

The Crossover Effect in Rehab - Ref 72CM - Draft Transcript

with Claire Minshull

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TRANSCRIPT

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Steven Bruce

We're going to be talking as you can see about getting better rehab today, and I'm joined for I think the fourth or fifth time by Dr. Claire Minshall. Now a bit about Claire before we start 10 years ago, she was the British powerlifting champion. And a few years after that she bugged up back, which frankly, I think serves her right for lifting stupidly heavy weights. But since then, she's been involved in teaching and research and all sorts I think she's got about 20 research papers to her name, as well as her PhD, which on two occasions, I've remembered, but on this occasion, I can't, but I don't feel too bad, because last time I asked her, she couldn't remember what her PhD was in either. Claire, great to have you with us again.

Claire Minshall

Great. It's a pleasure to be here. It's always the title.

Steven Bruce

Yeah, so we're going to talk about the crossover effect, which I suspect I mean, everybody knows that if you wiggle the good leg, then the bad leg will react in some way. But there's more to it than just that isn't there in terms of getting the best effect from your from your rehab?

Claire Minshall

Yeah, sure. I mean, It's the several labels for this cross over fact across education effect.

Claire Minshall

A few other as well, but basically, there's an implication inherent within that map title that you do one thing on one side, and it transfers to the other. And we've actually known about this since it's 1894, was the first report of this phenomenon. And in the 90s, certainly in the 2000s, and probably the 80s, as well, and that's 19 1980s etc. It's, it's really well known about in performance related literature, so like sports performance, and physiology and when we're looking at athletic athletic performance, if you like, but as we find with many of these things that are commonly known about in In performance based literature, they're less well known about and less well translated into why I think they're really, really important. Not that I don't think elite athletes are important that they are, but that really kind of big gains can be made in in clinical settings. And we're kind of that's what I'm really passionate about kind of trying to integrate some of those really well established principles put into a rehab setting to see whether or not we can enhance people's rehabilitation or rehabilitation or indeed make that that recovery from condition or injury. Better. Yes,

Steven Bruce

I should have perhaps pointed out when we started that your your whole life at the moment is about rehab, isn't it your organisation your website, your business is called get back to sport website, get back to sport.com and you're doing a lot of high level stuff with athletes, but of course it all translates just as well to people who are not elite athletes. More likely to show us in clinic

Claire Minshall

Yeah. Absolutely, I mean, I set up the company several years ago, because I was getting phone calls from people asking me how can I get back to sport. But my, my real passion is translating that into my knowledge into other clinical situations, particularly rehabilitation. And indeed, we'll talk about this before I'm receiving the the knee and where arguably, we can make a bigger impact on quality of life by just doing some points with these basic principles. So as it is get back to sport what I teach in my courses, online and in person is applicable across that continuum of performance whether it be elite sport performance through to all the person wanting to be able to walk on unstable ground for you know, a wee while without getting too much pain or avoiding rolling over that kind of thing, that they they musculoskeletal model is the same. It's just that demands placed on that and their baseline conditioning of each is going to be different. Yeah.

Steven Bruce

Just give us a an inkling of how effective the crossover process is because clearly if I do single arm curls with my right arm, I'm not going to turn into Mr. Atlas with my left arm Am I

Claire Minshull

know. And again, we've spoken about specificity before. So there's a real difference between training for strength and training for size or hypertrophy training for endurance training for power. And we manipulate the load in which we left the resistance to achieve our specific outcomes, or we should, and we're starting to get better about that. doing that now in in rehabilitation. So the crossover effect or the cross transfer effect basically implies you do a from let's think about a strength perspective. You do some strength training in one arm or one leg. There is is a benefit in the other leg, which are the other arm, which does not do any training, which is quite phenomenal, really. Some of the largest size of effects have been up to 50%, which is again, quite remarkable. And it gets you thinking from a clinical perspective, what's the utility about Kirby so in, in a healthy population, we do a strength training programme on a right leg and let's say we get, I don't know 100 Newtons of increased force, you might get 50 for doing nothing in the untrained limb. Yeah, so it's not generally that much across the board all the time. And different meta analyses have reported different size of effect for upper and lower body but certainly it's a consistent phenomenon. And the way in which we can generate that effect you've you've got to really lift those heavy loads for low repetitions, rather than going for a muscle size development programme. Charge kind of eight to 12 repetitions to failure, certainly in those clinical populations as well, healthy and clinical, actually that there hasn't been as effective transfer or no transfer by doing the more hypertrophic type stimulus training. So it's a higher load and lower repetitions, which really stimulates effect.

