Episode 12 - Orthopaedic Biomechanics

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SPEAKERS

Timothy Burkhart, Tiffany Tiu

Tiffany Tiu 00:14
Hello and welcome to rehabINK podcast. My name is Tiffany and I'm a physiotherapy student at the University of Toronto. I'm also a student researcher at the Biomechanics of Orthopedic Sports Medicine Lab at the Faculty of Kinesiology and Physical Education, or in short, KPE. Today I'm joined by my supervisor, Dr. Timothy Burkhart. He is a KPE Professor since 2020, with research interests in injury prevention, treatment, rehabilitation, and orthopedic biomechanics. In this episode, we talked about his journey of getting here and running a lab, the exciting things we're doing in the lab, and his thoughts on narrowing the research to practice gap. Enjoy. Hi, Tim, thank you so much for being on the podcast with me. How are you doing?

Timothy Burkhart 01:06
I'm good Tiff, thanks for having me, I'm excited to talk about some of the stuff.

Tiffany Tiu 02:04
I'm excited to as well. To start off, can you tell our audience what are you what are you doing?

Timothy Burkhart 02:37
So I did my PhD at the University of Windsor and there I was primarily interested in distal radius fractures. We were looking at how people fall and how they might injure or break the upper extremities as they arrest those falls. I went to Western for a Postdoc where I met up with Cynthia Dunning. She was prolific researcher in orthopedic biomechanics. I've done a project with her over my PhD and it just kind of made sense to go and work with her for my Postdoc, so I went to Western, did a postdoc with her, and got introduced to some of the orthopedic surgeons at the hand and upper limb clinic at St. Joe's in London. And then I kind of start off my sports medicine, orthopedics research, when I met up with the orthopedic surgeons from the Fowler, Kennedy sports medicine clinic, so it was there that I learned to more of the knee biomechanics, the hip biomechanics, and really starting to explore more of those sports medicine, orthopedic injuries, and how we can prevent or reduce the risk of those injuries, treat them better and rehab them better. In May, I started working with the orthopedic surgeons there

as a research scientist both through the Fowler clinic and then also through London Health Sciences Center, or the Lawson Health Sciences Center that's kind of affiliated with Western. And I did that for a few years. And then I was lucky enough in 2020, right at the start of the pandemic to get hired at U of T as an assistant professor in kinesiology and physical education, and I've been at U of T now since 2020. And since I've been here, I've been able to begin to make more collaborations with the orthopedic surgeons in the city. And really continue kind of our orthopedic biomechanics program. As I started up the biomechanics of orthopedic sports medicine lab within KBE, we're interested in reducing the risk of injuries specifically in the lower extremity. And most of our work is focused on hips and knees, injury risk reduction, improving treatment of orthopedic sports, medicine, injuries, and optimizing rehab with this really overarching goal of can we help people live lifelong mobilize pain free, that's really all we want to do. We want to make sure people have the ability to live actively and exercise, run around and play with their grandkids, pain-free with lots of mobility. So that's kind of our overarching goals, and we've got lots of different tools and techniques and methods and approaches to do that.

Tiffany Tiu 03:34
Yeah, thanks for going way back to your PhD. And I really echo that passion. For those who are unfamiliar with the term biomechanics and orthopedics. How would you explain these terms to them?

Timothy Burkhart 03:45
So biomechanics is just the physics or the mechanical engineering of the human body. We're really interested in what forces act on the body and what is the result of that on the body, or what forces are produced by the body and what is the consequence of that. And that extends from the macro level - so whole body, with the sprinters doing 100 meter dash, what kind of forces are they producing to make them run fast? And it goes all the way down to the joint level- so what forces or what motions is the knee experience? And how is it rotating? How is there, how is it translating? How is it moving? And how does that affect whether somebody gets injured or how we treat the knee? And then there's all the way down at the tissue level. So, how much force is on the individual structures at the knee? Or how much does that ACL actually get pulled apart during certain movements? It's all about how the body moves, how the body responds to and creates different forces in the everyday environment from all those different levels, orthopedic biomechanics. It's just taking those principles and applying them to injury and orthopedic conditions specifically in the musculoskeletal system. So whether that's tendon injuries or ligament injuries, muscle injuries, bone injuries, all of those things kind of fall under the lipidic umbrella at work. We're specifically interested in, you know, how does the biomechanics contribute to those injuries? But then also how can we use the biomechanics to help treat them and rehab them? So there's like the biology of orthopedic injuries, and that's a whole area of study and research and application. There's the physiology of orthopedics, but we're really interested in the biomechanics of it. So, how did the forces how the motions act on the body to create injury and how can we kind of understand that better, to help prevent or to help treat and rehab them a bit better.

