus, but stays out there the whole time. However, that last little bit that we talked about on the subtalar joint and neutral graph earlier, that last little bit, if he was to stay on the outside part of his foot the whole time, he would never get to his big toe. So you'll see this little wiggle, this little medial heel whip.

And what that allows him to do is allows him to get to his big toe on his right side to be able to get over, his body transfer over to his left foot. I'm gonna play this one more time. It's that wiggle right there, right there, there. It's a little medial heel whip. And all that does is allows him to get his big toe to the ground. Otherwise, he's content staying out there the whole time. But even when he gets his big toe to the ground, I'm not gonna see his rearfoot goes into much pronation at all. So this person you're looking at, it's going to stay on the outside.

So you're looking at your peroneal tendonitises, mainly your brevis, not so much longus, but can involve longus. But not shock absorption. Look at your bone stress fractures up above, your fifth met stress fractures. You can see this picture of the bottom of his foot here, all the shading is on the lateral column of his foot. His middle of his foot, the arch, hardly touched. Okay, let's go to the next slide. Next video, sorry. Maybe, there it is. So now, just the opposite. Think about what you saw before. Does that line, does she hit the lateral side of her calcaneus? It's a good freeze frame right there. Let's pick the left foot on this slide, so you're looking at one foot at a time. Usually people have pretty consistent feet unless there's a leg length difference or some kind of previous injuries or some kind of compensation. Usually, people are pretty consistent with their feet. Look at her left side, the line on the calcaneus. It does

not even come close to going to neutral or inverting at all. So she basically walks along the inside part of her foot. In fact, her left fifth toe, I don't think it ever touches the ground. It doesn't come close to touching the ground. And there's her position of initial contact. There's a nice freeze frame. It's doing it by itself. I'm not even doing it. And then you can look at the right foot. As her heel comes off the ground, now her foot starts to come close to inverting. So if you look at the line on the lower leg and the line on the heel, those don't come close to lining up yet. She's still got an inverted rearfoot. But I think one more frame to go, and she would be straight up and down. So she gets back to neutral. But for the most part, she's living on the medial side. These are people that, anything medial to the subtalar joint axis, you're looking at chronic fasciitis. You're looking at posterior tibial tendonitis. If she was a runner, medial tibial stress syndrome. Bunions, tarsal tunnel, anything on the medial side. Even Achilles will have this kind of gait pattern or potentially develop Achilles because it is medial to the subtalar joint axis.

Okay, let's go to the next slide. And just watching someone walk, I've seen videos, I have videos. I was just at a combined sections meeting last week in Denver. One other person was going through running the gait. They had the one person as a heel striker and the other foot was a forefoot striker. And I've had that too. So basically just watching for symmetry, does right side versus left side make a difference. And I absolute say yes. Okay, let's go ahead and advance here. One of the key factors that can influence gait and, up the chain, several things, is lack of ankle dorsiflexion. If you have lack of ankle dorsiflexion, if you don't have 10 degrees of motion in a static position, let's say, you're gonna lead to early heel rise, so that side-view gait. And you can see it from behind too, but it's easier from side view. Just early heel rise. You'll see that people are kind of walking on their toes a little bit. A lot of sprinters do this, a lot of high jumpers. A lot of people who are basketball players will do this. The compensation for lack of ankle dorsiflexion can be toe out because, if you think about somebody in a cast or a walking boot, what is the first thing they do? They turn their foot out because,

now, the ankle doesn't have to dorsiflex at terminal stance nearly as much. They can just kind of roll through the midtarsal joint and get to the next foot, the next step. Another common thing is knee hyperextension. When your foot's flat and your body's coming over your foot, somehow or another, we've got to get the body to advance over the tibia, or over your foot, to take the next step. One way to do that is to hyperextend your knee. And that's another thing that can lead to later meniscus tears or just trashing the anterior joint capsule of the knee, just from all the compression forces. But again, all that, major contributors to several pathologies. Plantar fasciitis, medial tibial stress syndrome, metatarsalgia. Metatarsalgia mainly because you are off your heel as much.

You're putting more weight through the metatarsal heads. And if there's a bunion problem or alignment problem, that can definitely cause some problems. Or if you have a dropped-down metatarsal head, or somebody has a dropped-down head, that could cause some pain. The fat pads, as we get older, wear away. So that can definitely influence that too. Achilles tendon pain, whether it could be an osis or an itis, from popping up, from using plantarflexes a lot. Again, Achilles and plantarflexion strength, they can handle a heck of a lot more stress and weight than we could ever give them in a weightlifting event. They're tremendously strong.

But also, looking at ankle sprains, if you have an early heel rise, that tells me that, typically, when your heel's off the ground, you go in a slight supinated position. So you're gonna go into a plantarflex position, a slight inverted position, and an adducted position to make up supination. So if you're in a supinated position, that typically tells me that you are in ... You have a higher prevalence to sprain your ankle into an inversion ankle sprain. If, because you're off your heel and you're putting not full weight to the bottom of your foot, you can have poor balance. So if you do a balance exercise, a single-leg balance exercise, now, imagine your heel off the ground, or you can try it while we're talking, with your heel off the ground, if you go to balance just on your

forefoot, it's harder. You can have your patients ... Some of our patients, we'll do that, with their big toe off the ground. So if you can raise your big toe off the ground, that's gonna plantarflex your first ray and make your foot more stable for balance exercises. Getting off on a little tangent here. For balance exercises, a lot of people think just gripping their toes gives them balance. If you raise your big toe up, that will make your foot more stable and give you better balance. Also, lack of ankle dorsiflexion, going back to knee pain. And that is primarily from the knee going into hyperextension. So all kinds of conversations can be made by lack of ankle dorsiflexion. So how do we look at this?

I can tell you right now, most of us go, "Yeah, that's tight," or look at it, "Yeah, that's tight," or, "Compared side-to-side, yeah, that's tight." And I agree, symmetry or asymmetry is more important than just a tight calf. If I have one side that's long, one side that's not, that's a problem. But visual inspection, this came out of combined sections just a couple weeks ago. They ran a study that said visual inspection is not accurate for assessing or diagnosing ankle equinus. So they pulled orthopedic surgeons, podiatrists, PTs, and they said, "By looking at this, just by looking, "is this true ankle equinus or not?"

And an equinus position is basically the lack of plantarflexion. A couple ways to measure is with a goniometer or an inclinometer. The goniometer in the picture on the bottom right, we can use that. More importantly, it's how I set the foot up to measure it. Remember, we talked about that terminal stance is when you need the most amount of ankle dorsiflexion to take a step, that terminal stance. At terminal stance, your rearfoot should be in a slight inverted position, or your foot in a supinated position because that locks up the midtarsal joints and makes it a stiff foot to push off to the next step. So it makes sense, if we're gonna measure this, to measure in a slight inverted position. So notice that's why my hands, in the top video, my hands are more in the first ray, second ray, or the medial side of the forefoot. And now, I'm pushing her into ankle

dorsiflexion. Then I can measure. In the bottom one, how I measure is up the base, the line of the fibula, and then the bottom of the calcaneus where it would hit the floor. So you're taking away the fat pad, taking away the arch, taking away all that, and just look at the calcaneus specifically and up the fibula. And that's how it should be. It should be roughly 10 degrees, or maybe a little bit more. But bottom line, it should be at least 10 degrees. So those are good. Inclinometer, which is a tool we'll show here in a minute, basically use it for plumbing to roofing, so it measures small angles. You can use that, as well as we have inclinometers on our phone now, which I'll show you in a minute. So those are good, and then measure in weightbearing. I still think that, yes, this is great while you're off the table. But we've got to function with our foot on the ground. So let's measure it with the foot on the box in a weightbearing lunge. And that's got great validity for that.