Steven Bruce

So we're coming back to the, as you've said, on many occasions in the past, you know, it's five repetitions to max to failure. Yeah,

Claire Minshull

yeah. Yeah, something like that. He said that that higher load, low repetitions and the way in which we can relativize the intensity is the repetition that we fail at. So like you said that if you go to five repetitions maximum, they actually can't lift the six or consistently across three, four sets whatsoever, because it's, it's

literally two is too heavy, and that's obviously correct form and safely, but that's really within that strength training zone, which we've seen spoken about this several times before so many of your listeners, I'm sure are now familiar with that most people aren't, it might be come as a bit of a shock. But by performing, we know that performing novel resistance training generates all the adaptations initially on neural. So you don't see a morphological change initially once you start a strength training programme, and so the the drivers of the adaptation are neural, which then kind of makes sense when we think about why we might get a transfer effect to the other side. Because it's not a size per se, although we can get into the details straightaway, aren't we but we don't really know exactly why it happens and many theories but principally is thought that it's a neural effect.

Steven Bruce

thought the micro tears in the sarcomeres was part of the process of improving strength and probably more importantly, size, if that's what you're after. But clearly that can't happen in a crossover effect, can it?

Claire Minshull

Yeah. So. So the theories why why it happens, you kind of have this initial or the strength training programme requires real concerted effort to lift that weight five times. So there's a real increased drive central drive recruitment stimulus to the muscle that occurs in the trained arm or leg. And the some of the effects we think are like a spillover effect in the cortex, whereby there's a neural stimulation of the other pathways to the contralateral on trade limb. More research is kind of questioning whether that's this Single serviettes cortically driven whether that's a single mechanism might happen at the spinal level as well. So it's probably mainly at that that neural supply that's facilitated initially. There is some question or argument that if you're training one arm, I assure you not doing a little contraction in the in the other arm. So that you can't really eliminate that unless you do, you know, EMG studies to there might be a small role of that, but the level at which that contralateral limb is contracting. If it is at all, then it's far, far less, considerably less than the opposite.

Steven Bruce

Obviously, in doing this, you're going to be applying a lot of strength training to the good limb. Are you Is there any problem with sort of the imbalance in the muscles that was going to occur because the good ones going to continue getting more and more powerful while the other one is going to be a lot slower?

Claire Minshull

Yeah. So I think the, the evolution of the investigation of its effect has gone from like a performance situation. Then we think, oh god, this could be really useful in musculoskeletal conditions or orthopaedic conditions. So then you see some pseudo clinical studies, which are some really well controlled ones where you cast one limb, so it's a mobilised and then you train the other leg. Now obviously with the mobilisation comes atrophy and reduction in strength, so that could you know, 510 20%, depending on how long you you immobilised for so then you're thinking, well, if we can attenuate those losses, then that might help with the rehabilitation process. It might be expiate for rehabilitation, you know, it's got a considerable benefit for that. So we've seen that in healthy populations. Where the limb has been cast and all this research is