Tiffany Tiu 05:28
I know when I was doing my undergrad in kinesiology, as soon as I was in the course of biomechanics - which I didn't know existed - biomechanics as a field, I was immediately captured by the content and concepts of it. I was wondering, did you experience the same, like, being captured by biomechanics and how tissues get injured, how forces go on in the human body?

Timothy Burkhart 05:51
Yeah, absolutely, I kind of had the same experience. I had taken high school physics, and I thought that was kind of cool, but you know, that's all based on these metal structures, or spring. But I always had this passion for sports and for activity. And so probably the same as you when I got to university and got to take my first biomechanics course I was, kind of instantly fell in love with it. I thought, you know, this stuff is so cool that we can apply those things that we learned in fitness class to the human body, that kind of all made sense to me. Part of what I want to do is, like, instill that in other people that there's these really cool concepts that we can apply that I don't think that we don't think about enough. That there's like injury and treatment and rehab. There are these really important biomechanical aspects that sometimes we don't all know about, or we just don't apply enough. Then I took all my biomechanics courses in undergrad, and I took grad level biomechanics courses, and yah, absolutely fell in love with the field as well. That's so cool. Now that you've gone far in your career, have you always wanted to run a lab? Yeah, that is a great question. I didn't always know that this option existed, when I first got to university in undergrad I didn't really know. Or I kind of probably thought I wanted to do what most of us want to do is we want to get into physio, or occupational therapy, or chiropractic or maybe teaching. I do remember my first orientation session at the University of Windsor, where I was doing my undergrad. And I think it was our dean, at the time had asked kind of everybody what they wanted to do and all I could think about was sport medicine. I didn't really know what I meant by that, but I knew that I love sports, I was always actively engaged in sports. So when I kind of always wanted to be in that area, so I did kind of always have that in the back of my mind and I kind of went through my undergrad, again, taking the biomechanics courses, still kind of thinking I would do maybe physio or occupational therapy. I had some really great ergonomics professors at Windsor, so I kind of funneled my way towards that stuff as well. I thought that was really interesting. But come forth here, I didn't really know what I wanted to do, and I just took a chance. And even halfway through my undergrad, I don't even know if I knew that you could do a masters or what a PhD was. I was kind of all new to this and I got to see the TAs and that they were doing this research. And it kind of started to interest me. So, I just took a chance and knocked on a prop store in my fourth year and I just kind of said, like, "I'm interested in continuing to learn and would you take me on as a grad student?" And for whatever reason, they decided to take me on. In first year of my masters, I kind of fell in love with the research and it was kind of at that point that I knew I wanted to stay in the field of academics. And then I just kept on, and lucky enough to get my own lab. That's the message out there for those, that it's okay to maybe not know what you want to do right away, that you'll figure it out, and you'll still be successful.

Tiffany Tiu 08:26
That's fascinating. So circling back to the lab, now the lab has been established for about three years. What is the overarching goal of the lab now?

Timothy Burkhart 08:35
So, we just want to like kind of bind ways to stop or reduce the risk of people getting injured. So, if we can reduce the number of injuries that we're doing, again, we can find strategies, or we can first figure out how individuals are getting injured, then we can develop interventions to implement that to reduce the risk of them getting injured, which then helps them kind of meet that goal of living long, mobile,

pain-free lives. We're fully aware that we're never going to be able to stop everybody from getting injured and injuries are going to happen. And so, the next thing is how can we, how can we improve treatment of those that do get injured so that we can get them moving in a way that they were moving before they were injured, or at least as close as possible so that we're maintaining kind of natural joint motion, those natural pain free motions? Part of that is treating them efficiently so we can get them back to sport or back to activity as quickly as possible, but also as safely as possible. We know that there's a big mental health component with injury. Part of that is not being able to get back to sport. Part of that is being fearful that when you go back to sport, you might get re-injured, and so some of the stuff that we're interested in is, let's get people back to the sport or activity as quickly as possible, but let's make sure we're doing it in a way that they're not going to re-injure themselves and that it's safe to do so. So there's treatment and then also kind of part of that is the rehabilitation. So how can we improve rehab strategies? How can we understand, from a biomechanics perspective, how rehab is affecting the body in order to kind of optimize those rehab approaches, build better rehab interventions to get them back to sport, back to activity safer.

