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Transcript

Chronic Pain and its Treatment with Neurofeedback Training -ref276

SPEAKERS
Nick Birch, Jon Graham, Steven Bruce

Steven Bruce
Good evening. Welcome to our last live broadcast till the new year and I promise you, it's going to be a good one. First, I have Nick Burch, a spinal consultant who cut his teeth as a doctor in the early 1980s, before becoming an orthopaedic consultant in the mid 90s. He specialised for most of his career in the spine, and as a result, there's not much he doesn't know about it. He's also very happy to tell it like it is. So ask him a question and I know you'll get a straightforward answer. Welcome back,

Nick Birch
Nick. Thank you, Steven.

Steven Bruce
Also treading the boards today, we've got Jon Graham Jones is recognised internationally as a specialist neurological physiotherapist. And his first gig with us was several years ago when he bought Rex in two metres. Worth Looking back at actually Rex is a robot exoskeleton and I had great fun trying that out in the studio. But the point of the show was to demonstrate the kids and Jon has expertise in spinal injury rehabilitation amongst other things. So welcome back to you, Jon, I'm looking forward to seeing what toys you brought in to demonstrate the secret. Yeah, thank you. Since we're talking technology, at least in part, we are still waiting for someone to be brave enough to join us through the video link. So if you've got a question the buttons on the webpage below the video screen, and if you'd like to be the first to join us in person, as it were, then give it a press and and it will sort it all out for you. Otherwise, of course, just let us have your thoughts, your experience your questions via the chat links. And we'll see what Nick and Jon can do to help you out. Right, Nick, what's new in chronic pain?

Nick Birch
Quite a lot, actually. So you might be aware that in 2021, nice updated their guidance on chronic pain and its management. And what they've done is to define chronic pain now as primary and secondary. And be nice if the slides advanced.

Steven Bruce
Just in the slides, I decided not to advance area.

Nick Birch
So primary cause Tegrity, great pain. So in the past, we knew that chronic pain was complex, you could have somebody who has knee arthritis. And by definition, they're quite their pain is chronic, because it goes on for more than three months. But of course, then they go and have a knee replacement or whatever the treatment might be. And as a result, then for the majority, the pain disappears. So that secondary chronic pain because it's secondary to something else going on primary chronic pain. It's fascinating for me for most of my career as consultant because I knew in certainly as early as 9697, that there were changes within the central nervous system that occurred with people who had pain for a long period of time. And you could do treatment to them that you think would just work and they'll get the right it didn't. We didn't know why but it's now very obvious why it is and that is because primary chronic pain is probably essentially neurological. So what you're looking at is changes within the organisation the networks in the brain. And that really leads on to most of the advice now has going for nice regarding the way to treat primary chronic pain,

Steven Bruce
but what's causing it

Nick Birch
a trigger and It's probably epigenetic. So something happens to you, you get backache, sciatica, something triggers, and you have a predisposition. And we know from some of the the UK, biobank studies and the twins, UK twin studies, that there are some people who are more likely to develop chronic pain because of their genetic makeup. And so there's an epigenetic event, it turns on some gene somewhere, that then produces a downstream effect within the brain, and you get alterations in neural networks and neurotransmitters. And that then means that the message is coming into your nervous system, instead of being interpreted in the way they should be. So I couldn't be moved my hand. And that might be a proprioceptive message, but then it could then be interpreted by the brain as being a pain message. So normal normal sensation, then becomes misrepresented as pain.

Steven Bruce
So we're at the stage where they've identified what Gene it is that's causing this and therefore they can prospectively say so when is susceptible?

Nick Birch
There aren't there are candidate genes, but I think it's a bit early stage yet to be able to say to people that you could screen them, because if we could do that, it'd be nice to say, well, let's screen you to see if you were likely to go on to get chronic pain, but we're not at that stage yet.

Steven Bruce
You and I have shared a couple of patients with chronic pain. And we have to choose our words carefully on this. But chronic pain patients can be quite difficult, quite challenging to deal with, can't they? Yeah. Which is Which comes first? Are they challenging patients in the first place? And that's what leads them to be susceptible to chronic pain? Or are they challenging because they've had pain for years and years and years? And just can't get into

Nick Birch
it? Or are they challenging because the way they've been treated? Or not treated as the case may be or not believed? And I think one of the problems is that it's a combination of all

of these. So you've got somebody who's got pain? And if then you go by the nice guidance, which is to say, well, have they actually got a condition that would lead you to believe that amount of pain is appropriate? If you as a doctor, or as an osteopath think? Well, no, actually, they're trying to kind of make it up. You don't don't believe them. And then they start to bang their heads against the wall, and then it goes to somebody else who doesn't believe that they get around this this circle, whereby they're seeing people who aren't believing that, that they can have something that seems to be out with what is normal, you know, well hang on a second, I treated you I gave you medication, why didn't you get better, it's your fault. And they become they despair. And patients I see usually need time and space to just dismantle all of the stuff that's gone before, to try to work out what is actually that sort of the baseline of where they are. And then to build them up again, and to get their treatments in a logical order. So you said Okay, have you tried the baseline conservative treatment? Have you tried this? Have you tried that when you've done all that, and you still got pain? That's where you've got primary chronic pain, which is neurological, so you have to exclude all the right things. I think the big, big difficulty is that patients get desperately frustrated by the slowness of which things happen. And that in its own right feeds into chronic pain, because the slowly it happens, the more likely it becomes ingrained in the nervous system.

Steven Bruce
I suspect they get frustrated as well. I've seen this in one patient only recently, about the lack of joined up adness in the NHS as well. They'll go and see a consultant on one hand, but the GP won't know about the results or whatever. And they can't get a single answer from their practitioners.

Nick Birch
And that's actually true. But it's not just the NHS. I mean, it's actually the whole of the whole the whole of the whole of healthcare systems across the world. Because you have to have, in some respects, it means sort of Seamus Malone in the wonderful book he wrote, at the end of his career, describing patients who've got complex problems and supertankers, you need to have a captain of the supertanker to be able to turn it and to guide it. Because if you don't you got lots of people that supertanker just carried on going. And if you've managed a patient with chronic pain, and like a supertanker, unless you've got someone there who's actually taking charge and saying, Look, we need to make sure that you're being guided through all of the right stages at the right time, then then they don't actually use the right person to do doesn't matter. It could be could be anybody, somebody who's actually got the time to spend with them. And he's got the knowledge that you need, you need some, some specialist knowledge, but I think what you really need is an understanding of people and good communication skills, or anything else. And you don't you don't have to be a particular person, you need to have a competency rather than a professional certificate.

Steven Bruce
Yes, I see so often, I think not just with guests here, but with patients in my own clinic. You when you listen to them, you think well actually, I think probably what went wrong there was that somebody didn't handle you properly and not give you the treatment you needed but they just didn't speak to you the way you're expected to be spoken to.

Nick Birch
I think that's obviously right. being dismissive is never helpful to any patient. And if you've got someone who keeps coming back and, and and is complaining of pain, and you think you I've come to the limit of what I can do, the next thing to do is not to tell not not to dismiss

them, but say, Okay, you need to see someone who does know how to deal with it. And that's, that's the step that often isn't taken,

Steven Bruce
you are yourself in a great position at the moment, I always feel because since you stopped doing surgery, you don't have any skin in any particular remedial game, do you so you're able to do that captain of the ship stuff, and say, Well, I'm not going to give you the treatment, but I can tell you where to go and get it and marshal the soldiers.