generally around about from about 2009 onwards but still vastly under research in clinical Mfk populations, stroke people, they're there on it, you know that they're though they're far more ahead of the game, but in terms of Mfk issues and orthopaedic conditions, we're still in its infancy. So then we put together a clinical trial A few years ago, a couple of years ago now, which we've just finished and submitted this week for review, where we took a an anterior cruciate ligament population, we're going to our deficient population who were listed for surgery. We use them because they're usually quite compliant population. And there's a known, well documented effect of reduction in strength post operation. So we live Did they they randomly allocated 44 patients to a two conditions, one of which was a strength training programme in the non operative limb, which commenced at two minutes, two weeks prior surgery. So we're using a clinical population here. And then the other group was randomly allocated to a few like a placebo time matched or polym stretching protocol. So they've got the same amount of tension that's given to them, they've got an additional task to do, but it shouldn't really convey any benefit to the to the lower limb at all. And we measured them before surgery. We measured them at 10 weeks per surgery and then at six months. So what we saw was in the control group, if you like or the placebo group, there was a reduction in quadriceps strength. Measured other things are the parameters as well. But this quadricep deficit is really well documented post ACL reconstruction. And there's you know that the inference that might that might play a role in early onset osteoarthritis, etc. So there was a 30% reduction in quadriceps strength in the in the control group when we measured them at 10 weeks post surgery, which matches what's reported in the literature. And I just add as well that everybody did the standardised ACL rehabilitation programme, which is well documented and everybody followed this as they would normally do.

Steven Bruce

I was going to ask how you got it through an ethics committee if they didn't do that, because that would have been sick?

Claire Minshull

Yeah, withholding of care. No, everybody did the normal and so they either did additional stretching or they did additional training on the non operative leg. So that was three times a week. Three to five rep marks, extensions, curls and leg press. And the cross education group. So the whilst the control group lost 30% of strength, the cross education group was half of that. So it's really 15%. Yeah. So by doing this intervention, put them in, you know, we've demonstrated that cross educational effect in a clinical population, which is then got potentially a good or better basis for them recuperation as we go down the rehabilitation process. Yeah.

Steven Bruce

They've done asked whether the effect in the opposite limb is due to stabilisation.

Claire Minshull

So yeah, that's, that's one of as I mentioned before, if you've got these potential small contractions in the opposite limb, then you can't argue against that playing a role. But what I would argue is that it's it's the level of contraction required. Certainly in our study and other studies that have gone before, you know, you're in

a fairly stable position, your your body is in a fairly controlled position and stabilise such that it's minimal. So what you do in that the opposite, like you can't get unless you put EMG on the musculature you can't ever eliminate that has been a contributing mechanism. But you wouldn't expect us like 20% 10% contractions to elicit or attenuate the, that 30% reduction by half if you like. So, at that point, and it's one of the potential contributing factors,

Steven Bruce

but not really matters if there's a way of exploiting that which doesn't involve doing the cross over trading because what we want is the outcome. We don't care how it occurs, do we? Yeah, it's nice to understand the mechanisms but we know it's working.

Claire Minshull

Yeah, that's that's what I was gonna say. So arguably, off pragmatically when you look at it, excuse me, what we're after is that effect so we can still debate the mechanisms. As long as it's not contrary indicative to the condition, which, you know, those even if you are contracting 510 percent of the MVC that I can't think of off the top of my head, and the conditions where we're discussing in this forum on this remit where that will be country indicative, so it doesn't, it doesn't really matter. It's nice to know and it's been, you know, it's a body of research in itself, but the outcome is potentially huge for those clinical population. So we're really keen to pursue that and look at other populations where you can imagine a much better enhancement of like, total knee replacement, hip replacement other really big orthopaedic surgeries, and particularly when you're competing with the effects of sarcopenia and Well and previous immobilisation, or certainly limited physical activity. Yeah,

Steven Bruce

dude, this is slightly off the topic of what we said we were going to talk about today, but we'd already agreed we were gonna go off piste whenever it was necessary. I don't know, ask the question, but they want to know if you know anything about the effect of blood flow restriction training. And Claire myclass says she's checked with the Vimeo gang that that really is a thing.

Claire Minshull

It is it is. Yeah, so I really like the restriction trainings. It's got its place.

Steven Bruce

Explain what it is because I suspect many of you,

Claire Minshull

yes, tonic a round neck and putting on

Steven Bruce

a mouse I know.