Also, thinking about, the last thing to consider with this, is midfoot control while you're testing. So if you put someone's foot on a box or someone with their foot away from the wall and knees touches the wall, which we'll show these in a minute, if you allow someone to collapse to the midfoot, that's going to pronate the rearfoot at basically terminal stance. You don't want to measure pronated rearfoot at terminal stance. You want to measure a supinated rearfoot. So there's ways that we'll look at how to adjust that here in a second.

The ways to measure it, you've got the one on the left. That is foot on the step. And what we typically will measure with that is, you want their knee over their second toe. So when they're lunging forward, the knee over the second toe is kind of a guideline to use. If you're there, you can control the knee. You definitely do not want them to collapse in or have their foot turned out to allow them to get ankle dorsiflexion because they will. I guarantee they'll get more. But it's not really what we're looking at. We want the midtarsal joints at a neutral position, the rearfoot a somewhat neutral position. We don't have to measure it. Usually the knee over the second toe is adequate. But that

little device in your phone right there. So iPhone, and go to measure, and then measure will have a level. The bottom right, it says level. And then you have an inclinometer right there. If you measure off the crest of the tibia, along the ridge of the tibia, there's not a lot of soft tissue influence. And that's a pretty good, consistent area you can measure from. I think hers is, I don't know, what that says, 20 degrees maybe. And a weightbearing, 'cause you're driving your body over. And you're not stretched. The knee is flexed. So now you take pretty much the gastric out of it because you're flexing the knee. So they should have definitely more ankle dorsiflexion in weightbearing with the knee flexed. What we can do is measure in prone. The middle picture here has my hand-hold, again, over the first and second.

So I'm controlling the medial column of the foot. I can measure this with the knee extended, and then I'll bend the knee up and measure it again with the knee bent, as the picture on the far right. I also like, with your hand on the medial side of the foot, it frees up the whole lateral side ankle. So nothing's getting in the way of your measurement.

So you can see a clear measurement from there. If there's a big difference between prone with the knee extended and prone with the knee bent, then basically it's a gastric tightness, a gastric influence, because you're taking that out of the equation by flexing the knee and getting more motion. Hopefully that's nothing new. Other ways to measure. Again, I'm looking at asymmetry. We talked earlier about a previous injury being the number one reason for an injury. And I completely agree with that. The second most common reason is an asymmetry. So looking at right versus left and measuring that. This is a box stood up, which we are mimicking a wall for video purposes and picture purposes. You can look at the ... I can't get my arrow. Looking at the distance from her big toe to the wall here. Still trying to draw this arrow so I can point to you. Okay, getting some help maybe. There we go, now I got it. It's on the left side. For some reason, I couldn't get it. So the distance between her toes and the wall

here. The key with this is, the foot should be pointed forward. The knee, as it hits the wall, should be over the second toe again. So you don't want the knee really going in, which is going to pronate the rearfoot. So one little thing, you have to watch for that too. But let's say this is her right side. And I have this measurement here. We normally measure in centimeters. And then you come back, and you take your left foot here. And same exact thing, knee over the second toe. And look at the distance from the wall here. So if there's an asymmetry, that's something to look at. Again, with the knee bent, you're taking the gastric out of it.

So is it more of a soleus problem? Is it more of a joint capsule problem? Is it a midfoot problem? We don't know. That's what we've gotta assess here, coming up soon. The other one that we typically do in the clinic is the standing reach test. If we can, let's play the third from the left video, yeah. That's a single-leg balance reach test. And I got these years ago from Gary Gray, doing Gary Gray's stuff. And I still use this today. We do a medial anterior upper extremity reach test, mainly looking for asymmetries. So what this looks like is a person single-foot balance, and reach out, and I'm measuring from the toes to the heel. The heel's gotta stay about an inch off the ground, the one that she's reaching out to.

Okay, so let's go back to the regular slide. The question I get with that is, when someone reaches out, do you control how much their knee goes in the valgus position or varus position or what their knee position is? My arrow again, please. It's coming up to the left of the screen so I can't grab it. There you go, thank you. So what I'm measuring, again, off the toes to the heel. And I'm just going for right versus left side, looking for symmetry. Again, what are the other things to control? Can someone bring their heel off the ground? Can someone's knee go into a valgus position, and do I care about that when I'm measuring? I do, but I really don't initially because the initial, first assessment, when they first come in, I just wanna see how they move. And if the knee goes in the valgus, that's one less thing I have to control about. I'm just gonna say, "Do

it." Eventually, they're gonna fail. So we're gonna go as far as they can on one side, and usually far as they can on the other side. And you will see big differences. This is a great measurement to do after anything, ankle-foot surgeries, ankle sprains, knee surgeries, ACLs, all that stuff, and just to see how they function, right versus left side. No questions yet, I like it. Okay, assessing the rearfoot. We're gonna start with the rearfoot. And if you look at the top picture, anything posterior, backside towards the heel, of that line is what we're talking about, meaning the rearfoot. It's basically, the calcaneus, the talus, the talocrural joint, and the subtalar joint. Those four things make up the rearfoot. We need to assess this in prone and in standing, but mainly assessing in prone. The rearfoot should have about 10 degrees of eversion and about 20 degrees of inversion from a neutral position. So if we can look at ... Let's go with the video on the bottom left, yeah. So this is how it's done. So going from inversion to eversion. And notice I'm not going straight side-to-side like a straight talar tilt test. I'm basically moving her foot into a pronated and supinated position.

So it's a tri-planar motion, kind of a scoop in, scoop out. It's resetting to play, there you go. There's 10 degrees, and there's 20 degrees. So now, you have the line on the lower leg and the line on the heel to measure with. We're gonna go through how to put those lines on here in just a second. But this is what it's gonna look like for assessing that. Now, let's go back to regular slides. Grab my arrow. Grab me an arrow again? There you go. So I'm looking at this line here in the lower leg compared to the line on the calcaneus. So if you can put your goniometer here in the middle, put one line up the lower leg, one line here, that's going to be about 10 degrees or maybe a little bit more there. And over here, the same way. Goniometer's here. Lower leg, calcaneal bisection. That should be 20 degrees. What I will do is, I just measure both of them at the same time 'cause I'm looking for symmetry. And, more important, if I have to measure this and it's six degrees versus seven degrees, I don't really care. It's tighter than it should be. So looking about 10 degrees. So hand holds to assess that motion of the subtalar joint. So the rearfoot's done. That's the measurement we did there. Now, in the

subtalar joint and how to find subtalar joint neutral. I put these marks on the foot. You definitely do not have to do that. But on the one on the left, I have a circle on the fourth metatarsal head. And the reason why we're gonna grab the fourth metatarsal head is because metatarsal heads two through four function as one basically. So you can control the whole foot from two through four. Number one, the first ray, and the fifth ray have their own joint axes. So they go kind of up and around instead of straight up and down. So how you can control the foot is by grabbing just the fourth metatarsal head. And it's easy to grab. Let's play that video. If you can't find the fourth metatarsal head, if you just dorsiflex the toes, the metatarsal head will drop right in your hand. So there's the fourth. I'm gonna come in and grab with my thumb. Notice my thumb also is in alignment with the metatarsal heads. It's not pointed up to the sky. So by grabbing that, the metatarsal heads, now I can control the whole foot, inversion, eversion of foot, and see what's going on there.

Okay, let's go back to regular slide. With the other one is, you're gonna come and grab your thumb on the medial side. You've got the arrow for me? There you go. You've got your thumb here on top the navicular and at the medial malleolus here. So somewhere in this area, this hole here, is where you're gonna find the talus stick out into your thumb. And on the other side, your index finger's gonna wrap around the foot, and you have the sinus tarsi area.