Tiffany Tiu 10:07
So I'm hearing two large, main pillars of the goal, which is to understand injury, which would help inform how we prevent injuries. And the second is to optimize the process of treatment into rehab and to return to play so people can get better treatment, faster return to play, and safer return to play.

Timothy Burkhart 10:27
Yes, absolutely. I should say that I think a large part of this is lost via joint preservation. So keeping the joint as intact and as moving as naturally as possible. And part of that is keeping individuals from getting hurt so that they don't mess up the natural environment, the knee, but also, how does the treatment and the rehab preserve that natural joint environment. And so there's also a lot of work on the treatment of osteoarthritis side of things where we're not so much interested in replacing the joints, but we're interested in techniques and treatments, that preserve the joint surfaces, while still treating certain aspects of the way. It's really about preserving all of this motion preserving this kind of lifelong mobility preserving the joint.

Tiffany Tiu 11:07
Yeah, can you share a few current projects that are going on that speaks to this overarching goal?

Timothy Burkhart 11:13
From the injury risk reduction point of view? We've got some projects where we want to know if individuals, athletes and even non athletes, if they move differently in a sporting environment, or do they move compared to in a lab environment? So most of the injury assessment work that's happened in the past, it's all in the lab, which is good. There's some really great research that's looked at how do people move in the lab and how do we correlate or associate those movement patterns with the risk of injury? We think that maybe if we study individuals in their natural environment, so if you take a lacrosse athlete for example, and you measure the way they're moving in a lacrosse environment, doing lacrosse-specific tasks, will we get a better understanding of at how they're moving? And can we pick up kind of abnormal motions, that might be a better indicator of whether they're gonna get injured playing their sport? So that's a study we've got going on right now. And we're lucky enough to have a

data collection system that is portable, so we can take it anywhere, easy to set up, and we can measure the motions of our participants in their own environment. So we've got across athletes, soccer athletes, basketball athletes, and I think volleyball athletes as well. So what we're doing is comparing how do they move in their own environments compared to in the lab, where they're doing kind of generic type tasks. So what we think we'll find is that the all of these individuals are going to move a bit different in their natural environment. And then part of this study is prospective in nature. We'll follow them through the next four years, and we'll be able to record when they got injured. And then we can determine if any of those kinds of sports-specific motions that we calculated are measured in their sport environment, are those better indicators of whether someone's at risk of injury than these kind of generic general tasks in the lab? So that's kind of one of the big studies that we have going on in terms of injury risk reduction. In terms of our hip, we're really interested in femoral acetabular impingement syndrome (FAIS), one of our PhD students is using computer modeling to look at, what are the contact forces in the hip and can we use that information to identify who might be at risk for FAIS. So FAIS is a kind of a tricky musculoskeletal disorder to kind of nail down there's this weird cycle of our abnormal motions caused by the FAIS, or is FAIS causing these promotions. And we think that using these modeling techniques can help identify, you know, what's going on inside the joint in a non-invasive manner. And so we've got some other studies around the FAIS as well as looking at things like sports specialization. So if you sport specialized, if you specialize in a sport too early in life, are you at risk of these kind of biomechanical or these mechanical hip disorders. In terms of like the treatment and rehab, one of the things that we're really interested in is instead of just looking at end-point assessments, so instead of just looking at is somebody jumping a certain distance, or somebody jumping a certain height, what we want to be able to do is take a more global look at this and look at how they're getting to those points. So using some statistical techniques, can we actually categorize the entire motion cycle so we can look at how they're moving? So we take the horizontal jump, for example. Can we look at how they're kind of loading their musculature? What motions are they using through that kind of lower extremity chain at the ankle and the knee and the hip to generate that power or generate those forces to get to that distance? And so what we're hoping what we'll find, or what we think we'll find, is that individuals who have had an injury and may have been cleared to return to sport might display different types of motion patterns as someone who's healthy or has never had an injury, even though they might pass a return-to-sport test based on how far or how high they can jump. So really kind of trying to find more efficient means or more effective means of assessing whether somebody's ready to go back to sport or not.