Claire Minshull

That's that's a different show, isn't it?

Steven Bruce

We turn the studio round overnight for that one.

Claire Minshull

Buddy. Got it. Okay. I'll change my outfit. So in blood flow restriction training is basically blood flow restriction involving training and it involves atonic a. So what you tend to do is paste a tonic, a distal to the musculature that you're so proximal to the musculature that you're training such that you occlude temporarily the blood flow to the exercise muscle. Now you can see this being haphazardly applied in gym settings when gyms are open, and you see guys would just turn in case pulling them around you know, cuz biceps and upper limb so you've got the arteries appear also lower limb, kind of in kind of inguinal region, you know where you've got a more superficial alignment of the arteries there. So that's where typically you apply the the tone occasion. But they, it needs to be a measured approach. I'm not advocating that everybody goes away and does it right now it's you need a either a Doppler certainly to monitor the effect of the Atomic Age on blood flow. And you also need ID ideally, the way in which you are measured way to occlude the supply by a certain percentage or it can be something like 40% of mean arterial pressure. And once you've got that protocol in place, and and there are contraindications to doing it as well, so, pregnancy or vascular conditions, you know, there's a whole list of things but the advantage of doing it, which I'm sure you're listening to forgive me, I forgot what the name was asking about is that it offers an advantage because you can have considerably less forceful contractions. This are very similar gains in muscle strength and potentially size. So a typical protocol would be occlude by a set amount their blood supply to the lower limb through new extension exercises, and you'd be going something like a protocol 30 repetitions. So this is completely out of the range of what we're talking about in terms of strength. But from a blood flow restriction training perspective, you do 30 repetitions, and maybe three seconds total in duration. So it's highlighting or extending the lowering phase by two seconds, then have a break of around about 90 seconds then you might want to do three sets of 12 and that's a standardised protocol followed in the literature. There are others and there are different weights have different intensities, but what that generally enables you to do is Exercise the musculature, much lower level of muscular contraction. So if it's uncomfortable to do five rep maxes and heavy resistance training, it offers a potential window to make those strength gains which can be quite similar to that of strength training, as we've discussed it before. So this has a real utility, again in clinical populations. And I know some great friends and colleagues of mine who work in the English Institute of Sport, use it potentially or thought about using it with athletes to enhance recuperation from surgery where there's a real performance goal, you know, there's a need to accelerate recovery, but we can't load up in this particular way for whatever reason. It's got advantages in the older populations where you've got a stiff and sore joints. So it's a real done well done correctly. It's a great adjunct to rehabilitation.

Steven Bruce

Sorry, I was just so I'm struggling to understand the mechanism of action because to me, it looks like you're trying to train the muscle to operate anaerobically you're starving it of oxygen essentially. So why is that having a beneficial effect in terms of strength training?

Claire Minshull

Yeah, I'm not an expert on the mechanisms, but you see a different response, hormonal and enzymatically. And the, the response to it, which is different when you occlude the blood supply means that then there's a almost like, compensating mechanism for increasing muscle strength thereafter. So forgive me I'm not I'm not the expert on the mechanistic drivers, but their response is obviously quite different compared to that neural high intensity neural input for you know, that fast twitch fibre recruitment synchrony of firing which is very short and sharp, and that five rep max It's a slightly different approach, also a slightly different mechanism or very different mechanisms. And commensurate with that, though, you just need to be careful that there is a need. How do I phrase this? When you go back to the activities that you're going back to whether that be elite sports, or whether that be activities of daily living, cross country walks, you need to think that you will still be encountering the same loading on the musculature on the joint on the on the non contractile tissues, which, at some point, you need to be able to reintroduce. So you're resilient and able to contend those forces, which if you think about blood flow restriction training, or other methods of training that might involve submaximal loading for strength effects, where we're not inducing that load into the musculoskeletal system. So I think as I said, as an adjunct, I think we can move from that then into higher intensity or heavier loading such that when we return to the activities that we want to get back to where we're able to contend with them better than if we were just stronger, but maybe the, you know, the, I don't know, I'm not quite sure we know in the literature, what the effects on tendons and ligaments are as well as we do on the muscles. But clearly, there's not that that loading.