Basically, it's a hole on the outside of the ankle. You can follow the third metatarsal head up. I don't even think you need to do that. You'll find a big hole over here, a big soft spot hole where nothing's really there. That's where the doctors will use that for an injection spot to get into the subtalar joint. So it's definitely a big area. When you invert the rearfoot, or supinate the foot, you're going to feel this talus come out into your index finger here. Some people may not. This is a tricky one. It may not come into your index finger. It may not come in your thumb. But you definitely want to go to extreme end ranges. And if not, then you just go by the one that you have and you back off that

one 'til you don't feel it in your index or thumb at all. And that's your neutral position. Let's play the middle video. Thumb's right between the navicular and the medial malleolus. You've still got your hand on the four, so you're wiggling. Let's go one more time. Let's go to the next video. Here's coming around. There's your thumb on it. There's your index finger. Wiggle the foot back and forth 'til you feel the talus come in and out. You've got to think about, the talus does not have any muscle attachments. The only way the talus gets moved around is by movement of the foot. Hence, that's why you have to move the foot. In this case, almost like you're gonna sprain your ankle, invert it and roll it in. And that's where it's gonna come out on the lateral side. Let's go one more time with that. Okay, let's go next slide. So there's your hand holds, your markers for what you want to find. How we want to mark the calcaneal bisection and the lower leg is, I'll show video of this. What you're going to do is called the window grip.

Come on, there we go. I'm getting good at this. So window grip. So you're going to draw a line on the calcaneal bisection. And then you're gonna draw a line on the lower leg, kind of what's over here on the right side. This is an inclinometer. What we use is basically a straight edge. We're gonna use it as a straight edge for this. But we also measure small angles as we go along. So let's play the first video. This is what it's gonna look like. You're gonna come in and draw, just window grip on the calcaneus. Notice how the foot's straight up and down. You're gonna put a dot in between the PIP and the DIP. All I'm doing is kind of taking my best guess. There is a dot between those two joints. I'm gonna reassess it again and say, "Okay, I like that." I'm gonna come back with my straight edge. I have two dots, so now I can draw a straight line. I use a felt-tip marker just 'cause it shows up easier and I don't have to worry about digging in their skin. Try not to use permanent because you want them to be able to shower and have a clean foot later. Now, take my thenar eminence, put it on the medial lateral malleolus, just for consistency's sake, and I'm gonna go by the MCP joint and make another dot at the DIP joint right there. There's my two dots for that line. Come back

with my straight edge again. This way, you stay off the Achilles, and you can draw the line between those two dots. So now I have my calcaneal bisection and my lower leg bisection. Does it have to be exact? It's the best you can do. Practice it. So grab the fourth metatarsal head there. And come back with my thumb to the medial side, index finger laterally. I find the subtalar joint neutral, and then I can come back. What I'm looking for is, I want those two lines to line up. If they line up, my rearfoot is in a neutral position. So I don't have to worry about finding it. Now, let's go back to the main slide. The picture on the right, the calcaneal bisection, lower leg, I have my thumb on the talus on the medial side, index finger lateral side. I have this thumb on the fourth metatarsal head. And that's the position I'm looking for. So I'm hoping that the lower leg lines up with the calcaneal bisection. That tells me my rearfoot is in a neutral position.

Let's go next slide here. Subtalar joint motion. If I, again, look at prone neutral position, that's what I'm looking for, that's what I want. If I take the same ... Well, take a new foot. It's the same foot, but imagine it's a new foot. If I come and I find subtalar joint neutral, and I find that, now, the calcaneal bisection is going towards medially. So now I have the lower leg, neutral. I have the calcaneal now is in an inverted position. So that is a rearfoot varus position.

So varus position the rearfoot. You won't find an eversion position in the rearfoot because, at birth, when our talus de-rotates enough to get our big toe to the ground, it doesn't keep de-rotating. So if you find in this prone neutral position here, if you find your calcaneus, the line on the calcaneus is showing you a rearfoot that's an eversion, your lines are wrong or you're not neutral. So the only thing you're gonna find here in the rearfoot is a neutral or a rearfoot varus position. If someone can't lay on their stomach, you can also do it in half kneeling position, like this. That's the same thing. If someone's pregnant, if there's back pain, for whatever reason they can't lay on their back, you're okay. Now forefoot positions, you do the same thing you just did. Your

rearfoot is held in that neutral position. And what you're looking for is, now, this lines up. So your rearfoot is neutral. So now you can get rid of this line. Who cares about this line anymore on the lower leg? What you're looking for is the calcaneal bisection and the metatarsal heads. In this case, I used a blue pen. But the metatarsal heads should be perpendicular. If they are perpendicular, that's neutral. That's exactly what you're looking for. That's what you want. If you come down and just go back to that rearfoot varus position, so remember, in neutral, the lower leg bisection's here. The calcaneus is here. So this is a rearfoot varus. Remember, we talked about ... I thought I grabbed the arrow. So this is in a rearfoot varus position. Again, get rid of this. Take this out of the equation.

And now, looking at rearfoot compared to metatarsal heads, a calcaneal bisection and metatarsal heads are still perpendicular, still 90 degrees, this angle here. If you didn't think about it and you just looked down and saw just the metatarsal heads, you can see that's a forefoot varus because you're deviating towards midline. It's not a forefoot varus. It's a rearfoot varus. So that's the tricky part. That's probably the trickiest thing I'm gonna throw at you today. Forefoot variations. Remember we talked about the rearfoot, you can only have a rearfoot varus. In the forefoot, you can have a rearfoot varus and a forefoot valgus.

So I have a deviation towards midline. If I have this line on the lower leg is parallel to the calcaneus, so this is neutral, metatarsal heads are deviated towards the midline. That is a forefoot varus. Think about walking. We talked about the primary function of the foot with walking is you have to get your big toe to the ground. If someone has a forefoot varus position, it's going to take longer to get the big toe to the ground. So the rearfoot's going to have to pronate more to get the big toe to the ground, which is gonna lead to some potential problems. And this is probably the thing that you'll see in the clinic the most as far as foot pain. Also, you can have a forefoot valgus. So the rearfoot, again, is lined up with the lower leg. But now, again, these are both left feet.

So left foot, this first metatarsal head is dropped, plantarflexed, so now it's a forefoot valgus position. So let's go back to walking. If this person walks, the whole goal is to get the big toe to the ground. This toe, the big toe, is going to get to the ground sooner. And so by it getting to the ground sooner, the rearfoot doesn't have to pronate. So that person you saw walking earlier on the video that had the rearfoot staying out there and never came into that little medial heel whip at the end, but stayed out there, that can be a problem. We don't know if that person that was walking away from us, that we saw that line never go to neutral, we don't know if it's a forefoot valgus or plantarflexed first ray position or if it's rearfoot mobility. There's no way to tell. There is a way to tell. The only way to tell is what we did. We looked at and assessed rearfoot mobility.

Do they have an adequate amount of eversion to do that? And now, we've got to look at what the forefoot does, mainly the first ray. Keep all those things in mind. And these are all just little pieces to the puzzle that we're gonna put together. Again, what we just talked about, you have it written down there. Forefoot varus will take longer. The rearfoot's going to have to pronate more to get the big toe to the ground. The forefoot valgus, the big toe is to the ground sooner. And so the rearfoot doesn't have to pronate as much.