Tiffany Tiu 15:01
Oh, that's all really cool. You mentioned the unique equipment that we have in our lab, which is Markerless Motion Capture, being an advantage that allows us to study the difference between people that are moving in their own sporting environments versus in a lab, which is very close, very structured, controlled. I'm wondering if you can elaborate a little more on this technology, and also some other things that are unique to this lab or being at U of T or Toronto that facilitate the goal of your lab?

Timothy Burkhart 15:33
Yes, so the Markerless Motion tracking one is a relatively new technology, we were lucky enough to get a system when I first got here and essentially, we can track motions. Traditionally, if anybody has been in a gait lab probably had marked, those kind of sticky markers put on you, their reflective, and it takes

a lot of time to set up. You have to put them on all the anatomical landmarks, they can move as you're jumping, they can move relative to the underlying bones. But this marker, this system is nice, because it doesn't require any markers. So it's based on a machine learning algorithm, we've got eight cameras, and we kind of plug this into the machine learning algorithm. And it's able to identify where the bony landmarks are in space. And then from that, it can calculate the different joint kinematics. Our plan is to have as many of these orthopedic patients go through a gait analysis in the clinic. And it's relatively efficient to do with this Markerless system. And we can then start to build these kinematic databases, where we're going to have eventually hundreds of kinematic profiles of anybody that comes to the clinic as an orthopedic injury. The other things we have in the lab are pretty typical of a biomechanics lab, we've got ForcePlates, we've got EMG that we use. And then we've also got our Markered motion tracking system. So it can calculate ankle and knee angles, some upper extremity angles as well. And so the real benefit of this is the time. It's much more efficient, you don't have to set up all these markers. But as I mentioned, the other real benefit of this is the portability. So all we have to do is set up the cameras in any environment, take the video, and then analysis can happen after the fact. We don't have to have wires running everywhere, we don't have to take our data collection computer with us. So there's real, I think, opportunities to get some real like in like similar to what we're doing is some real environment data. And as for us, that might be sports-specific, for others, maybe that's in the actual clinic or maybe that's wherever you're collecting data. Maybe it's in the workplace that provides better data. One of the things that we're hoping to do with some of my clinical collaborators is actually set up a system like this up in the hospital.

Tiffany Tiu 17:05
Just for those who are unfamiliar with the term EMG. It stands for electromyography measurement to measure muscle activation. So we can see how muscles are working, how much force they're producing.

Timothy Burkhart 17:48
Yeah, so one of the great things about being at U of T is that it's a medical school. And there's a really nice orthopedic sports medicine program here. So I work with four or five of the orthopedic surgeons in the University of Toronto orthopedic sports medicine group, and they're all kind of across different hospitals. And they're all keenly aware of the importance that biomechanics plays in orthopedics and orthopedic surgery, and so they've been absolutely essential in working with to keep our program up and running, you know, working with them does a couple of things. It ensures that the work we're doing stays clinically relevant, that what we're doing has an impact - that we can translate the knowledge we develop in the lab and we can give it to the surgeons or the clinicians right away. Obviously, the hope there is that it changes clinical practice for the better. The second thing it does is it ensures that we always have work, so there are so many questions that those guys have. And so there's just there's so much great research that we get to do with them focused on orthopedics. And so that's, that's been a huge thing in being able to get my lab up and running as quickly as possible is that there's so many projects to do with them. It's been great.

Tiffany Tiu 18:55
Yeah, one of the things that I am really personally passionate about is having a close connection between researchers and clinicians. And that's a part of the reason why I'm interested in podcasting efforts to bring these people together, so we can better inform each other. I wonder in your situation, how does that process actually play out? How do you connect with these clinicians? And what is the collaboration like?