Steven Bruce

I was thinking when you started that I don't want to talk too long about blood flow restriction because it wasn't what we set out to do. But it when you started talking about tornadoes, I mean, there's an obvious danger with tornadoes and nikka sent in a question saying how do you measure the blood flow restriction? I think I mentioned Doppler earlier on but I'm not quite sure how that works.

Claire Minshull

Yeah, so you must measure the the blood flow so this delay can run the ankle. There's a doctor. Also, you need to speak on monitor and just look at the level of which you're, you're, you're including blood supply, and it's not a total occlusion that you need, it's a percentage of, of that pressure required to occlude. So as I said something potentially about 40%. But that's why it's important that you get this measured approach. And there are some systems on the market that enable that. It's not, it's not particularly cheap, because you need to have that standardised approach and that reassurance that you're occluding the supply correctly and at the right level, such that then you've got systems that continually monitor throughout the contraction throughout the sets. What that that occlusion is, and once you've established it, you know, once you've established what that is for that particular athlete, then or that particular patient, then you've got a known starting point. But you can kind of keep coming back to but that the measurement of it, I can't emphasise

enough, don't just go and start putting on a case on legs and arms and send your patients away. But done correctly with training, it offers a great adjunct to rehab.

Steven Bruce

And he's asked an interesting question. He says he uses a mirror for chronic pain patients using graded motor imagery techniques. And he wonders if it's possible to apply the things you've been talking about crossover techniques with that as well.

Claire Minshull

So there's a whole body of research that look at different types of cross transfer. So this mirror training where I think what you're describing is you're looking at your patient is looking at the whole self in the mirror, but there's a way in which you can use mirror imagery to reflect one limb or not the other Pc watermain so

Steven Bruce

I think that's what he's I think that's what he's talking about.

Claire Minshull

Okay. Yeah. So that's, that's an established technique. And that's, you've got different avenues to investigate this effect. One might be motor skills, are there other motor skills following a period of cross transfer training, education training, more refined, better, more accurate, etc. Another, as I said, is strength training and what's the physiologic strength enhancement or attenuation of deficit after and as I said, the stroke literature have got a far greater body of literature on this, which is probably where I'd suggest you go and have a look. If you're doing kind of mirror type training, and you're looking for those small, subtle or motor task improvements, then there as I said the streets ahead on that been awesome Mfk

Steven Bruce

I think we're what we're seeing at the moment is we're seeing a complete divergence of attitude between our Facebook viewers and our Vimeo viewers because I gather that the Vimeo viewers are going nuts about the idea of you and I are having a secret dungeon somewhere. And I want to point out that it's not the same secret dungeon. We don't share this in this room. But the Facebook who is a more intellectual and they're asking whether Voodoo flossing is effective. And again, Claire has checked that is really a thing that

Claire Minshull

I my understanding of flossing is I think there's there's two approaches and I might be I might be wrong here. I think I put them in potentially that, again, are junked, possibly feel better type therapeutic approach. One One approach to flossing is a joint so you might Wrap a bandage, I'm trying to get the right terminology here. So you, you wrap a bandage around that, let's say the knee joint or almost like a tourniquet, something that's really tight. So that when you flex the knee, you can't flex it fully because the materials in the way and it's quite a solid, you know, inflexible material. And then you go through a process of loaded flexion extension, and there's perceived to be almost like an opening up of that joint or less