Nick Birch
And the other thing I can do, which is, which is I think that that, if people can do it within their professional lives, is actually to say, I'm going to dedicate time. So if somebody comes along to me, if I know they've got a particularly difficult problem, they'll get an hour of my time, and you to let them speak. And if people can offload in the first 1015 20 minutes there, suddenly they think I'd be listened to that in its own right as a significant therapeutic intervention. And it really helps them. So you're absolutely right. I don't I mean, because nowadays, I don't say to people, well, I've got, I've got a I've got a hammer, you look like a nail, I'm gonna hit you, I gotta do surgery, I've got lots of other things I can do. And many respects that sort of, it's helped by colleagues like Jon, I mean, because we work very collaborative and collaborative together with a lot of neurological type problems. And having that ability to go without then having to resort to surgery is really quite helpful.

Steven Bruce
We're a bit off piste at the moment, but just just wondering, while we're talking,

Nick Birch
we forget the deck. It doesn't doesn't matter.

Steven Bruce
Well, while you're one you were doing surgery, despite the fact that I'm sure you must have selected your patients carefully to pick the ones who would do well, you must have had people who didn't do well, what's your attitude to handling them, but especially if it was a private patient who spent 1000s on his treatment, and then he still got the back pain he came in with?

Nick Birch
That's really difficult. It's really challenging. I mean, the first thing is that if you if you as a surgeon, you have to be absolutely honest with yourself and have complete integrity to say, that person in front of me is telling me that they're not doing well, I'm not going to put my spin on that and say, Look, your X rays look fine. You must be okay. You listen to what they're saying. So the first thing is hard, you have to be hard on yourself. And then when you do that the circuit is fine. I mean, we're not gonna let you stew, you've got a problem. Let's find out what's going on. So you have a very low threshold for investigation, and a very low threshold for then saying, look, if I don't know what's going on, I know someone who doesn't know what's going on. So you then have to swallow your pride and say, you know, this hasn't gone right. For whatever reason, maybe I have caught up, maybe I've actually done something. Technically, that's actually led to a complication that's given them for the problem. There are some some standout cases in my career where actually that didn't happen. It was one guy who had spinal fusion. Three days later, he developed paralysis, and I thought, my God, what have I done, he turned out to be picked up a virus and got Guillain Barre. But you beat yourself up in that that first the first few days was, sadly until you find out what's going on.

But the most important thing is to say, there's a problem. Let's face it, and you know, we're not going to close it down and sort of suggest that you are somehow getting better when you're not. So it's honestly really,

Steven Bruce
yes. I suspect that people in my position, possibly probably less so in yours, Jon, because you're a physiotherapist. Therefore, you're very much embedded within the the NHS world in conventional medicine, but osteopaths and chiropractors terribly worried about cocking it up because a complaint against us just adds fuel to the debate that osteopaths and chiropractors don't know what they're doing, which I don't think is the case, but within every professional, there'll be somebody who gets something wrong from time to them.

Nick Birch
But you do see that earlier with physios

Jon Graham
yeah, there's still there's still some people who it could be their first experience of physios and they've still got that the chaps are run on with a sponge onto a football match. And suddenly, you're that we have to build up their confidence in what we're going to going to do with them.

Steven Bruce
But you you in NHS practice, or only in private, in private practice, and people expect different things of a private physio than they do from an NHS physio, didn't they? Because expectations are quite low of physios in the NHS field, I think.

Jon Graham
Yeah, it's I've been at the HS for 19 years. So

Steven Bruce
and that's not a reflection of physios. It's a reflection of what the NHS was there to do. I

Jon Graham
think the you're right that they are they're coming with the current expectations but also in my early years of working selling private practice that what was knows what would they actually do the exercises you gave them to do? Because then paid to get them in the first six months. I thought crumbs I got really good all of a sudden, and I know they're actually taking they're taking note of what they were they were told to

Nick Birch
do. But one of the things that you'll get Steven in your practice is that I know that osteopaths in general will say someone with a cute problem. If I can't get you right in three or four sessions. We need to look elsewhere because osteopathy should work in that in that time course. The problem is if you've got a one size fits all model Much of what goes on in HS, unfortunately, is that because that's the time constraint a has six sessions. That's it, you know and off. What if somebody needs nine sessions, where they don't get it? So they they're on treated? And then they go on or the problem then. And so then they go back to the GPS, it hasn't worked. And then they say, well, physiotherapy doesn't work. It No, it's not. It's not physiotherapy doesn't work. It's just you didn't have the right dose. So that's, that's, I think, one of the problems with the, as I say, this one size fits all type model. So let's get back on track. Yeah. So

Steven Bruce
the slides up on the screen behind us.

Nick Birch
So I've clicked through some of the slides. And I know that the audience will have actually had to hopefully have time to read them as we go along. So all that we've done is on the slide has to say what's primary chronic pain, what secondary chronic pain, then there's this this thing called Central sensitization, and central sensitization that is very definitely something that is genetically predisposed to that has been shown. And it's really something that is identified 20 odd years ago by Clifford Wolf. And, and, and he realised that some people, their nervous system becomes completely over reactive. And therefore a minor pain becomes a major pain, that's called hyperalgesia. normal sensation comes painful. That's hallowed Enya, and that we couldn't explain that in the 1990s. And then after Professor wolf did all of his seminal work at the end of the 90s, between the 2000s, we then understood it. And now we know from functional MRI, where central sensitization occurs in the brain. We also know there's a whole bunch of different chronic problems, things like fibromyalgia, temporomandibular, joint problems, multiple chemical sensitivities, these things, all of which are likely to predispose people to central sensitization. And it's very difficult to treat.

Steven Bruce
You mentioned that multiple chemical syndrome, it says on the slide amongst those 13, middle rams that contribute to this What's What do you mean by that? Is this over pharmacy or polypharmacy, that is

Nick Birch
basically people being allergic to the 20th century. Remember those people you know, I have to I have to live in a century. Now because it came out in the 20s. Because the the syndrome was in the 20th century, before we understood about central sensitization. And then it was renamed because actually what it was, was that if you're exposed to certain chemicals, then you got symptoms. And this was an overreaction of the nervous system. And that's what this this multiple chemical sensitivity was. So good. It was it was it was it was originally named labels, I'm allergic to 20th century.

Steven Bruce
Also, fibromyalgia crops up again on your list here, isn't it, which seems to crop up quite a lot. But I've always thought of fibromyalgia as being a name given to a collection of painful symptoms rather than a thing in its own right.

Nick Birch
So Fibromyalgia is defined by the American rim as logical Association as being multiple sources of pain in certain areas, I think you have to have the 13 out of 32, whatever it might be 13 or 18, whatever, but you, you push something vaguely sharpened to somebody and they they they Yelp. And that thing gives you the diagnostic criteria are fairly clear. The question though, is, is Fibromyalgia a primary diagnosis in its own right, is it an entity or is the manifestation of something else? And in my mind, fibromyalgia, unfortunately gets mixed up with chronic central pain, I primary chronic pain, central sensitization, often menopause because Fibromyalgia is much more common in women in the peri menopausal period, and it may well be that there's actually some of the pain syndromes you get with menopause, or then call fibromyalgia. And it's a bit like it's a dustbin diagnosis. You go see a rheumatologist had multiple pain sources, and they say, Oh, you got fibromyalgia. Here's, here's a leaflet,

off you go. That's it. That's the end of the treatment. Whereas actually, it may well be that it's it is central sensitization. And the treatment for that might then be the right way forward.

Steven Bruce
Somebody who's moved to the system, as CR says that David Handscomb, a spinal surgeon wasn't predicting which patient would respond to surgery depending on the amount of stress they were under prior to surgery.