Timothy Burkhart 19:22
Yeah, so I think this is a really great initiative doing this podcast and having researchers on as well, I think we're at a critical point in time where we need more of these relationships. And I think we're doing better knocking down those silos and not just having our clinicians and we don't just have our researchers, but we're really starting to emphasize having those two groups work together, because I agree 100%. What I do in the lab doesn't matter if it's not getting out to the people that need that information. And journals, for a while, were good and most clinicians have access to journals and they can get that information. But I think we need to be more proactive in getting our messages out and those collaborations between the researcher and the clinicians is kind of where that happens. Having good knowledge translation is also important. And I believe in that fully for the rest of my caree - I will collaborate with clinicians. It doesn't make sense for me not to, I need to have them there, again, to make sure that the work we're doing is clinically relevant, but also so that we get that information out. And that they're the ones that are going to use it. Teaching hospitals like Toronto, generally, the clinicians are teaching at U of T, or they're teaching the med students. So there's a chance to give them the information, but then they get to pass that information on right at the trainee level. So we can kind of start translating our knowledge to the trainees that are coming through and instill those different philosophies in them as well or teach them the current knowledge. And the same, I guess, would be true through the physio schools and making sure that you guys have the most up-to-date knowledge or that the, the instructors and the clinicians have the most up-to-date knowledge that trickles down through all the trainees as they're coming through, and then they kind of translate that knowledge as well. So for me, I was lucky enough at Western, that my supervisors were already collaborating with all the clinicians. And that was kind of the model that they had in place for a while. So I was lucky enough to see that model and learn from that model where all of the researchers in orthopedics, worked with a clinician, they worked with the residents, and they worked with the fellows, grad students worked with the residents and fellows. It was this really nice interconnection between the research and the clinical side of things. So when I came to U of T, one of the first things I did was try to connect with as many of the orthopedic surgeons, I like it, and we're starting to establish that same type of model where I'm working with the surgeons, but now we're also working with the residents and the fellows. I'm trying to incorporate my students more, working with the residents and the fellows to kind of establish that type of model here as well. Because again, I think it's so important for getting our information out. And I don't think we can improve lives, where we can't reach our goals as a lot of for not getting the information out to the people who are.

Tiffany Tiu 21:55
Thank you - that's really amazing. I hope those who are listening, if you're a researcher, reach out to clinicians, and if you're a clinician, participate in research in the work that you do. With collaboration model that you have right now, do you see any challenges or areas of improvement that you'd like to work on?

Timothy Burkhart 22:14
Yeah, so maybe it's a good challenge that there's just so much to do, there's more questions to answer than we have time for. So that's definitely a challenge, I think one of the things I would like to do, or that I need to do more of, is I have collaborated really well with the orthopedic surgeons, but trying to collaborate more with the physios and establishing those connections is important too to help the orthopedic surgeons who are kind of checking the box on the treatment aspect. But there's a whole area of rehab that we need to do and collaborate more with - with the physios and the rehab specialists. Like I said, I've been pretty lucky that the people that I have collaborated with have all been open to collaborating. And other than time and money, there really aren't too many challenges that we have in terms of being able to work together.

Tiffany Tiu 22:54
You've mentioned two times, just having these collaborations and so many problems that we can solve. There are so many joints in the body, but each joint has its own to a flow of research questions and we can tackle. How do you go about that?

Timothy Burkhart 23:09
That's probably the biggest challenge, is just there is so much to do. And the problems at the knee, there are problems specific to the knee that maybe aren't specific to the elbow. So we need a whole bunch of researchers to look at the elbow and the shoulder and the wrist and in what we're doing. And they showed you were at least aware that just because someone has a knee problem doesn't mean the problem is isolated to the knee. So through our different kinds of data analysis techniques, trying to identify relationships between the ankle, the knee, the hip, likely that trunk plays a role as well. And so trying to look at it from a systems approach, instead of just "You tore your ACL, it must be a problem at the knee," when likely there are issues or things going on at the hip and the trunk and downstream at the ankle and the foot that are contributing as well. There's some other groups internationally that are taking this approach as well. But I definitely think that a more systems level approach is more appropriate and likely will give us more accurate data. But you're right it's, it's kind of mind blowing to think that I probably spent my whole career just looking at the leg and others are going to spend their whole career just looking at the spine. And the same for the, for most of the surgeons, they spend all their time doing ACLs and knees, and then there's hip experts. And it's amazing. I think it just talks to the complexity in the amazing human body that it's, just, it's so complex and there's so many moving parts that it's hard to focus on one. Or it's hard to kind of look at it all at once and you kind of have to focus down and look at one section or one segment at a time. Really, again, the human body is just so complex and so amazing. You need a whole career to really understand one joint or maybe even generations of researchers to know their joint and then now you put together the hip, the knee and the ankle all together how this work together, which is a part. Here's the thing that I appreciate, that we are looking at the human body as a kinetic chain, that everything is connected together, one thing affects