compression associated that you might get. So that's one possible mode of doing it. So I've heard people use it when there's potentially meniscal tears, and maybe there's a bit of meniscus in the joint that needs to kind of flip back to nose. So whether it's effective or not, I don't know if it feels okay, feels good. And then another, I think, is the fascia of the musculature. And again, a similar way of trying to get that to occur. I'm not an expert in those techniques. I'm not aware of any high quality research that shows those to be effective in performance or pain loss or range of motion. But I'm not, I'm not pooing them. You know, I'm a big fan of. If something feels nice, it feels good. It feels like you, it helps you. It helps your patient to come in and tell you you've been doing something if you were to tell them so that's a load of rubbish. But politely don't do that anymore. You need to do this. You've probably lost them. They're not going to buy into what you're going to say anyway. Okay, that's fine. You keep doing that, but let's try this as well. When there's a mass, you know, your knowing is as much stronger evidence base. It's like foam rolling, you know, why do you foam roll, it's to try and change the, the parameters of, of tissue requires far more force pushed into it, then then a foam roller can navigate, but if that person likes doing foam rolling for whatever reason, you know, don't dispossessed them of that. Just make sure that other stuff is incorporated in there that has got a strong evidence base.

Steven Bruce

Promise me we've got what we got another quarter of an hour left and we press we could get a bit more specific about using the crossover effect. Let's let's take Anyway, here's a nice particular area of interest for you isn't it won't have let's say someone's had either arthroscopy or total knee replacement or something they've they've been discharged from hospital. We want to rehab that knee as effectively as possible. What would you be prescribing them to do? And we're assuming here that they're not an elite athlete, they don't have access to a high tech gym. Mrs. Miggins at home?

Claire Minshall

Yeah, well, the desert, there's a few things in there. So you could you could use a cross transfer cross education effect preoperatively. If it's really difficult to elicit those high level contractions in the limits that's about to be operated on. For example, tea is a tool for your toolbox. If it's post operative, then clearly that's in on this restrictions, whether it be just because it's pretty painful and stiff, you know, still still a restriction. So the way in which you could approach it would be, you do need that high intensity level of contraction. So that real strength training stimulus, because it's not really gonna work if you're doing submaximal efforts, if you're doing endurance efforts, if you're doing eight to 12 even eight To 12 rep max, are shown to have very little effect cross transfer on the opposite limb in healthy populations. If you can't get that person to go to a gym, to be able to do this, you want them to do it in a controlled way you don't want them to, you know, be doing barbell squats. If you have never done that before, you know, it's, that'll cause loads more complications. So you want stuff like knee extension machines or leg press. If you can't get them to do that, then there's evidence as well for isometric contraction. So that's maximal contraction. So that literally there's no appreciable move in the movement in that joint.

Steven Bruce

So we're talking on the affected side or the uninjured side,

Claire Minshull

on the so if you want to use the cross education effect, I mean, you just can't get that activation in the affected side without the post op, whether it be pre op, it's just too slow and then they're not gonna do it because they've got this belief that they're going to damage them, you know, you could instead of leaving them to decondition you could get upon a leg up by applying a high intensity isometric training programme in the opposite limb that's that's shown to be efficacious. Probably the most efficacious contraction would be eccentric, and then it's much of a muchness in terms of essentially concentric, eccentric and isometric all of which have got validity. It seems to be a systematic,

Steven Bruce

I guess there's no easy way in a domestic setting to get people to do a routine which involves five reps to failure, is it because yeah, elderly Mr. or Mrs. miggins is not going to strap a hefty rucksack to their back and start doing one leg squats.

Claire Minshull

Exactly, exactly. So you might set them if it is the lower limb and it is the you know, the quads that you must worried about that you might get them. If you could fashion something where they're set on a Chair, that's, that's not gonna move and you able to. So I'm thinking of like using a gym ball, put that at the lower limb. And so they start with a kind of knee, no 90 degree angle, you pushing against the gym ball against the wall. If that if that makes sense. They they compress the ball to a point, but then it won't compress anymore if you're able to fashion something similar with cushions, for example. So they're able to push against that maximally, for five seconds, and then relax, then you can use that as your set. So you'd be doing something like three to five, sorry, does it matter? The

Steven Bruce

degree of flexion in the knee will be obviously what we just described, you virtually got 90 degree flexion in the unaffected knee and you're and you're trying to extend it, but you can't. But it's gonna be for virtually isometric, isn't it because you can't push that ball very far.