Nick Birch
There Well, it's well known that if you've had I mean, stressful events will magnify pain responses. And the less stressed that somebody is, the more likely they are to do well with surgery and to to rehabilitate very well. I think most

Steven Bruce
people prior to spinal surgery will be quite stressed

Nick Birch
on the day of surgery, but if you if you if you've not combined, if you've had this that's what just gets me for a nasty alpha, this one does kurnia If you've had rip roaring leg pain for three months, you go into that operation, really looking forward to actually get Have you heard of that pain, so actually, you can be less stressed. Whereas if you've got back pain and suddenly said to you, well, there's a 70% chance you'll be okay. And there's a 30% chance you won't be and maybe a pain will be somewhat worse. And maybe I'll do make it make a hole in the JIRA, and you have a general tear, and you'll get meningitis. And then you might get paralysed, and then you might end up in a wheelchair, etc. That's a really good reason to be stressed about having surgery.

Steven Bruce
So informed consent is about

Nick Birch
informed consent properly, as far as is a good thing, read my two papers on informed consent.

Steven Bruce
Well, outline of those papers are there about how to get proper informed consent definitions of what it means primarily

Nick Birch
their their review of the Montgomery process and where we are with Gonorrhoea and actually why we have to spend time with patients exactly tell them what's going to happen, what the treatment we're offering them is compared to no treatment or any other treatment. And making sure it's in terms of they understand this goes back to communication is actually talking to people in ways that they understand and know what's important for them.

Steven Bruce
Yeah. Okay. Well, if I can, I'll share those with the audience. Can I share your slides with them as well afterwards as a handout?

Nick Birch

Yeah, no, no, you can send me that that's obviously fine. So but don't go back to the recommendations for treating chronic pain, because this really sort of comes down to the second half of this broadcast. And that is, the big problem with nice was it said, The only thing that we can really suggest for prior recurrent pain is is acceptance, commitment, therapy, therapy, and CBT and an exercise programme. That's it. But they reintroduced acupuncture, because their previous iteration, they said, Oh, you can't have acupuncture. And then they will still there was basis on the rest of that was no evidence, there wasn't there wasn't enough evidence to support it. And then they turned it around again. And I'm not sure if any randomised control trials that were actually then introduced to support the vote for us. There were people in the British Pain Society, who had been sat on that nice panel to begin with, who were sued. And so they may, they may, there may have been other factors there. But what it does show is that nice will change their recommendations depending upon what the what the well, let's let's be generous and say whatever the evidence is. And that's important, because they say that the moment the recommendation is no biofeedback. So neurofeedback training, which is what we're going to go on to, is considered by some people are fooled by feedback. So what we'll suggesting in reality is that if you get enough evidence of it, then you represent us to nice, then it may well be that that's something that's going to be worthwhile.

Steven Bruce
What doesn't nice mean, at the moment by biofeedback,

Nick Birch
anything that's biofeedback, anything that you are interacting with another entity be that a brake computer interface, or whatever it might be. And that then is changing the way that the brain is actually functioning. Biofeedback can be something as simple as wearing something on your shoulder that feeds back from your skin to your brain to say where your shoulder is in space. So there's quite a good example. Certainly, when I was doing shoulder surgery in the 1990s, we had a group of patients who had recurrent dislocations their shoulders mainly because they had altered patterning of the muscles. So the the agonist and antagonist muscles were not working away, they kept the shoulder in place, so they kept dislocating. But if you put if you put a little cuff around here, so that they got feedback from the skin, the brain knew where the shoulder was, and then could overcome that that muscle imbalance Neurofeedback other than the pressure of a cut step that is actually an electrical connection. No, no, no for girls was a bust. Yeah, just actually have your busty on there. And as a former biofeedback that's actually using one sense to inform the brain of something else that's happening. And they may there are various forms of biofeedback and one of those, which is neurofeedback training.

Steven Bruce
And for years, we used to be grew up to be gripped with that in mind, and we didn't do anything to strengthen ligaments or tissues, it just gave feedback. Yeah.

Nick Birch
And that's a downside, right and use it effectively is proprioceptive, isn't it? Right? So one of the one of the things that I think that that nice gets excited by the placebo effect as well and that's specifically we need to talk about that because the placebo effect and has been known obviously for for centuries, upon centuries, but centrally half it's very specific because it affects certain parts of the brain. So the the anterior cingulate cortex, prefrontal cortex, the periaqueductal, grey, these are all areas that whether we're opioid receptors, or concentrated the thing about neurofeedback training and biofeedback is it doesn't affect

those parts of the brain that's primarily affecting the somatosensory cortex and the insula. So what we know is that this this new technology that Jon I've been involved in, and I've run the proof of concept trial, and Jon's gonna go through that in a second. But that is not affected by the standard placebo effect. So therefore any effect that we have in the treatment that we are trying to then help people with is unlikely to be live as placebo.

Steven Bruce
So, you're saying that the neurofeedback that we're going to see doesn't affect those areas of the brain, but we buy some mechanism. We know that other factors do that. If we're doing a placebo for a sugar pill, we know that that does.

Nick Birch
Yeah. So so your stat, your standard opiate opioid networks, that's what the placebo effect is essentially tapping into

Steven Bruce
right? Could I just take you back for a second for five to fibromyalgia, which I thought might provoke some interest? Lawrence's How does it differ from polymyalgia rheumatica

Nick Birch
polymers dramatically as a as a as an autoimmune anti inflammatory condition. And typically, you get a very high C ESR and CRP. You give them a dose of steroids and magically they get better. So they're totally can totally separate conditions. The only thing that connects them is the myalgia. That means a muscle pain.

Steven Bruce
And Wendy says I find some of my patients with fibromyalgia are just happy to get a label and a diagnosis. But when I first trained as an osteopath, one of the things that used to upset one of our senior tutors was that people were obsessed with labels for things, and thought he felt that he often made them feel worse, when he goes on to say most of their symptoms can be explained by mechanically but then it's convincing them that it may not be fibromyalgia and more leg length differences or scoliosis problems, etc. How do you convince them that it might not be fine with fibromyalgia and might be biomechanical

Nick Birch
by doing a proper examination? I mean, I think that's a completely valid point. If you if you look at somebody, you can't make a diagnosis of fibromyalgia unless you get into it close off. How many people I would I would challenge that challenge, really, but just actually put out there as something for your for your audience to really think about. And that is, if somebody comes in with a diagnosis of fibromyalgia, get them to ask, Will you examine properly? Did they take off all your clothes down to your underpants? And do all the tests that you need to do to go through the American College of Rheumatology tests? And if they did, then it's possible that diagnosis correct and if they didn't, then I think when they said is absolutely correct, and that is you've got to look at the biomechanics, the, the whole of the body that it starts off with have they got flat feet? Have they got not knees? Have they got a leg length discrepancy? Have they got a scoliosis how they got a kyphosis? So it's all very, very straightforward.

Steven Bruce
Out of curiosity, what we regard as a leg length difference,

Nick Birch
more than one centimetre. So physiologically, one centimetre is easily tolerated. More than one centimetre is less easily tolerated. And anything is more than two centimetres is significant.

Steven Bruce
Okay. We've got a neurofeedback training slide up on our screen. Is that for you, Jon?

Jon Graham
Yes, no, absolutely. So just go back a little bit. I mean that to him, just the biofeedback. So biofeedback is making information available. That is normally not available, it's normally automatic. So heart rate, for example, heart rate monitor is a form of biofeedback. So if you've got your, your chest strap on, you see your heart heart rate, you do some deep breaths, and that that descends. That's that's biofeedback. So what we're looking at is the brain activity that were completely unaware of, how can we influence that and reduce pain?