the other. In my work, for example, when I coach, a squat and squatting technique is not good, I don't only look at the knee, but also look at the hip and ankle, I think that's a really good approach there. So now the main goal of the lab being understanding injury, injury prevention, and optimizing treatment and rehab processes.

Tiffany Tiu 25:31
You talked about some of the research that are currently going on that speaks to these goals. What are some future directions of the lab, let's say in the next decade?

Timothy Burkhart 25:41
The goal is to get some more equipment in so we can start looking more at a multi-scale, multi-level approach to what we're doing. So the way we're set up right now is to look at global motions, joint segment motions, like we just talked about understanding what's happening at the hip, knee and the ankle, being able to get some imaging equipment in the lab would be wonderful so that we can start looking at more structure level type stuff, and how that's affecting motions and responses. And then being able to get back to kind of where my roots were, which was cadaver stuff and looking more at the tissue mechanics and being able to quantify things at the tissue level. But then taking all that again, similar to how we, you know, we're interested in the relationship between the whole body of the system like the whole lower extremity as a system, being able to look at all of those levels as a system. So how do the tissue mechanics affect the joint level, affect the tissue level, or the segment level, and then kind of being able to incorporate that into our basic science to clinical research back to basic science cycle. So what can we learn in the lab from a basic science level? How can we translate that to the clinical level? And then what can we learn at the clinic level? The feedback into the basic biomechanics level and just kind of keep this cycle going, where one is always feeding into the other, so it's never ending loop of kind of discovery, and then refinement, until we can really optimize it. And so I think continuing to work with the clinicians, building better and more relationships with other types of clinicians is going to be essential in doing that, I think, over the next five to ten years, being able to establish some really great new interventions to help address the issues of injury and injury risk reduction. I think that's definitely on our radar. And in getting those implemented on a eventually a global level, one of the things that we're interested in long-term is how do we incorporate technology, right? There's no denying that technology is playing a huge role in every aspect of our lives. And it's no different in injury, risk reduction and rehab. And so how do we then take all these new technologies that are out there and incorporate that into what we're doing? For the next ten years, we've reduced the number of injuries and we've returning people back to sport.

Tiffany Tiu 27:51
Yeah, I'm seeing a very comprehensive vision to have the basic science informed applied science, finding the basic science and so on. Do you see a difference if there were no funding time and resource restriction, the work that you can achieve? Versus, there is obviously these restrictions in reality?

Timothy Burkhart 28:10
Yeah, I think so, like, time and money are probably the biggest bottlenecks in all this. And you know, we need better funding, we need to fund our scientists better. And there's my rant for today, I'm not the only one, there's more senior scientists that would agree with me as well that we need better funding

for this, especially this stuff. Orthopedics prevention is the ultimate money saver. Like if we can stop or reduce the number of people that are getting injured, the return on investment there is huge, so we can invest more money into these research programs and I think it returns on itself. If we took out those barriers, then I think the research gets done more efficiently. We can do more, in a shorter period of time, we can hire more trainees, which I'm extremely passionate about - is making sure that I've got a really good set of grad students, undergraduate research students. So being able to train the next generation of scientists and clinicians is important to me. And so removing those limitations on some of those resources would ensure that we could have more of those students, more of those trainees in the lab, not having time or money restrictions, also opens up how big your projects can get and how much the types of things that you can do. So you can have more equipment, you can look at things from different perspectives.