You're gonna stay out there and be comfortable. Now, the first ray, it's the first cuneiform and the first metatarsal. So what are you looking for? You can assess it in long sitting, and you can palpate the metatarsal heads from the fifth to the first. We're gonna show a video of this here in a second. Assess those. They should be in alignment. They normally are in alignment. From two through five are pretty much always in alignment. When you get to first, things can happen. What you want is the metatarsal heads one and two to be lined up. While you're assessing, your index finger and your thumb are in alignment. So if the fingers don't line up, it's either plantarflexed, which is dropped down, which is more common, or dorsiflexed. And I see probably

four or five dorsiflexed ones a year. So they're not that common. More importantly, since they're there, a good stable plantarflexed first ray, I'll take that foot all day long. That's a good, stable foot. But then we have to assess the mobility of it. We move it up and down. And it should move about one index finger above and below your stable one on the second. And we'll show what we mean by that. So in a neutral first ray position, you're going to assess it. Actually, if you can play this video please. I'm starting at the fifth and working my way across to the first. From there, my index finger and thumb should line up. Then I'm going to assess mobility of it. Does it go one finger above and one finger below? Notice again, the joint axes are there. It's not just straight up and down. It's more of a rounded axis. You're kind of down-and-in, up-and-out kind of position again.

So work my way across, get to first, equal above and below. That's perfect. That's where you want it to be. Now, let's go back to the main slide. Again, I've lined up ... The cursor, give me my arrow. There you go. The arrow here is lined up. Index finger's lined up. Thumbs are lined up. That's what you wanna see. That's neutral position there. I'm not forcing this with my right hand here. I'm not pushing this either way. I'm just laying my hands on, fingers across, and seeing what it gives me, not forcing any direction. Let's go here.

Now, if we get to that position and I go here, this is slightly off. So this is not a great example. Slightly off here. My index finger on this hand is slightly below. But more importantly, you can see the thumb is below. My right hand is below my left thumb. That's a plantarflexed first ray. That's what that would look like. And if you're going to see them, they're pretty much there. If you have to really study them close enough to measure, I'm not gonna worry about it too much. More importantly, with this one, on the right picture here is, if you look at my right hand coming over to neutral, that index finger is way above that. That's not what you want to see. This is a good example of a bad foot, let's say. So that's definitely a dorsiflexed first ray. Now, when you assess

mobility of this, and I did, this one comes up easy, really easy. When I go down, you're gonna get about even is the best you're gonna get. There's no way, at this, my right index finger here is not gonna drop below the second metatarsal index finger. No way. But that's how you assess it. Also, let's go back up to hallux dorsiflexion, a little bit farther down the foot. You should have about 60 degrees of this to walk. And you want about 90 degrees to run, to run up stairs, to do fast, a lot of jumping sports. You definitely want mobility there. So to measure that, you're coming off the hallux. You're coming off the hallux bisection there, and then up the first metatarsal head, not from the ground, but first metatarsal head. So that's probably, I'm guessing, roughly 80, 85 degrees. The first ray mobility can affect the function, the function and use of available hallux dorsiflexion.

So let's say that foot that I just showed you, that was a dorsiflexed first ray. In a non-weightbearing position, this is easy. She has plenty of motion. I actually think this is the same foot. So she's got great motion there. However, when she stands up, if she stands with her weightbearing on the medial side, it's going to dorsiflex the first ray up. If you dorsiflex the first ray up, you take away the ability for the hallux to dorsiflex or to bend, to extend here.

And that's what happens in gait. Remember, to take a step, for your body to come over your foot, you need 60 degrees minimal to walk. She was an athlete. She played several sports, played college volleyball. She has to be on her toes. She has to be on her forefoot, to react, to jump, to land, all that good stuff. So you want this available motion here. If not, the first metatarsal is going to get pushed up. And as the toe tries to extend or dorsiflex, you're going to get pinching at the first MTP joint here and cause excess bone formation on top of the foot, which you'll see just by standing and looking at people. That's down there. Go back to midtarsal joint. What controls what the forefoot does? So the midtarsal joint assessment. It consists of the talonavicular and the calcaneocuboid joints. Let that set in a minute. Talonavicular is gonna be right

basically through here, where the talus hits the navicular. And the calcaneocuboid is going to be right over here, in this side over here. The talonavicular joint, it's made into the longitudinal axis of the midtarsal joints. So it's primarily responsible for inversion and eversion of the forefoot. So we're thinking about pronation, supination, components of pronation and supination. There's three of them. Each of them have three, obviously. So for the longitudinal axis, the only thing we're looking at is inversion and eversion. Let's play this video. We've got eversion, inversion. Inversion there. That's the way the forefoot's moving through from the rearfoot. That's one joint we're going to assess.

Now, let's go to the next slide. The other one of the midtarsal joint is the calcanealcuboid. So its angle of movement is about here, this line. The joint axis is about here. We could also call it the oblique axis. What this one will be responsible for, components of pronation and supination. It's gonna be plantarflexion and adduction, which is down and in, and dorsiflexion and abduction. So you can say dorsiflexion abduction. For us in the classes over the years, I actually think Suzie Lefever came up with this. It's just kind of down-and-in, up-and-out. It's a lot easier. Let's play the video on the right here. So there's your up and out. There's your down and in. Up and out, down and in.

So together, these two joints, the talonavicular we just did inversion-eversion, and this one, we're going down and up and out. Those three motions, basically, make up pronation and supination. Now, let's go back to the main slide. What you're looking at is, they don't separate, let's say. So when we go to asses them here in a second, they don't separate. They function as one. They basically work together. Now, what we've got to look for is, are those joints, let's say the midtarsal joints collectively, are they loose or are they stiff? If they're loose, they're going to cause a delayed response getting to the forefoot. They're going to cause the midtarsal joint collapse, which typically more pronation to the rearfoot is needed. So a lot of things can happen with a

loose midtarsal joint. If it's stiff, not as bad. But typically, as they're non-shock absorbing factors, that's your inverted rearfoot, and those things come into play. But if you pronate the rearfoot, the midtarsal joints will move easily. You basically unlock the midtarsal joints by pronating the rearfoot. If you supinate the rearfoot, and I mean supinate it, not just put it in a little bit. You've got to turn it, kind of drive it up a little bit, and twist it to really supinate it, almost like you're trying to sprain their ankle. That's going to lock the rearfoot, and then the midtarsal joints should become less mobile. They don't have to completely stop moving, but they need to be less mobile. So what is a normal feeling? It's like taping an ankle. You have to do a hundred of them or plus to get what the right angle, what the right feel, what's loose, what's not loose. Again, you have to practice this stuff. So if the midtarsal joints get stiffer with supination, then this tells us that we can affect the forefoot stiffness if we can get the rearfoot to supinate.

So basically, you're going to give ... The rearfoot can set up the midtarsal joints, which will set up the forefoot for a nice smooth transition and a push-off step. If the midtarsal joints stay loose when you supinate the rearfoot, that means that they need something. They need exercises, possible external support, such as taping, wedges, shoes, orthotics, whatever you wanna try to get them external support, because no matter what we do with the rearfoot, the midtarsal joint's still loose, still sloppy.

So you're not gonna push off the ground with a stiff foot. You aren't given the opportunity to. Typically, for these, our first go-to is taping. We'll do a navicular sling taping that we'll briefly talk about in a minute. And that just gives them the support, allows them to transition out of pronation and into supination, in hopefully a timely manner. So this is what they look like. We're going to look at longitudinal axis. Remember, longitudinal goes inversion-eversion. Oblique axis goes plantarflexion-abduction, but let's say down-and-in, up-and-out. We can play the video. All right, so there's the hand hold. I'm on the fourth. I'm not on the first ray. The

first ray has a joint axis of its own. So I'm gonna grab the medial side with my thumb side. And the forefoot, notice I'm kind of close to the midtarsal joints, but also distant left towards the toes without just grabbing the toes. And that's kind of where your hand should be. So pronate the rearfoot, loose. There's your oblique. There's your longitudinal axis, good. Now, if I supinate the rearfoot, and I mean really get in there and supinate it, I should lock up some. She still moves. This foot, I guess, still moves, which I would like it to be a little stiffer as I supinate the rearfoot. So there's your pronate the rearfoot, down-and-in, up-and-out, inversion-eversion. Supinate, there's the trick. Supinate the heck out of it. I would ideally like that to be even stiffer. But that's what you're assessing.