Steven Bruce
Isn't there a big difference between one looking at a monitor in response to a heart rate monitors, you're looking at the readout on your Fitbit, or whatever it might be, and simply having a bit of Tubi grip around your arm, which is telling you where your elbow was in space.

Jon Graham
So the, the, they're still biofeedback. So they're still they're still making you these external agent to make you available for something that you're that you're not normally consciously aware of. So I'm not normally consciously aware of where my elbow is in space. And then suddenly, you put a tuba grip on it, and then you're aware, but it's not. And so the first time we put a wedding ring on our watch, we're suddenly aware of your wrist where your wrist is, and to certain extent, we couldn't wear clothing, if we were constantly there's a there's a necessary gating of sensory information anyway. It's an important. So with this particular area, it's it's been known for a long period of time back into the, into the 90s, that there are certain areas of the brain that produce a characteristic array of brainwaves that are predictive of current potential chronic pain. So you will see this even when somebody at the at the moment is at a sort of not vertically suffering, you can say, well, actually I've got a feeling, give that a month or two and you will will see some pain symptoms were emerging.

Steven Bruce
Is this a pattern that you would have Seen long, long, long, long ago. What is it? Is it brought on by some other trigger later in life? And so it might only happen a month or two before the chronic pain? No, I

Jon Graham
think I think I think the the indication is that if you're looking at someone who's had, who's had an injury, that potentially looking at these these brainwaves and certain people, it's probably goes back to the epigenetic stuff that, you know, that'll be the mechanism and underlying it. But the key thing in terms of understanding what we're talking about in terms of the the research is that there are the two key brainwaves, we're looking at a theta and alpha. And what differentiates it or classifies them is the actual frequency that they're that they're working at. So if you think of an old school to graphic graphic equaliser, in chronic people with chronic pain in a particular area of the brain, the C for the theta is like high bass is pulsing up here. And the alpha is, is down here. And well, if you then look at individuals that

don't have chronic pain, they're graphic eichlers alkalizer is different. It's it's high alpha, low theta. So they got low bass, high, high treble. So these are internal automatic activities. And so what we're doing with the neurofeedback training is making them explicit, so that the individual can then influence them. So what the, the axon device does is it, as you'll see in a moment, it's a headset, and it's sampling, it's not putting anything into the brain, it's it's picking up those those brainwaves. And relaying the brainwaves to the software, that then gamifies, the therapy therapy process. So as well as wants a strand of logic, if you kind of can accept that, in chronic pain, there's a particular look at that graphic equaliser, we've got high theta, low alpha in non pain, low theta high alpha.

Steven Bruce
So just just to clarify, high theta low alpha, is that driving chronic pain or response to chronic pain?

Jon Graham
So that's the that's a good question, Nick,

Nick Birch
I think is reactive, right? I think people who have not had chronic pain in the past are likely to have a baseline of either equal alpha theta or higher alpha theta, if you put a person who's who's a calm individual, they're likely to have high alpha and low theta, because that's the nature of the the those what the brainwaves are actually reflecting. If then they get pain, and then they become it becomes chronic, that's when it flips over. However, there will be people I'm sure who are effectively anxious or have already got a reason for their brain waves to be in a particular configuration, who are more likely, then to just flip into that situation. So I think that's, that's, that's part of the answer.

Steven Bruce
Okay. We're gonna go into your thing in a minute. Can I just go back a little bit, this is completely off the off piste, as far as what our discussion is this evening. But Sophie says, what treatment would you recommend Nick for leg lengths differences.

Nick Birch
And if it's a minor leg length discrepancy I saw but then he'll come is the first thing. And if that doesn't sorted out, then refer to a well trained podiatrist. And the well being well trained podiatrist will normally sort them out, up to about two centimetres with with good orthotics. As long as they wear them, that's absolutely fine. Anything that's much longer, much bigger than that. And if they've got a congenital abnormality, a congenital short limb, and they've got a big leg length discrepancy, and that's given the scoliosis. Yeah, if you pick that up in a child, then you might be looking at a leg lengthening type procedure. But that's thankfully, pretty rare.

Steven Bruce
Right? I was told long, long, long ago, when I first started studying gait analysis that anything as you say about an inch to two centimetres also in difference, then, instead of any sort of heel, if you're looking at a soul lift on the shoe, which I discovered is remarkably easy to get done at various shoe

Jon Graham
size where I would normally raise up to about 1.25 centimetres inside the shoe. Because of the structure of everyday shoes. If you raise more than 1.2, you then affect the whole way.

And that is exactly as you said, you can just split the soul and put an insert in there, which will give you

Steven Bruce
give you anything more than that, of course it's altering the balance of the Achilles tendon.

Nick Birch
But if you go back to my way, we were kids, they were always cobblers in the local towns that would then do the built up boots because there was people who'd had TB their hip. So they also had short legs. And they didn't have any leg lengthening type type surgery at that time. There were no less Ross around. So they had it was all somebody in the village who had had a Bhutan that there's this big and they had, as you said, an order gate and they had back pain, all the other things that went with it. So yeah, it's absolutely right. It's extra external up beyond As I said, I mean I would say sort of thing he'll up to a centimetre maybe the you can get the podiatry games to know of you being bit bit me at 1.25

Jon Graham
it's just it just the shoe. Yeah, it pushes the heel up to too high there

Nick Birch
but that's what that's what you did the whole foot orthotic. Yes. As as as as opposed to just a heel. Yeah, you're right. Yeah, heel, heel, I get one centimetre.

Steven Bruce
I'm always telling people how helpful my team are to others. And that was coughing a bit earlier on and I just I'll bet this is only because I've just been told him he's got a cough sweet for me if I need it, so they're going to do something with the cameras while you talk. And somebody's gonna come in here. Give me a coffee sweet now. And it all happened seamless. mentioned it, nobody would know. Just warning.

Nick Birch
Islam COVID

Steven Bruce
COVID? Everything Islam COVID. Jon?

Jon Graham
Yes, let me so. So we're what we're trying to do is we're trying to in these, in this cohort, we're trying to alter the brainwaves such that we've got, we lower the theta raise, raise the alpha. So we're trying to make that unconscious information available to the individual so they can alter it. The other strand is for some of the audience may may have remembered from back in the day, tomorrow's world on a Thursday night. This was science science programme. And one of the things they did, which just illustrates how you can learn these things. They picked on a chap in the audience and said, Right, sir, can you see that counter? Over there? Well, yes, it says, Can you see how it slowly counting up? 123? Yeah. So as you're doing that, sir, well done. And we'd like to keep on keep up with a good work. And the guy looked completely confused. And they came back regularly through the show. So look at that you're doing a fantastic job there, sir. And the numbers were going up at a faster rate. And they got at the end of the show. And they said, What do you think? And he said, Well, I can, I can see that. Whatever I'm doing, I'm doing better, because the numbers are sort of flying by, I have no idea what I'm doing to influence those numbers. So they then pulled out

a little chat from behind the screen. And all that had happened was this, behind the screens fellow had been looking with a telescope. And every time this chap blinked, he hit a clicker. And the, throughout the period of programme the brain, because it's getting that positive, you're doing well. It's auditory stuff, you're getting some visual feedback of those numbers going on his brain is just trying to learn that connection. So by the end of the programme, the brain had managed to get a sort of a slight change in terms of the blink rate. So the so the beans some potentially some, some postsynaptic, the membranes had kind of come a bit more sensitive to release of ferns, mitis. Again,

Steven Bruce
I've probably lost the thread. But I was thinking as you were talking simply artificially lowering theta or raising alpha or whatever isn't going to change chronic pain because it's being driven by the chronic pain, it's not driving it. But if you're talking about a positive feedback mechanism hasn't there got to be something which says that if I keep doing this, it will lower my pain.