Tiffany Tiu 29:24
Is there a reason why scientists, or more specifically, orthopedic biomechanics, science is not as funded as much as you want it to be? You know what, I don't know. You got to have somebody from CIHR on to ask them that question. I shouldn't say there are some really great like orthopedic biomechanics projects that are funded by our funding agencies, and I'm personally funded by them so I can't slam them too much, but I would think overall, we do need more funding. As a researcher, how much do you identify yourself with rehabilitation? Obviously, our podcast name is rehabINK. What role do you see yourself play in rehab?

Timothy Burkhart 30:04
I see myself as providing information to the rehab specialists. And that's kind of our goal is to provide information, so that you guys are gonna do the heavy lifting, we're gonna provide the knowledge, we'll give it to you. And then it's up to you guys to apply that and make sure people are getting healthier, more efficiently. So I think, you know, we're, we're knowledge creators. It also falls on us to not just put it in a journal, not just like, passively put it out there, but to be actively communicating with the rehab specialists and making sure that they're aware of what we're doing, and that they are providing their feedback and their information. And they know, to our projects as well, so that it's get this kind of cycle that, here's what we want to do.

Tiffany Tiu 30:48
Do you as a rehab specialist, think this is important? And if you do, you know, how can we make this better to make sure that you know it's something that you think that you could incorporate into your clinical practice? I just see myself as a knowledge generator, and it's really you guys that have the big effect on getting that information to patients and implementing it, and you guys are the ones that make the difference in patients' lives. So that's kind of where I would see it is, Right, so, the whole flow of knowledge from knowledge creator, and then there is a knowledge translator and the knowledge users have is ideally there will be constant flow both ways. And what you're talking about the knowledge created, from the research side of things, getting used by the knowledge users, the rehab specialist, this involves a translation process. And would you see the knowledge creators as kind of responsible for the translation process? Or who else do you think should be doing?

Timothy Burkhart 31:43

I think that needs to be a collaboration too. I think we do a study and we get good results on something and we put it in a journal, is it just gonna be other researchers that read it? Or is it gonna be a few kind of really dialed in clinicians that are going to read it? I don't think that's enough anymore. I think as a knowledge creator, we need to be more actively engaged with the knowledge users. So I try to do that with our orthopedic surgery collaborators, but we need to be doing with our physios and our occupational therapists. And we need to be having these dialogues about what's the best way to translate this information to the people we're collaborating with. But then how do we get that out to all the other rehab specialists, so I definitely think there needs to be more communication amongst us, there needs to be more collaboration amongst the researchers and clinicians and researchers. We need to be, I think, actively involved in getting that information to the people that it needs to get to, and not just kind of, "Here's what we know, you do with it, what you think you need to do with it," but having those kinds of active relationships where we're involved in that as well. But then, you know, taking the feedback, like I said, breeding that kind of lab or basic science clinical cycle where develop the knowledge, see how it gets incorporated, and then take that feedback and refine those things in the lab and continuously work in this research slash translation cycle where we can get knowledge out as quickly as possible.

Tiffany Tiu 33:00
A common thing that I've heard is that research and practice there's generally a ten-year gap. Do you see that in the area of orthopedic biomechanics?

Timothy Burkhart 33:11
I don't know if it's quite ten years, but it's definitely too long. That I mean, I would say it's definitely true, like the sport performance and strength and conditioning world that that's probably true, things do happen a little quicker. I think in orthopedic biomechanics, like the surgeons are pretty good about, or at least the ones that I work with are pretty good about changing clinical practice if they see something that requires clinical practice, practice to change. But I would say it's definitely not instant. And you know, coming back to this, am I changing the practice of just the four surgeons that I'm working with? Or are we is this leading to greater clinical change? So I think locally, it probably happens a bit more quickly. But globally, or kind of other more macro level, it probably does take a bit longer, maybe not quite ten years, but certainly longer than it should be taking. In 2023, with all of the communication devices that we have, and all of the different strategies that we should have at our fingertips to get information out. I think it's still taking too long to make clinical change happen.

Tiffany Tiu 34:07
Yeah, absolutely. And ultimately, the goal of the lab is to impact lives. So we got to get this information out, as soon as we can. One thing you mentioned is the act of relationship between yourself and the clinicians, and that helps them incorporate newest research evidence in their clinical practice. And you talk about globally, when you don't have that relationship with every single orthopedic surgeon that's out there. They may need take some time to get to know of the work that we do. What are the things that can facilitate that process?