You're assessing the tarsal joints. And what happens as we get older is, the midtarsal joints start to get laxed. Either we put on weight, or we've had kids, or just a lot of time on your feet. And typically, you will increase your shoe size. From when you're 18 to 60 years old, you'll increase your shoe size by maybe two sizes completely. So that's things that, they just loosen up. That's when your bunions can start coming in even more prominent at this age.

And all those factors come into play. Let's go back to your main slide please. All right, so brief recap. Let's put this together. I'm hoping I can get some kind of questions could come in maybe, if we have some questions. But we still have more to go. But a brief recap. The talocrural dorsiflexion mobility is necessary to allow the body or the tibia to advance over your fixed or weightbearing foot. You have to figure out if it's a mobility problem or it's just a compensation problem that they've done in the past. So it's one thing definitely to look at and measure it. I just gave you several different ways to measure it. Don't get caught up too much in measurements, I would think. I'd say go by asymmetries are your most important thing. And then rearfoot mobility is definitely necessary to allow the pronation to get the big toe to the ground. So there's your rearfoot mobility. You have 10 degrees of eversion. Some way or another, your foot is

going to find a way to get the big toe to the ground to take another step. We realize that. But is the problem coming from rearfoot, not only talocrural joint, but rearfoot mobility, your inversion-eversions. Does it have enough motion from there? Again, if it's a mobility problem, you've got to address that. Whether it's joint mobilization or however you want to get it to move better, get it to move better. That's what you gotta do. Next thing is midtarsal joint stability. So when you do their lock-up test, it should be stable. It should get definitely stiffer. It's vital to allow the foot to resupinate in late midstance to terminal stance.

As your swing leg starts to come through is definitely when you want the foot to resupinate to be able to push off the next step quickly. Looking down the forefoot, the forefoot assessment, if you have a forefoot varus, a deviation towards midline, so perpendicular. Their big toe is farther away from the ground, let's say. It's going to cause the rearfoot to pronate more than normal. It has to because the big toe has to get to the ground, which can lead to all kinds of problems on the medial side of the ankle and the foot.

A forefoot valgus position, or plantarflexed first ray, first of all, you don't know which one that is until you look at it and assess it and look at mobility of it. It may cause the rearfoot to stop pronating faster, thus causing the rearfoot to stay inverted. That's watching someone walk away from you. Again, you don't know if that line, on the calcaneal bisection line, if it does not get to neutral and through neutral, you don't know, your first, initial impression, you don't know if that's a rearfoot mobility problem or if it's a plantarflexed first ray issue. So you have to assess it. That's why we have to go through these assessments. And they're brief. They don't take long. We will get to there, how they don't take long. I'll show you that at the last slide that we do. Now we've done assessments off the table. And that's why we've done them off the table, because when you watch someone walk, you need to know what's available motion. Let's go back to neutral again, but now let's do it in standing. What happens when the

foot gets on the ground? It's a neutral-to-relaxed position. I have a dog in the background, cool. Neutral to relaxed position should measure around five degrees of motion from inverted to an everted position. So total of about that motion. In standing neutral, the picture on the left here, shows I have put her in neutral, and I have the inclinometer. That's on the ground here. The right side of the inclinometer is on the ground. The left side is up because I'm measuring that calcaneal bisection line. So in this case, I can't zoom in on it. But let's say I have about two degrees, two degrees of inversion, which is what I want. Got the arrow for me? There you go. Notice that this part of the inclinometer's off the ground. So I'm measuring along this vertical line here in the heel.

Now, if I have her relax and go into a relaxed position, then over here, the rearfoot goes into eversion. And I'm still measuring that line in relaxing. That's exactly what you want. When someone's standing and you relax, you want them to go into pronation. So now, if I measure this line here, this side of the inclinometer's off the ground. And it goes to about three degrees or four degrees. So that's why I'll go from two to three or four degrees. That's five degrees of motion. If I move five, if I move six, if I move four, it's a moot point.

Somewhere around five degrees is what's ideal. More importantly, she starts in an inverted position and goes through neutral and ends in an everted position. That is ideal. You can play the video, yep. So this is the process. This is what it looks like. This woman's up on a level surface, hopefully a level surface. It can be a box. I don't like the ground 'cause I don't like to get too close to the ground or lay on the ground, but you can. We just have a box. I can use a rolling stool in the clinic. And this is just a step up. But I'm using my lower leg to invert the ankle and evert the ankle. I tell my patients, "Act like you're gonna sprain your ankle," and they pretty much know what that means. They don't turn their foot out. Depends on your population, you may have to use some different wording. But that's fine. So I get neutral, and then I see where that's at. I put

the inclinometer on it. You can start by measuring ... Just have the person relax and measure that line to begin with. You don't have to put them in neutral measure first. You can measure their relaxed first, and then put them in neutral. In this case, I'm using my right hand. So my thumb is now on the lateral side. My left hand, I'm actually helping control. I'm internally and externally rotating the tibia, which is going to drive the ankle the way I want it. I'm going to have her go out, and I'm gonna have her come in real slow, real slow, and I say, "Hold that position." So as I'm saying, "Go slow," I'm looking up at her. I'm talking up to her because she doesn't know what I want. Your patients will not know what you want.

Once you get it said, you go, "Slow, slow, slow. "Okay, stop, hold right there." And then, once you hold right there, then you can come back with the inclinometer and measure that line again. In this case, it's right there on the line, so it's probably zero is where she's at. Now, if I have her relax and she goes into eight degrees, then from zero to eight degrees, that's more motion than I want. And it started at zero. It did not start in an inverted position, which is not great either. So main thing, think about five degrees of motion or so.

But it should be from an inverted to everted position. Most of the patients that you see in the clinic will not be this way. They will not be ideal because that's why you're measuring them. Let's go ahead and, next slide. So let's say what I just said again. Should have about five degrees of motion, ideally from inversion through neutral to eversion. And then, if you have excessive eversion, that can lead to several common pathologies, such as plantar fasciitis, posterior tibialis tendonitis, even to go back to Achilles. I keep throwing Achilles in here because it's not always a lack of ankle dorsiflexion problem, because Achilles is a later-stage secondary restraint of ankle pronation also. So anything to the medial side. Numbers that you can look for, if you get from zero to 10 degrees, that's a lot. You can get 12. That's about as much as you're gonna get. From there, we also do a partial squat. But we're not gonna worry

about that for this talk. So excessive rearfoot eversion can also be caused by several factors, including proximal weakness. Again, we're not going to talk about what the butt, the glutes, can do to your foot. But it can add a tremendous amount of help for your foot. And then also is it midtarsal joint laxity. Do you need to put something under the midtarsal joint to stabilize? And again, we always start with tape. A lack of rearfoot mobility in standing can be due to a stiff subtalar joint or a plantarflexed first ray. We have had people, and you may get them, if you put them in a neutral position and you ask them to relax, when they relax, their rearfoot goes into inversion more. That's not what you want to happen. And we are set up to collapse.

We are set up to collapse immediately. If you look at the medial ankle joint structures, the ligament structures, the medial versus lateral ankle, medial versus lateral knee, we are set to collapse in. So think about that as you're doing it. And then if someone, when you ask someone to relax, and their rearfoot goes in an inverted position, that is a high risk for ankle sprain. Typically, that's a plantarflexed first ray problem, a stable or rigid plantarflexed first ray problem. But it also can be a rearfoot mobility problem. And that's someone that a different taping would help, and then potentially an orthotic device.