Jon Graham
So So again, you're looking you're looking back at the the central nervous there has been some sensitization so the brain activity has has changed out with long after the whatever cause whatever, whatever the trigger trigger was the it's the burglar alarm that keeps going off long after the burglars fled. And the the the manifestation of that that we're seeing is this is resulted brain activity. And as we'll see from the, from the results here, if we can influence that activity and change that, to move to what would associate with a state of not being in chronic pain, you then get these get the results.

Nick Birch
Yeah, the thing to remember, of course, is that pain is only felt within the brain. But so so with primary chronic pain, all you've got is a neuronal circuit that has altered the way it's interpreting the world. It's a bit like being in the matrix. And suddenly, you know, whichever pill you've taken, you've gone gone down that down the rabbit hole, and then to you the world is real in the world of chronic pain is very real, because that's what the brain is experiencing. All we're doing with the the axon device is trying to retrain the brain. So those circuits, say something else. And that's that that's that's all it is. And that's why it's called neurofeedback training.

Steven Bruce
In terms of Katrina has asked a question. Have you heard of Neurofeedback being used for treating ADHD? Which she asks because someone she knows is having this treatment? She's not previously heard of it?

Nick Birch
It's what it's well it's well, it's one of the indications for neurofeedback training.

Steven Bruce
It is okay. And is that exactly the same sort of thing we're going to see this evening. Yeah. Right. So you've got some results on here from a trial of

Jon Graham
going back to for the audience for the logic of this. So that person at the end of that studio, the brain had made the connections to change the the resting blink rate. By the time that person went home woke up the next day, they were back to their, to their normal, normal

blink rate. Had they been constantly every day exposed to that kind of activity, the brain may go, well, actually, that's the rate we need we need to be at. So with the with the axon system, we don't just give that person one experience in modulating their brainwaves, they get numerous opportunities to do that. So that you get the neuroplasticity, you actually get the neurological change within the brain. Now, whilst whilst there is this graph, there, this there is this high theta, low alpha and chronic pain. Periodically, there'll be a switch the other way, it's not a constant, it's, it's predominantly high alpha. So high theta that predominate, and then it'll be a switch, there'll be a switch. Okay? So what the axon does is, when it sees that switch, it then gives the reward within the games and the brains thinking Hang on a minute, why have I Why have I just got a reward, and that's where you start to get the change in those, the rate at which the fluctuation goes in the direction you want changes. So during 2021, we screened was 2933 33 people. And we ended up with a in this thing, 19 people into the trial, of which 16 completed, this was during lockdown, so that the original, the original plan that we went to the research ethics board was we would train these individuals in person how to use the use the headsets, send them away to use them at at home, we had to do the whole thing remotely. So

Steven Bruce
there was this 19 a reasonable number for a pilot study or pilot

Jon Graham
separate for a proof for a proof of concept. It's absolutely fine. And in fact, it was then accepted by the New Zealand Health Board as sufficient proof of concept to them fund this very large trial that's gone on in 2022. So our individual joined lockdown, where the packages were delivered, they were trained remotely via via via zoom, how to put it on how to connect visually, the tablet that gives them the feedback to the internet, how to play the games that will see Nick doing one in a minute. And we encourage people to do between four and six sessions a week, for an eight week period, there is a session. So a session lasts about about 42 minutes, because you set a baseline because the brain is changing. So each session you want to know what though what that baseline fluctuation is looking like. So that your your your reward them as you go as you go along. We did a number of questionnaires before they started number of questionnaires at the end. And then at three and three and six months. Is this only relevant to primary chronic pain. Now, because there was there was a mixture within the within the group, we took a broad a broad brushstroke in terms of some remnants of primary and secondary. So one person was, for example that was awaiting hip hip replacement.

Steven Bruce
Does that does the late do the latest studies need to split it between the two to show who benefits more or doesn't?

Jon Graham
I think I think the key thing the moment is if you look at the responders here we found that said 11 out of 16 responded in our trial and then said which is 69% and 79 had a positive effect and the other in the other trials. The interesting thing is what what makes a responder and going back to that today really quick question i Hanscom is a responder somebody who hasn't had previous traumatic events. So it could be something as simple as that. One of the things that Nick and I are looking at in subsequent study is about optimism, pessimism, do people who people think that the life can be different, and they responders but in our in our original trials 11 out of 16 responded and 50 positively and 50%. So 50% of those had a greater than 30% improvement in pain, which is a clinical clinically significant.

Steven Bruce
Was there was there a dropout rate similar in both trials. The other I think were three dropped out in the UK one wasn't.

Jon Graham
So they said the dropout rate? That's a good question. This is with any this is only just to come to completion. So we've only we've only been given some headline headline data on on this on the show versus the first time it's coming shared outside of the research research group. So what's interesting is how similar that the the figures are Um, so in our proof of concept we had 69% reported significant improvements in quality of life 69 and improvements in depression, anxiety, 63% proven and sweet quality and 69% up who had heard up related the Alpha had improved and improved their pain. And broadly similar in the in New Zealand trial, the slightly less in terms of the improvement there but they similar broadly similar in terms of the depression, anxiety and stress.

Nick Birch
What I think's interesting there is that in the New Zealand trial that was a true randomised controlled trial against placebo, and 80% were responding so higher than in the proof of concept. And of course, our proof of concept was very much hand holding these are these people who would guide you through so we're really finding our way with it. So the fact that then you go into an RCT, you get a better result than your highly controlled highly regulated proof of concept actually says that. Yeah, this is working well. Just good.

Steven Bruce
Okay, we're gonna do the practical in a second. Yes. Can I get put a couple of questions here beforehand, since they've come in and French Claire says will Jon elaborate on how they use the feedback machine to re educate the theta and alpha brainwaves in chronic pain patients? I imagine that's what you're

Jon Graham
you will see that.

Nick Birch
You do need to understand what that they need to understand one concept and that is neuroplasticity. When you and I would children and going through whichever medical school training or osteopathic training you did, we were told that the brain was fixed. That there was no changes. Once you had an adult brain you had no changes possible. We now know that it's complete bunkum, the brain changes it could change almost on an hour by hour basis because of neuroplasticity. And the key here is what the neurofeedback training is doing is tapping into that neuroplasticity so that the networks of change to produce the chronic pain we're trying to change the back again. And that's that's the key is neuroplasticity. And Jon mentioned that earlier.

Steven Bruce
plasticity is just the the neuronal connections direct connections

Nick Birch
are just changing back to where they should be instead of being this this this aberrant aberrant connected

Jon Graham
process. We want one thing that neuroplasticity I like is that is the is the human lens. So, so the human lens is a very optically if you can't see through it, it's it's very It's like It's like glass with with Vaseline on it. So the reason that babies take four to six weeks to have some vague idea who mum and her mum and dad is, is the neural nets in their eyes are adapting to the imperfections in the lens. So it starts as early as that Yeah,

Steven Bruce
yeah. Just 134 says how do you interpret when a patient describes severe pain in a particular area, but when you the practitioner palpate that area when the patient is distracted, the patient shows no reaction

Nick Birch
that's that's a primary there's a good example of primary chronic pain that is that they they've got pain coming from somewhere. But the joint moves completely normally or, or it is turn it around, flip it around and say if I if I rub my thigh, and it hurts just when I touch it, why is it hurting that should be just a doorway that but that's our idea. So that's that's actually a primary chronic pain, because central sensitization so the fact that they've actually got a localization for it just means that that is the brain says that that's originally where the message came from. They could well be they've got a sprained ankle, or a bit of back pain or whatever else, but it's all long gone. So they're now maybe complete normally, but they're still complaining pain there. Right? There's, it's a representation within the brain of what their, their their map is of the body.