Claire Minshull

For the cross transfer factor does it So, I don't think we know, I don't think we we've got that level of evidence in terms of the evidence for the trained limb, if you do isometric contractions at a longer muscle length, so for example, 90 degrees knee flexion for quads, compared to a shorter muscle length, I don't know it's 30 degrees knee flexion. You get a strength training benefit up that particular joint angle but longer muscle lengths, you get a greater transfer across a range right in the trained limb. So I would say, probably for recruitment for drive. This is my personal opinion and gas really, I'd go for a more of a mid range or more flex along the joint, longer muscle length, so you're able to recruit potentially more than a much shorter length. It might be easier to achieve as well in certain kind of anatomical configurations. But in terms of the evidence, I'm not sure we know. We can answer that. Likewise, limb dominance, we're not really sure about whether that's got a role to play. There's no hard and fast evidence on that either.

Steven Bruce

I guess instead of the gym ball, we could also be using resistance bands and things like that to give a little bit more sense of the gym. What about in the gym bunny? We've talked about two particular forms of quadricep exercise. When you send him off to the gym, what would be your protocol for him is it going to be three sets of five to failure using two different machines on each of those?

Claire Minshull

Yeah, actually, um, do that twice to three times a week. So I'd be looking to accrue depending on their experience I'd be looking to accrue between 25 to 45 repetitions per muscle group per week. Now when you assimilate the the evidence and the Go quality trials and you're looking at a dose response it's quite difficult to achieve. But from my evaluation of the literature, I would say you need to do in excess of 300 repetitions on the on the train blend to get an effect on the on trend blend now clearly that's not in one session. And it's it's maybe dosed over a six week period, maybe twice, twice a week, and I'm saying in excess, probably of 300 repetitions and that's going to be at that five rep max. If you distil that down, you know, you can start to work out a type of programme but generally it's four to eight weeks, it's two to three times a week, it's certainly more efficacious in those those higher intensities. If you can get something similar like that put that programme together, then it matters not if you're doing what's at home isometrically or if you're in the gym doing leg extensions and leg press, as long as you're getting that intensity and approximating that dose.

Steven Bruce

chameleons asked an interesting one. First, I thought it was fairly straightforward, but she's with this elderly person we talked about a moment ago. Yes. We talked about what we're doing with the uninjured leg. What position does the other leg have to be in? Or doesn't it matter?

Claire Minshull

Just a comfortable position? Really?

Steven Bruce

Yeah. Yeah. It's likely to be in a fixed position anyway, isn't it? They just come out of surgery because they're not going to be moving it around too much.

Claire Minshull

Yeah, yeah. Yeah. And

Steven Bruce

Nick has come back with an observation. I'm not quite sure about this, because he says laying in bed and pushing against the headboard to start with I'm not sure if he's talking about our dungeon activities or whether this is the elderly people in bed. And he said, so yeah, pushing the sideboard limit gradual progression for just starting muscle stimulus is that same reason.

Claire Minshull

I'm trying to think of the configuration that this this person In his in, so

Steven Bruce

I missed the leg once you push against and which muscles is it then exercising?

Claire Minshull

Yeah. Is that some sort of leg press? Exercise potentially, maybe. And was that was that for the for the non operatively mother operative limb, I'm guessing

Steven Bruce

he's talking about doing it with the effects of the non operative limb to try and get that crossover effect. But I'm struggling, I'm not I'm not sure how much that's actually going to target the quads if it's the quads that we're after. But I want to ask you, though, we always talk about the quads, but then on a separate occasion, people will talk about balancing quads and hamstrings. So what's the effect on the hamstrings of inactivity? And how much do we need to do for them?