But a lot of just get it to move, get it to move. So what do you do now? You've completed your subjective eval, and hopefully you've listened. You've completed your visual gait analysis. You don't need to be on a treadmill yet, just watching them walk across the clinic and back. You've completed your rearfoot mobility. Don't have to measure, but move rearfoot mobility once you put them in neutral. Midtarsal joint stability assessment. So is it loose? Does it lock up? Does it get stiffer once you supinate the rearfoot? And then, bottom line, is it a mobility or a stability problem? That's what you're looking for. Usually, if there's both, you're going to always address the mobility first. It's the same thing in any joint we're looking at, but particularly for the foot. Looking at mobility first. Is it in the rearfoot? Is it in the tarsal joints? Is it in the

first MPP? Where is it at? Because you want to go after the cause and not just the pain symptoms. That would drive me crazy. You'll get me on a whole different tangent on that one. Again, if it's a mobility problem, get it to move. We talk about several different joint mobilizations in class. We know that there are several joint mobilizations online that you're good at, that you practice in school. I don't really care, to be honest with you, what joint mobilizations you use, as long as they're effective. I typically use a lot of mobilization with movement. I've heard over the years of listening to other people speak and talking with other people that that seems to be kind of their go-to as well because it actively involves them and they're not just getting some passive treatment.

Also, some passive stuff, but also mobilization with movement seems to do well. iStem, you can use instrument and soft tissue mobilizations. I don't care what tools you use. It doesn't matter if it's just your hands, if it's something you've created, or something you've purchased, whatever, if there seems to be some more evidence as we go along that doing joint mobilizations with that seems to produce good results. So definitely don't forget about soft tissue.

Stretching-wise, if you're going to stretch with a mobility problem, please stretch them correctly. Again, if you're stretching ankle dorsiflexion, don't let them turn their foot out and drive their knee towards the inside their big toe. Remember, ankle dorsiflexion, we need the most amount of ankle dorsiflexion at terminal stance with the rearfoot in a slight supinated position. One of the easiest ways you can do this in standing to stretch ankle dorsiflexion is raise the big toe up. So with their foot pointed forward, raise their big toe up. That's going to plantarflex the first ray, create an arch in their foot, and supinate the rearfoot. That's how you want to stretch the . Then, also, we can use the Mobility Wise exercises that emphasize mobility. We have several exercises we use in the clinic and pick up all the time to try new things, but get it to move. Usually, your exercises that emphasize mobility are for lack of rearfoot eversion. They don't have that 10 degrees. So think about some exercises that will use body weight or

additional weight or resistance bands that will emphasize that mobility. We can use fibular relocation taping. What that does is definitely puts more weight to the medial side of the foot. I don't know how it does. Nobody knows how it really works. But it works. And when someone has peroneal tendonitis or someone with lateral ankle pain, that is a great thing just to offload the lateral side of the ankle. Neutral to less stiff shoe, those will work usually well unless they're really collapsing into inversion. And if the neutral shoe has a soft rearfoot area, if it's too soft, they're just gonna collapse into it more. So it's something you have to ... It's not always ... Again, there's no specific protocol.

But that's one thing that could possibly work for them. Lateral wedges, if you put a lateral wedge, maybe a thicker wedge, two, three, four-degree wedge, underneath their insole in their shoe and hopefully get them to pronate more, the potential problem with doing that is they have to have the mobility. You can't force the into something they don't have. So that would be something to do after you do your joint mobilizations, your mobilizations with movements, anything to get more mobility exercises. And then, when they walk out the door, then you can probably put a lateral wedge in their shoe and see how well that would work.

So that's always good with that. If it's a stability problem, this is where we come in. This is what PTs do. Usually it's the medial foot or ankle pain due to excessive or uncontrolled pronation is why you get the medial side. However, think about, if someone has a lot of pronation problems, they're going to collapse the lateral side of the foot also, just so to the lateral malleolus. So people that get ankle pain in there, the doctors, they'll come with diagnosis from their doctors that it's an ankle sprain, although the doctor never put their hand on them, never really asked them what causes the pain. It comes with ankle sprain. But you've got to be consistent in your evaluation and your reviews why they're getting that lateral ankle pain. And I can tell you, a lot of times, it's from compression. They pronate too much. They pronate too

long. When they land, they go into pronation. They're collapsing medially, which is compressing the lateral side. So how do we get more stability with that? Definitely exercises. We have pages of exercises, to get more single-leg balance exercises with that, to increase stability with the exercises. And that's what PTs do. That's what we should be good at. Wedges, again, use your medial wedge. It can be at forefoot if the forefoot needs it, meaning the midtarsal joints are unstable. You can put something in the midfoot. But usually it's the rearfoot you'll get your biggest bang for your buck because, if the rearfoot is in a stable position, in a good position, it can set up the midfoot to do what it's supposed to do, which will transition to the forefoot. So wedges, again, two, three, four-degree little wedges you can purchase, you can make. But they're going inside the medial side of the heel underneath their insoles that they're currently wearing.

Our biggest go-to with this is in navicular sling taping. So we've done this for years. I would say very rarely do I get through a work day that I don't do at least one navicular sling taping. What it does is, it increases the height of the navicular. It doesn't let the navicular drop as much. But it will when you're weightbearing. It's tape. But it's stability tape, using Leukotape and the coverall.

So you're looking at just increasing stability, basically giving them a chance to resupinate their foot from mid to terminal stance. And that will take pressure off a lot of things on the medial side, even your Achilles tendonitis problems, as well as open up that lateral side joint so they don't have lateral ankle pain if it's from pronation. So that's what we use all the time. And we practice that in our class, again. I'm sure there's videos out there of it somewhere on YouTube. Everything's on YouTube. Take a look and practice that. Proper shoes, what are proper shoes? That's a loaded question. There's a big article literature review that just came out about a month ago that we just updated our class with. And there's talks about several things in there, what is a proper shoe. It depends on what you're trying to get to. It depends on what you need it for.

There's all kind of depends, depends, depends. But the proper shoe, basically, is one that you should wear and not get pain in. We used to say, "Well, if you have this type of foot, "then you need this type of shoe." Now, we know that is completely not true. So you can't get molded into, "If you have this type of foot, "you need this type of shoe," not anymore. Shoe designs keep coming out. Shoe companies have to make new models, new designs, new techniques, new materials all the time. They have to sell shoes. But if you look at the foot injuries, running-related injuries, they haven't really gone down a whole lot, even with the better shoes. You can get someone who runs a sub-two-minute marathon with better shoes, but that's only for him. I'm still not convinced the shoes made that much of a difference. Proper shoes, that's a big question. We team up with our shoe store, our local running shoes store that goes with us. We work well with them.

Usually, the running shoes stores will give a 30-day money-back guarantee or trade it in for a new shoe at least. So try that with your shoes. We will videotape someone in a pair of shoes and see how bad they are. And then we'll show the patient and say, "We want you to get these type of shoes." We don't say, "Go get Brooks Adrenaline 2.0" or whatever. We tell them we want a stability shoe, a neutral shoe, a forefoot rocker shoe, something that we want there.

And they can go try them on. I say shoes are like cars. There's good Chevys and bad Chevys. There's good Fords and bad Fords. There's good Porches and bad Porches, whatever. But what fits your feet. Just because they're great shoes for your neighbor does not make them great shoes for you. So there should not be a break-in period anymore. You should be able to wear them out the door and be comfortable, and be comfortable tomorrow, and not have a big break-in period. Otherwise, what we'll do for stability problems, again, we don't jump to it as much as we used to, as fast as we used to. But we have over-the-counter orthotics that we carry in the clinic. One of our sponsors with that, I've been using about 12, 13 years now, have great success with

them. We can heat mold them. We can put wedges in where we need them. That's a great, quick start with that because we have them. They can walk in the clinic, they can walk out with them that day. We also do custom orthotics. So we cast for them. We plaster cast, do a bunch of measurements beforehand. The measurements that we do beforehand are a lot of the same measurements that we just showed you. It does not need to be ... It can be fast. I can cast an orthotic, I can do it in about 15 minutes if I had to. But otherwise, I want to listen to their problems. I want to see how they walk. I want to see all kinds of things.