Timothy Burkhart 34:42

I think, you know, one of the big things that we do is present at conferences. It's a good way to get the information out there, especially at the clinical conferences to stand up in front of other orthopedic surgeons. We have specialists from around the world is obviously a good way of doing that. One thing I think my group specifically that we need to do better is the use of social media, there's definitely probably a better approach that we could be taking to get our information out there. I'm kind of like, I'm just old enough to not be savvy with social media trying to develop those types of strategies, we're using those to our benefit, because there's some really great orthopedic surgeons, I know, there's some great physios and rehab specialists on Instagram and Twitter. And they do such a great job of getting their messages out and starting dialogue. And that's probably an approach that are good for sure. Myself specifically needs to do a better job. And there's an opportunity to reach so many people.

Tiffany Tiu 35:31
Yeah, I feel you though, in terms of social media, there's a huge potential to make a big impact and get the word out there. While going back to the time and money restriction. Everyone is busy and passionate about the research work, and everyone has their own strengths, and that social media is not necessarily a strength of us in the lab. Now, we've been talking about this knowledge translation process to clinicians and rehab specialist. What about the lay public? How is your research connected to the lay public? And how would you want to facilitate the process to the public?

Timothy Burkhart 36:08
It's probably my least effective area in knowledge translation, and one that I think many scientists probably lack is getting the information to the lay public. I think we can do a better job. And I think one of the ways that we can do that is by similar to the way that we collaborate with the clinicians is collaborating with patients. So there's a big push now in kind of the orthopedic space in the rehab space to include patient advocates and patients themselves in the research process. So getting feedback from so if we were doing an ACL study, including an ACL patient, on our study, as a contributor to what we're doing in the research. I know there's a lot of this goes on in the osteoarthritis space, where they include osteoarthritis patients in the design of their studies and get feedback from the patients. And they include them as advocates, and as contributors to the research almost as a collaborator and not just as a participant, I think that really enriches the research. And it begins to make connections with the public. And it helps to make sure that you're generating materials for the lay public that they are digestible, and they're interpretable, by the public. So I think that's something that we'll try to do moving forward and model it off after some of the really great osteoarthritis researchers that have started to do that.

Tiffany Tiu 37:27
You have a lot of connections with Toronto hospital network in terms of clinicians, and I'm hearing that you are wanting to work on having more collaborations with perhaps people who are good at Knowledge Translation, is there anyone else that you would like to collaborate with to advance the work in the lab?

Timothy Burkhart 37:43
Now that we're out of COVID, and we're relatively back to normal, we'll start to make more international collaborations and start working with other researchers in the areas that we're researching in that are

not just in Toronto, but that are outside of the area. So I still collaborate with some of my colleagues from Western but expanding that to working with individuals in the States. And there's lots of great ACL and osteotomy research that goes on in Europe trying to make connections that way again, kind of hits on the how do you globalize your research, but also brings different perspectives from different healthcare systems and different orthopedic approaches. So they're certainly those type of people that we would want to work with.

Tiffany Tiu 38:19
Wonderful, thank you so much for sharing in this episode, I hope that listeners now have an understanding of what orthopedic biomechanics is, and see the very exciting potential we have in the present and future research in this area, and having a perspective of what research to practice. Tim, do you have any last final words for the audience?

Timothy Burkhart 38:41
Thanks for having me on and happy to answer any questions. If the audience has any questions, they can reach out at UofT, or you know, I'm always happy to talk about the work that we're doing. So I always appreciate having mediums like this where we can have these conversations. You can get in reach me at Timothy dot Burkhart at U Toronto dot ca. And we do also have an Instagram page @BOSM underscore lab where we try to post things related to the research we're doing so you can always check us out there.

Tiffany Tiu 39:07
Thank you for listening to this episode of the rehabInk podcast. To support us, please subscribe and rate our student run podcast on pod bean, Spotify, Apple podcasts or Google Play Music. You can also find us on our website, rehab Inc. mag.com/podcast. That's our REHABINK.com/podcast. Stay tuned for future episodes on rehab research and practice.