Steven Bruce
Okay. A couple of people who apparently asked whether there is a rule for psychedelics or cannabis products in the treatment of chronic pain?

Nick Birch
Well, I mean, C. CBD, is very well understood. Now, we know that there's a cannabinoid receptor system, there are type one and type two receptors in the brain. I think the thing that hasn't been worked out particularly well is how to the cannabinoid system and the opioid system work together. And the other part of it is actually the psychogenic part of it, which is, you know, essentially magic mushrooms psilocybin, where do all of these various receptor systems that can modulate brain activity whether they will fit in so see CBD for some people works extraordinarily well. In other people, it's less effective. It take out the THC, so you don't get the hyperactivity that are the high as it were. And what you're looking at is just should be just type type one or type two cannabinoid activation. And if that's the work for you, that's absolutely great.

Steven Bruce
You said one of the problems is we don't know why it works. Is that a problem or not? There are quite a lot of conventional drugs. We don't know how they work, but they do so we use them.

Nick Birch
Well paracetamol is good example. was well, that spring when they were asked for aspirin is it and that's that's, that's just straight fairly straightforward anti anti inflammatory. But paracetamol is the classic and there's no knows how parallel paracetamol was. We didn't really know how general anaesthetics work, you know, so you actually right? Does it? Does

it matter? Yes, it does matter. Because I think when you're dealing with substances that are, if you like, loss leaders for an epidemic of a disaster like opiates, yes, you've got to make sure that if you're introducing something new, you know as much about it as you can, aspirin would never get approval these days, not because we didn't know how it works, because it's psychological, isn't it? So it's actually because we know that the side effects can be pretty disastrous, some people paracetamol would not get approval because we can't prove how it works. Most genuine studies would not get approval. If you're going to introduce a new cannabinoid, or if you're going to introduce a psilocybin for magic mushrooms, we need to know a lot more about the pharmacology.

Steven Bruce
Okay, last question before we move on, Darren says so how does this process affect the substance P receptors and help to reduce sprouting as found in chronic pain?

Nick Birch
Most of the symptoms be receptors are peripheral rather than central. So the answer to that is it's we're not really aiming at that that peripheral type activation so the neon utilisation that you see for instance in the outer part of the desk, the degenerative disc when you're getting in growth of new blood vessels in grades of new nerves, and when when substance P is really important in that sort of environment that's not what we're talking about here we're talking about internal neuronal networks within the brain which are very much more the sort of the the usual brain neuropeptides

Steven Bruce
Okay, thank you. So now we're gonna watch Nick pace and

Nick Birch
Yeah

Steven Bruce
Jon, you're dangling a resembling Angele background but let's be careful so Nick sitting here

Jon Graham
yeah

Steven Bruce
we just put this on I thought it was about giving advice.

Jon Graham
I describe it to people as a broken as a broken cycle cycle helmet. So hopefully, the audience can see what we're seeing on the on the laptop. So they can't yet

Steven Bruce
well, you know, Justin will control what the audience so what's going on in this

Jon Graham
so so basically, so in this broken bike helmet, we've got a number of electrodes that are picking up next brain activity over oversee for are we seeing that on the revolver so so we're still the revolving brain is a sort of an infographic just kind of showing, showing it a generic a generic brain, and where you can see the little lights there, the coloured sections in the sort

of networks there, that's indicating that the area of the brain. So that trace that we're seeing there is the as the bait is the is the next brain activity in the Alpha, theta, and beta areas. And so all lines, there's four lines, and then one is the, the, the earth one letter word. So when we first when an individual is first putting this on, we we like to kind of put this on because it gives us an idea of the fluctuation. And so when it gives you you can see the, the movement artefacts if I if I touch it, as Nick shakes his head around a bit as well, you can see those artefacts. So that's the key thing that when someone's working with it, they have to keep quiet still, because you'll get movement, artefacts, artefacts, which they which the software will, might confuse with actual and how many sensors have you got? So there are six, six senses. So if we go back, so we're gonna start off, and then. So that gives us the, the four. So there's two Earths and four and four actives. So that's one the reason why we've got we've got the headset as well just to ensure a really tight, tight fit. So we can then go, as we know we're getting good, a good connection, press start. So the first part of it and this is the key thing to establish a baseline what what is next brain activity. Now what is his relative theta, and he's relative and rizona alpha. So there's a baseline established with your eyes open, but of course, in because keeping your eyes open is 10 active muscle activities, there are also EMG artefacts coming from the muscles that make your eyes open, which can confuse the electrodes. So there's a baseline eyes open, baseline eyes closed, and then the software is able to take out the the EMG artefacts from your eyes being

Steven Bruce
next, not currently listening to his playlist on Spotify.

Jon Graham
Hopefully he's got earplugs, and he's he's tuning tuning out so his eyes open, concentrating on that on that cross. And of course, because Nick hasn't got chronic pain, his threshold will be quite, will be quite high.

Steven Bruce
So do we need to stay here.

Jon Graham
So no, in terms of sort of reach, we're gonna sit over there. And I'm gonna, I'm gonna click gonna click on Next. The next bit. So normally, normally it's two minutes. And in fact, let's go back to the it was good to the neurofeedback for HD. I mean, there are sort of, There are clinics where you can go, go and have that done. It's it's not there out. At the moment, I don't think you can get it done at home. So one of the things about this excellent headset, is it's available for home use. So even though the trials I mean, that is a concept yet because the the research that it sort of inspired the development of this was based on pretty on lab research. So you could go in and someone could wire you all up and but in order to do the intervention, you'd have to turn up at the at the lab and be wired up. The the key thing is what what the developers have this access to what they want is something that can be can be used at home. So Nick's not doing this with his eyes closed. So next in the eyes closed. So again, it's establishing what's the EMG activity that could be confusing the E G activity. We know that the for the very best, most accurate baseline, you probably need about two, two minutes. But that's that makes me quite dull TV. So we've kind of just dropped it down to it. Give it a minute on on each. And then normally when an individual is you is in using it clinically on it clinically at home, they will play each of the games for five minutes, and then have a have a minute in between minimum rest before they go on to the next on to the next game to do six games. And then it does the does the baseline at the end. So we've got a choice. But a choice of games with a puzzle game as a balloon game. The bars actually

show you the very raw, like a graphic equaliser. The one that's kind of nice. It's nice to look at as, as an audience person. So so there's a sort of screensaver. So the bar on the right, is the movement bar. So we want to we want to see if Nick just shakes her around a little bit. Nick can shake your head, see the artefacts? So that's, that's biofeedback, keep still. On the left, the white line is the threshold. And every time that the pink go, the the alpha and theta ratio goes above that threshold, a piece drops into place. So that is the audit. There's the visual, the visual feedback, right? So Nick's not moving those pieces now. Deliberately. No, so he's really clever. So here's level one, we know that. So he is being visually rewarded. When he gets that natural fluctuation from high theta low alpha. And if it's maintained for point, point four of a second, then he also gets you can set it up a little auditory paying as well. So you can have auditory and, and visual, but it's quite a penetrating. I've not said it I've just left it the for the visual stuff. So So what does he do to change who's theta and alpha lungs? So again, it's a bit like the guy in the thing the guy didn't do anything. The guy just sat watching the screen thinking what though? Why are those numbers going up? So you're zoning out you would just relaxing into this. And this work this is this has proved one of the one of the more popular games to to do for us because he knows that you're seeing a pretty scene gradually assembled before you on the initial training session, you have to don't try and mentally sort of teleport those pieces into into into place. And sometimes people who are struggling we actually say you know just close close your eyes. And then sometimes that that can work. There's looming problems please stay stay on check. You have two fingers Next. Yep, so you've had your so here's the