And people that have come to us from going to other people before, they'll say, "Well, I've never seen anybody "measure this much for making an orthotic," or, "I've never seen anybody assess this much "or ask this many questions." That's what we do. We have a great relationship with our orthotic company we use. Again, talking with the orthotic company down there, if you don't know that route but you're interested in that, definitely you can contact me later with that if we need to. I still think there's a need for them. When you look at someone that's a really, I say, a trashed midtarsal joint, you can exercise 'til the cows come home. It's not really going to help as much. You're not going to get the foot, all the intrinsic foot muscles, you're not going to get the six-pack on the bottom of the foot. It's just not going to happen.

Again, I think a lot of those people have that type of foot because they're not really exercisers. And they won't follow through with the home program. So I don't mind jumping to that right away. Okay, let's go here. We've got one question. Question coming about the navicular sling taping. I won't show it on here. I didn't know if we had time for it. That will be, if we do another one, we will do it. But you can go on our website if possible, or contact me after this, and I can direct you how to look at it. Again, I use it every day. Then we've got, "Do you like the Hoka brand shoes "that are so popular in the running stores?" Hoka brand shoes are okay. They are good for some things and for some people. They are trying to get ... They like their thickness

cushion-type shoe. I know they're trying to get into a little minimalist right now. I think they can stay in their lane with the cushion stuff. For typically people with knee problems or arthritic-type problems, the older population loves them. I know if you look at the Iron Man Triathlon results, there's several people that wear the Hokas in those because of distance and time on your feet. I personally have not tried them, I don't know. But the person who teaches the running course with me, she likes them, but she would rather go the minimalist route. So she runs in ultras. And I think they're fine. Okay, this couple questions there. People always want to know how long, does it take a long time, is it fast, what can we do. I think, again, subjective, listen to them. Watch them walk across the floor. Forget about the lines. Just watch them walk. If you watch enough people, it gets pretty obvious.

Otherwise, once you get to the assessment part and you draw the lines, this is how fast it can be. So let's go ahead and show the video. So come in, grab the fourth. Go right into neutral position. There's my rearfoot lining up. There's my inversion-eversion, the rearfoot assessment, which was good motion, good symmetry. Turn over, grabbing there. Down and in, up and out, inversion, eversion. So midtarsal joint stability and supination, and now in pronation. And then I'm grabbing, work my way across the metatarsal heads, looking at first ray position and then mobility of the first ray and then how much hallux dorsiflexion you have.

And I think, by looking at the video, that was done in 27 seconds. So once you get a pattern ... We'll show it again. I'm gonna show it a couple times, actually, while I'm talking, and then I'll answer some more questions if you have them. We're almost done. So inversion-eversion, checking rearfoot mobility, 10 and 20 degrees. So you notice I'm staying off the first ray. So my right hand's on the lateral side of the foot. I pronate the rearfoot. I should get a lot more motion. I supinate the rearfoot a lot, and that should loosen up some ... I'm sorry, should stiffen up some. And then, metatarsal heads, are they in alignment, one through two, and then how much mobility do you have from

there, how much dorsiflexion do you have. All right, so I won't talk through it. I'll just let you watch one more time. Every time I see the video, it's 27 seconds. That's good. I've got a question coming in that says, "Can you make the assessment and technique videos "available in the class links for review "as I learn to assess feet?" I'm going to say yes, but I don't know that question. That's a question Calista or Kathleen can help direct with that. Can you guys help me with that answer? I'm gonna say yes. They own it, so they can do whatever they want. I just want you to get comfortable learning feet and practice. I'm going to say yes. If not, you can contact me afterwards, and I can get them to you somehow. All right, let's go back to regular slide. I think some people that are at lunch get to go back to lunch a little bit early. With that, let's go here. We've got a couple more questions, let's see.

Do I like the orthotics that have the raised bubble in the middle that helps Morton's neuroma? If it's a metatarsal pad, that's what you're talking about, that little teardrop, and if it's for Morton's neuroma, yes. But you don't have to make orthotics to do it. You can cut with a felt pad that teardrop shape and use paper tape, and tape it onto their insoles that are in their shoes.

The tricky part with that is getting it in the right location. So what I would have someone do is, I have them stand up. I take a foot model first, and I say, "This is where I want the pad." And it should be just proximal to the metatarsal heads. So it should be towards the arch of the metatarsal head site, but not pushing the heads up. And then, you want that tear drop to go there, basically between three and four. I'll have them stand and say, "Okay, this is where I think it's going to go. "Does it feel like it here on this model? "Is this where you feel it?" And if they say yes, I hold my index finger there, and I have them step off of it. And then I will use paper tape and put it in place. The reason why I use paper tape is because, if you're putting that on the insole of a shoe, when you got to take it off, it doesn't leave a sticky residue. It doesn't pull the insert if you use a stiffer tape. And with that, you can also make changes if they don't like it. Or

if they don't like it, they can take it out. That's kind of, yes, but I will do that. What I have been doing more in my custom devices lately, if someone has metatarsal head problems or metatarsal pain somewhere, is I will use a metatarsal bar instead of a ... It supports, it pushes up two through five instead of just that three and four small area. Ah, a million-dollar question. What is the best shoe for plantar fasciitis? First of all, we've got to figure out what is causing the plantar fasciitis? Is it a pronation problem? Is it a supinated foot? So there really is no best shoe for it. But I think the navicular sling taping is going to be your first go-to. And that can be done day one when they come in.

Again, even if it's a high-arch rigid foot, they still like the navicular sling taping with that because it just gives them support and total contact of the arch. Usually, the number one reason for plantar fascial, plantar heel pain, is limited ankle dorsiflexion. That is the number one reason why. So you gotta figure out what's causing it. So hopefully that answers that. There's no magic one. What do I recommend doing if you notice a leg-length discrepancy during ... I can't say any more than during. During running or whatever, I used to be a little concerned with leg length difference.

There's a study that come out, running, last year, last six months, that basically said that there was no increase in symptoms with a leg-length difference, no increase in running-type injuries with a leg-length difference, unless it was males that were very heavy, and they had basically a three-quarter-inch leg-length difference. So if you're looking down to that quarter-inch area, three-eighths of an inch, I typically don't get too caught up with it anymore. You can look at if someone's walking with asymmetry and they do have an early heel rise or a shortened length or shortened stride length, again, what are you gonna do about it? First, is it a true leg-length difference, or is it a side joint problem? That's the other part you have to look at. I don't know, I just don't get caught up in it too much. If I did see someone, and I had someone stand, in bare feet, stand on a half of a towel that's probably a quarter-inch thick or so, if they stood on it

and weight shifted back and forth, and they said, "Oh, yeah, that feels a lot better," if it's a true leg length, I may put what's called a sole lift. So it's a white crepe material, but I cut it the whole length. It's like the insole, but I cut it the whole length of the shoe, take the insole out, put that in, put the insole back on top, and that kind of raises their whole foot up. The problem with that is, you can come with a little bit of a shoe volume issue if it's tight, if it's tight in the toe box area. You can look at that. But that would be my main thing for leg-length discrepancy. I'm not going to get too caught up with it. I used to. I used to put a heel at the end. I used to do something like that. Good question. It says, "Sorry I missed this, "but how can a rigid plantarflexed first ray affect gait?"

So if you're doing your assessment of the midtarsal joints, and you're going five over to one, and you see one is down, plantarflexed, I'm okay with a plantarflexed first ray. In fact, I almost like a little bit of a plantarflexed first ray because, what happens with a plantarflexed first ray is, you create your arch height. You keep your arch height up. And with a plantarflexed first ray, you also increase dorsiflexion of the hallux. So your big toe can bend a lot more at the terminal stance. If it's rigid, as your body comes through ...