Claire Minshull

Yeah, so you could argue that the hamstrings even more important for protection of for example, the ACL, what kind of thing so we also did an our study we did leg extensions, hamstring curls and leg press. Now we We didn't see the same effect cross transfer effects in the hamstrings. And we don't exactly know why. I think some of the reason might be that. So it's a dose response effect in terms of the cross education so we want to stimulate the musculature and get the train the non trained limb to in the small, joyless musculature to change as well. I think our dosing for hamstrings probably wasn't enough such that the leg press is probably a bit more quads dominant. Although the hamstrings are involved, maybe we weren't dosing the hamstrings enough. You also there's not much on the hamstrings. To be perfectly honest with you if anything at all in the literature. It's polenta bicep Lots of Alma deviation, and also quadriceps. There's very little in the hamstrings, even those ACL papers. There's one or two other studies that have done ACL cross education. And today, we're the first study to investigate hamstrings.

Steven Bruce

Such a horrible muscle to train.

Claire Minshull

You don't see interestingly, in all the research that we've done with, from an ACL perspective, you don't see the same level of deconditioning in the hamstrings as you do in the quadriceps. Yeah. So by the same token, maybe there's not as much gain to be had, if that makes sense. We don't have a definitive answer, but some of the questions we're asking ourselves is Do it Do any to just isolate the hamstrings and I don't maybe we swap the maybe swap the leg, press for More hamstring curl, or Romanian deadlifts, but that's gonna be quite difficult to do a three to five rep max single legged. So that becomes a bit more logistics challenge. So maybe we need to do some more. Maybe you've got other questions, you know as well in terms of thinking

about the quadriceps are far more trained and in activities of daily living, so they potentially potentially they adapt and decondition and recondition perhaps more in greater magnitude than the hamstrings? I don't really know the answer to that we've got a lot of questions that surround that. And one of the ones that we were keen to answer

Steven Bruce

one final question from the audience because we're almost out of time. PC has asked that crossover effect on the hamstrings is that when exercising the hamstrings on the good side or exercising the quads on the good side,

Claire Minshull

so it's, it's muscle group specific, so If you want to get bicep strength changes in your right arm, you need to train the biceps in the left arm for the cross transfer effect, obviously. Otherwise, you just lift weights with the with your right arm, same for hamstrings. So you need to do a hamstring training protocol in the triangle m, if you want to see any change in the untrained gland, like so it's think about the muscle group you're trying to affect. And then train that in in the opposite lead. So it's muscle group specific

Steven Bruce

and now we're out of time, but I think it's worth you just once more going through the very, very quickly the principles that you've outlined on several occasions on our show in the past of improving strength in a limb because I think a lot of people find it quite surprising. number of reps per week number of reps per session, just give them a burst,

Claire Minshull

okay, so if you do something novel, you will get some adaptation so you can lift light weights, you might get some strength septation what we're saying is if you want to optimise for strength gains, you need to lift heavy weights for fewer repetitions and a ballpark figures three to five repetitions maximum, and it's relative to the individual. You won't probably do two or three sets a week but accruing somewhere between 25 to 45 repetitions per muscle group per week. And that depend, you know, dependent on the individual training status. If they're really well trained, you probably need more than that. And the benefits of that will be optimising strength gain, while minimising the change in morphology, because if you want to get bigger, you need to change that or change the volume certainly. And then also you've got the other effects that are beneficial for them, the non contractile tissue to

Steven Bruce

I was at work you said, let's say five sets to failure, three sets per week, but you want 540 25 to 45 reps per week.

Claire Minshull

Sorry, I meant three times per week, not three sets. So you dose that is usually can usually get to 25 repetitions per muscle group per week across two sessions during different exercise. The more experienced

resistance trainer might accomplish that quite easily in one session, in which case, you're really looking probably more than run about 50 Plus, to get a similar effect and that's optimising your strength gains, you will get some change with with with lower intensities. But if that's your key, that's what that person really needs to change to change them progressively get there because that's where you get the biggest bang for your buck.

Steven Bruce

Thanks for a good session with some strange rabbit holes that we dive down there but as always, lots and lots of useful information. And I'm sure we'll get you back on the show again because it's such good fun