Nick Birch
difficulty, of course, that this environment is not totally conducive to neurofeedback training. So I can hear you guys in the background. And that then becomes a little bit distracting. But I think you can see from that first, jigsaw, all I was doing so I was just looking at it. And as you, as Jon said, Just zoning out

Jon Graham
it is it is actually just quite a relaxing process. I mean, my my wife was also one of the clinicians involved in, in training the participants in the proof of concept trial, because we've got, we've got a kit at home, is that it? She actually quite enjoys doing around around a games, what I mean, one of the other things is, we know, for example that, that mindfulness for some individuals can can work so and it's backed will have How do the drugs work, we don't know how mindfulness works. But if if engaging in mindfulness reduces your pain over time, then there's got to be some kind of neuroplastic changes to bring that about. And that's, that may well be this, this change in the in the theatre and theatre and alpha.

Steven Bruce
Mindfulness, of course, doesn't have this positive feedback.

Jon Graham
And that's, and that's clicking that. And that's why I think not everyone can, it's hard to engage with this,

Steven Bruce
I think this is a much easier thing for people, people to involve with. But I suspect more so in the modern age where perhaps lots of people like electronic gadgets, rather than sitting on a map going on, potentially, potentially, not that I'm employing people sit on a map.

Jon Graham

But I think but I think the ultimately for those people that can do it, something and get clinical benefits, something's something's changing within the brain. So in any light, in all likelihood, it is going to be the brain activity. And in C four, but we know that it's hard for people

Steven Bruce
to do so in your study. If Nick genuinely had chronic pain of one sort or another, yeah, how long? How long is he going to be doing this for how many sessions is going to before he starts to see a change?

Jon Graham
So we found in the so there is behind this, there is a clinicians portal. So as clinicians we can we can see session by session, what those what their resting rates are. And they, in their responders, you see a really nice graph literally of the of the theta going down and the alpha going up. So in some individuals, we saw, we saw in his in, within two weeks that people were sleeping, I'm sleeping a little better for the better myself, I'm not quite hitting those peaks of peaks of pain, that then it seemed to sort of stay steady for a while. And then as you get to sort of week six, seven, that again, it seems seems to march, march on and get more get more results. In the week, what was it of those 16 For people carried on using it? Because they they felt that although their pain was in some cases, 50% better they wanted to go to go how How good will this always get?

Nick Birch
So that's two jigsaws. I've done so I would normally I mean, that's what I mean how many minutes that was about what five in total? I would guess possibly two, I've set it for two minutes. Okay, so then I take a break for at least a minute, they get back to another block, do six Training Training blocks in a session which I would imagine which is quite an attractive thing to do it can be quite exhausting. I remember the first time I did it when Jon's place and and I felt absolutely exhausted the first time I ever did it. And I think a lot of people find that down there. So

Steven Bruce
can we get back over here? Can I tell you to have a look at now in in 20 years time, the NHS will have four of the US and they'll be trying to work them through windows eight. I'm guessing that the NHS isn't going to see these in service anytime soon. What about in private practice because presumably lots of us have lots of chronic pain patients. We need lots of these in every single osteopath, chiropractor physiotherapy practice in the country.

Nick Birch
So when Jon and I are running out, we're calling a commercial validation trial. So having done the proof of concept last year, in year four, we then want to say okay, well let's let's let's put it into our practices and answer exactly that question. So my, my spinal practice is fundamentally full of patients who've got chronic pain that I see maybe 25% With acute problems that most of them have who are chronic patients of those, so I would see 18 to 20 patients in a week. So everyone gets an hour, so it's about 20 hours consulting. And of those, I would probably find two who would benefit from this each week. So you really talking about 10% of the chronic pain patients and it goes back to what Wendy was saying earlier about but essentially working out who's got Fibromyalgia who's not gonna fibromyalgia, if you examine them, you know, what they what the biomechanics are. So somebody comes to me with an adult scoliosis, and they've got chronic pain. Well, the adult scoliosis has to be investigated and treated first, you know, so we get all those things. Because this is this is essentially what you're looking at people who've gone through that whole process, you've

had a total Comprehensive Assessment and then you said, Okay, we've tried everything, there's there's nothing we want to do and we're gonna stick a needle and your knife into custody and it's gonna work. Let's try this and I wreck about 10% of my chronic patients are like that.

Steven Bruce
So therefore, what you just said though, it wouldn't take long to train clinicians to learn who to weed out and who to recommend for this because we are looking for chronic pain of no other call, which I think was the original definition of primary chronic pain

Nick Birch
is that there's there's Yeah.

Steven Bruce
Okay. We, this is probably going to take this off piste. Again, I apologise for that, but the questions are coming in slightly quicker. Katherine says that a patient with diagnosed hypervascular syndrome from birth causing pain in the right upper extremity. If the pain symptoms are associated with a congenital syndrome, and have always been painful, would it be possible to affect neuroplasticity to reduce pain with biofeedback?

Nick Birch
Well, first thing is that that that's that's likely to be a combination of chronic and chronic primary and chronic secondary pain because it's secondary to a congenital malformation you can get as the nice guidance of its you said you can get primary chronic pain with secondary pain. And that may explain why some people have knee replacements don't get better afterwards, because actually, they have become, they've gone over to be sent central centrally centralised, and they've got primary chronic pain as well. Can it be used to mitigate the symptoms? Yes, in the sense that if you look at the results of the trials, Bertha trials, it is much more to do with the management of symptoms that are allied, if you like to your primary symptom of pain, because if only half that half the people are getting about 30% or 40% reduction of pain, but they're feeling their quality of life is better. It means the other things that go with chronic pain, so sleep deprivation, anxiety, depression, central sensitization, all of those are being improved at the same time. So the answer is yes. Because you can because you can modify some of the primary components of this this mixed bag.

Steven Bruce
Okay. Good news for Catherine's patient. Yeah. Lauren says he had a patient whose son had epilepsy and was on cannabis, but was trying this for seizure reduction in your experience is efficacious with epilepsy as well. I had no idea. I think we're talking about this.

Nick Birch
This this rare flipsie

Jon Graham
primarily for the epilepsy. I don't know

Nick Birch
there's a bit I don't I don't know of any any evidence at the moment saying neurofeedback training for epilepsy.

Steven Bruce
Okay. And French player again says this is a very pragmatic way to show the patient how relaxation is deeply beneficial to their level of pain.

Nick Birch
And totally agree with that. Yeah.

Steven Bruce
And again, she says what techniques would be advised to the patient once they're aware of the brainwaves? So you've explained about theta and

Jon Graham
alpha. So it's interesting to some, some of the, the individuals in the of our, in our, in our trial, and some of the people in New Zealand, just just on the because there was some autism qualitative research going on as well. And some interviewing afterwards. And people were saying, well, actually, when it wasn't with the machine, the game and and I knew and I felt well, you know, what this is, this is coming back on again, I actually imagined myself in front of the screen. Right? And that allow them to just to get again, temperatures wasn't as good as but it was it kind of helped. But the key thing is back to the central premise of you've got a disordered part of the brain. That's that's then generating these brainwaves in these frequency arrays, and actually, the longer you do it over the sort of the eight weeks and the four to six sessions a week, you're you're physically changing through neuronal sprouting the the structure of the brain in such a way that the you're going to you're you're not getting the whole frequencies change, it's up regulate this upregulation of alpha and downregulation of, of theta.