No, at your initial contact of the foot. Remember, you're going to hit lateral heel, medial heel, fifth ray, and then first ray in that order. So if your first ray gets to the ground, especially if it's rigid, if it's a plantarflexed first ray rigid and it hits the ground sooner, your rearfoot does not need to go into pronation. So you're not going to shock absorb. So you have a higher instance of ankle sprains. You're just going to stay on the outside part of your foot because that rearfoot doesn't need to do anything. So how would you treat that? Try to mobilize it, for one. Try to get it to move. If not, you're going to have to cut out, they call it the first ray cut-out, in either their insole in their shoe or something that's custom or something that's over-the-counter orthotics. And by cutting that out, what that does is allows them to ... It takes longer for that plantarflexed first ray to get

to the ground so it can allow some rearfoot mobility. Usually, what goes along with a plantarflexed first ray is a rearfoot that stays in inversion. So you don't have that 10 degrees of rearfoot eversion. So I think you've got to look at what's causing the situation to be worse. If you just say your rearfoot mobilized and try to get your rearfoot eversion and you get it, somehow you get it, now what you're trying to do is, you're putting more weight on a rigid plantarflexed first ray, and you're gonna jam more weight to the first ray.

And it's not gonna like it. So my gut feeling with that says that you would get a basic custom device to cut out the plantarflexed first ray and put a little lateral wedge on the heel and allow them to move easier. What you can do, also what you can do quickly, is that assessment that we did in standing. We did neutral to relaxed in standing. Remember when I said, when you get in neutral, when you relax, you should go into more pronation, or collapse in, and if you don't, what you don't want to happen is, you don't want the rearfoot to go into inversion, go to the outside. So one way you can look at that is, let's take the metatarsal heads off the box.

So you can put the rearfoot in neutral again, and now have them relax. Now, the plantarflexed first ray is taken out of the equation because it's off the front of the box. So now you can look at rearfoot eversion in standing without the forefoot supported and see what happens. So that's kind of the ways to assess it with that. But mainly, I would cut it out and make it take longer to get to the ground. Hopefully, that answers. Any other suggestions for the neuroma besides met pad with paper tape? I think it's a shoe volume issue, to be honest. A lot of times, if someone ... Have them wear a flip flop. Wear something else at home that doesn't compress, if they can do that. If it's someone with a climbing shoe or a hiking boot or something that is compressing, ski boots, then that can definitely be a problem. I would have them, when they get home, get out of their shoe, wear a flip flop around the house, and potentially put that neuroma pad in it. Other than that, there's not ... Time and making sure they're walking

correctly. How are they compensating to walk? If they turn their foot out to stay away from the neuroma, then that's going to potentially lead to some other problems. But I would still address the neuroma and then the foot volume issue. You can re-lace their shoes, just not lace the first two or three holes and just lace up top. So anything you can to decrease pressure on the compression of the foot. So now, I think I got most questions answered, but still a little time. So basically, the summary is, try it. Get out and try this. Put your hands on feet. If you don't like to put your hands on feet, you're not at this talk. So I know you're interested. So put your hands on them. You will be the expert. You've gotta realize that.

People will come to you with questions, and you're supposed to be the expert. Again, practice it. There's no measurements. It's what's good and what's not good. You just gotta try it, and you'll see, you'll know. You're not giving someone a lifelong sentence by assessing this or saying, "Hey, this is a problem." If it doesn't work, try something else. Don't be afraid to make the mistakes. If you have a mentor or someone to reach out to, that's always a good idea to bounce ideas off them, similar to what we're doing right here. Bottom line, keep these principles in mind. The rearfoot should do this. The big toe has to get to the ground.

You have to go through your midtarsal joints. Those should be stable. So no matter what kind of surgical procedure you have to assess or coming out of a boot, you will get away from toe curls hopefully soon and start thinking more functioning with exercises. And don't forget about the importance of ankle dorsiflexion. Think about, as we get older, we sit. We're not as active. We're not climbing stairs as much. We're not walking out in heels as much. So our general lack of ankle dorsiflexion is a huge problem in the community. Not saying you need to go out and hurry up and try to get the motion back in one day. But while you're sitting there yourself, you should be doing ankle dorsiflexion. While you're standing, while you're getting gas at the gas station, stand and stretch your ankle, whatever. Several times a day, there's no reason why you

can't maintain ankle dorsiflexion, but more importantly, maintain it with your foot in a slight inverted position in your rearfoot. Bottom line, keep people on their feet, keep people moving. That's what life's about. No one wants to sit and complain of foot pain. More importantly, no one wants to sit around with relatives and hear about foot pain. So get them early, get them moving around. Bad things can happen. Real quick story, I've got a nephew that sprained his ankle in hole at work, stepped in a hole at work. He went in a walking boot. This is not someone that I talk to often. They're down in California. I found out, my brother was telling me, he's in a walking boot for a while. I said, "He's gotta get out of it." And I kind of forgot about it. Then about a month ago now, he says he's been in a walking boot for nine months. Now, he's developing, it's just too painful to put his foot on it, to have weight on his foot. Long story short, he developed regional complex pain syndrome.

So now he's got purple throbbing and swelling. I had this big outlined plan for him, put in the hot and cold, do this and do that, and my brother told me that, well, he went to PT today. And the PT just said basically just keep doing what he's doing, which is nothing. Keep doing what he's doing, and then do some of these ankle circles and ankle pumps and a little bit of resistance if he can, and leave it at that. And I'm just thinking, I just told them 15 things to do. At this point, he needs to fight through it. I know it's painful. I know it sucks.

But he's going to have to fight through it. And he goes to PT, and the PT basically says, "Don't do anything." And that's what got him in this spot. He's potentially leading up to an amputation if he doesn't get better with it. Family members are the most difficult ones to treat. Basically I'm not going to take the lead with this one at all. I'm just going to let it, and see how it pans out. I don't want to say I told you so, but we'll see how it goes from there. So don't get frustrated. Practice with this stuff. There is a lot of information out there. On PubMed, I'll do a simple little ... One more question before I get going. We're almost out of time. Can you review the ankle dorsiflexion stretch one

more time? So when you're standing against the wall, like you're doing a normal ankle dorsiflexion stretch, so they can put hands on a wall, hands on a counter, whatever. If their back foot that they're stretching has to be pointed straight forward, and before they put stress on it, raise their big toe up. So what I would say is kind of shift your butt back to put pressure more in the heel, raise your big toe up, keep your big toe up, and drop your hips back down or butt back down to stretch the ankle. Now, your rearfoot is in an inverted position. By raising your big toe up, you plantarflex the first ray, which is going to supinate or invert the rear foot. And that's the position we need ankle dorsiflexion in gait. Again, a little shameless plug. If you want more of this, we do two days of this stuff in a lot more detail and definitely more treatment, a lot of lab time. Our class, When the Feet Hit the Ground Everything Changes, we have it, I think, there's eight classes this year scheduled. We have about seven of the Running courses scheduled. You do not have to take the Everything Changes in order to take the Running if you just want to take the Running one first. But we will do some review, quick review, kind of like what we did today, in that class as well. Again, I love it. This is what I do. I treat patients, own the practice, teach on the weekends. I don't know where this time came to do this, but I enjoyed it. I see I beat my timeframe by almost one minute. How about that? As you can see, I like to talk, so I'm surprised I didn't go over. Anyway, any questions from there? Otherwise, we've got about one minute to go and let you guys get back from lunch, and I get to head to work. So thanks for your time.

- [Calista] All right, well, I don't see any questions. So we're gonna go ahead and close out today's course. But once again, thank you so much, Paul, for sharing your expertise with us today.

- [Paul] All right, thank you. I appreciate it, it was fun.

- [Calista] And we're gonna go ahead and close out today's course. Have a great day, everyone, and a great weekend.