Steven Bruce
I guess it's too early and perhaps the study is too small to comment on. And he said there wouldn't be permanent change in the brain because of course, it's plastic. But what sort of long term rehabilitation? Yeah, brainwaves? Listen,

Jon Graham
interesting thing. So. So back on an earlier slide, when we when we were when you can see that nice advocating exercise and we know is a physical therapists, that exercise is good. But when you've got this fear, and with more exercise, it's going to make my pain worse, and they can't, that they feel they can't do it. The nice thing about this is potentially after you've got this internal change that potentially say, Okay, now, you're in a position to start doing exercises. So you potentially you can maintain those the benefits by by doing exercise.

Steven Bruce
Rowena has asked whether this could be a helpful approach for Restless Leg Syndrome, whether painful or not, and I saw that restless legs was one of the 13 circles on your chronic pain chart. Yeah,

Nick Birch
it's a restless leg syndrome is is is considered to be at least some people have restless leg syndrome because it has central sensitization. So and that's as long as you've excluded the the other reasons for SSA syndrome or cramps, and things like magnesium imbalance and the diet and making sure you've got enough nutrients to make sure your muscles are working well. Right.

Steven Bruce
Okay. Bottom line, how much does it cost says Jason.

Jon Graham
So the, the hope is that the an individual that will have, it will be a subscription model. So the the first the first year would include the individual would have the have the headset, and then access to software for a year. So they look individual being the patient, the patient, yeah, so you're looking at a price point that we're trying to get between 850 and 1000, for that first year, and then subsequent years would be that sort of 750 800. So part of the clinical validation study that Nick and I are doing is trying to work out well, and see pragmatically, if you've done it for not the eight, if you've done it for 32 weeks, what happens thereafter? Do you do get to a point where the brains reorganised, you've done you've been able to engage with doing some exercise and you actually have it all intents and purposes soldier chronic pain, or is it something that you you'll get a good a nice reduction. But every two or three months, it'll start to creep, creep back up again. So you just do a little bit of a top up top up dose,

Nick Birch
there are a number of different models, as you'd imagine, one of which is you have an individual headset, and you've got the subscription to the software with all the various feedback and that's your 1000 pounds of fragment, say, in a year. And you might keep that yourself in, you might then pay 750 per year for your ongoing licencing bit like a sort of super TV licence. Alternatively, you would go to a Brain Train cafe. And you'd go along lunchtime. And you'd take our set out that have been sterilised and then because it's linked to you, you would just keep your code in, and it comes off the cloud. So that's, that's fine, put it on, eyes closed, eyes open, and then away, you go have your half an hour session at lunchtime, then you go back to your stressful office and sit in your corral and do whatever you do. So there are lots of different ways you can think about it. And that would then fit lots of different pockets. The base, the baseline model, the single user is about a third of what the NHS spends on chronic pain per person per year. So I did some work that informed the early part of these studies and looked at the international comparisons for how much we will spend his country's on chronic pain in the UK for every chronic pain patient is cost the NHS about 3400 pounds per year to treat them. So if we are able to get 75 to 80% of people responding to this for a third of the price, when you do the cost benefit analysis, the Do you recall is etc. It turns out that it's actually got a a benefit that runs to something like 10,000 pounds per quali per that's the quality of life life here. So it as long as we've got 75 to 80% responders, then it works out to be a very cost effective mechanism treatment.

Steven Bruce
How long will it take the NHS to change the NICE guidelines or to take on board

Nick Birch
that NHS would would be reactive rather than proactive, so nice would have been invited. Essentially, when they do a review of their chronic pain management recommendations, which will not be now until 2526. They would need to be persuaded that actually, this was a technology that had enough evidence to support it. So we'd need some more randomised control

Steven Bruce

trials. Okay, but there's time for that between time 2526 Yeah. Okay. And going back to your Brain Train cafes, do you see those being part of, say a physio was to Cairo clinic or

Nick Birch
you, I will very much see that. I mean, if you've gotten me here, for instance, you could you could have literally people walking on the street, sitting in a in a booth and then a glass of water headset on and coming in and doing that for their lunchtime morning, whatever else. You could do it in Tescos. Or Sainsbury's, they can actually have their brain train cafe next to the they're sort of Starbucks type cafe. And that'd be obviously fine to come in, have a brain training set, and then you get your your latte, for skinny RC and whatever else off.

Steven Bruce
But you talk about condition input into the setup early on. So somewhere there was a clinician who's looking at the results monitoring the progress.

Nick Birch
Well, Jonny, I mean, that's that's through the cloud has access to the clinician portal.

Jon Graham
So I think I think the the cafe's would would come is the longer term maintenance part of it, I think it would, you would initially be very much involved with your physio, your osteopath, or your chiropractor. So I think the model that you'd be, we'd be looking at work, so we'll be looking at is probably be a clinic clinician set. So you'd have I mean, I've put it for tonight, put the software on my laptop, but in reality, it comes with a little Android tablet. So I think it clinicians kit would be a bigger box, a single tablet, and then the three headsets, the small, medium, and large. So I think before someone invests a few 1000 1000 pounds for their first year, as a clinician to say, well, I'll show you what it looks like, Let's book you in in the next session and actually do your first session. And just to see, is this something that you would be at you feel you could engage you can engage with? And then potentially they would then or order it? And then they'd have

Steven Bruce
to rather than how much time is the clinician having to invest in looking at the results of all of these people at the Brain Train cafes who are using the

Jon Graham
kit? So I think I think the I mean, the portal is probably in, in use in a clinical service that's set up for for chronic for chronic pain. I envisage for most patients, whether whether one one person, outfit or handful of clinicians, ultimately your wants you once you say, with the conditions kit, given that individual a chance to see what someone would want to commit with. And then they've got their own got their own kit. I'm not necessarily envisaging that you would be going on to see how the how the Porter was, but I've in our clinical validation trial, about a couple of texting on Can I Can I just ask you? How in our field I'm dealing with better? What can you tell me? So actually, I say, well, actually, now you've asked, I can pick it up and say what actually I could see from week four, I could see your alpha was starting to rise in the theatres going down. And they go, Well, that was the week that I was able to go out that night and so that it correlates

Steven Bruce
I just think that the patient would say, Well, I know I'm getting better because I've got less pain.

Jon Graham
I think and again, it comes back to your one of the earlier things in term in terms of the the pursuit to a certain type of people get chronic pain or if you've got chronic pain, you become a certain type of type of person. And you're not, you know, you're there are very few jaw droppers of people that are going from seven to eight down to one or two, there's actually a grey area in the middle where I can't think it's working. Can you give me some feedback on actually I can see this and that ah, hang on a minute, if you're saying wait for that. So it kind of all ties, ties together.

Nick Birch
But what you said earlier was absolutely true. And that is the very, very first thing we noticed the proof of concept trial about three weeks it was that the feedback we were getting was I'm sleeping so much better. I can cope with my pain because I'm not tired. I'm not exhausted. So managing my pain is much easier because because I am sleeping better. Once you get that part of it again you begin to break the cycle of chronic sleeplessness and then pain exacerbation. I think that that that's sort of where people begin to recognise they're responding quite well. And they need that validation occasion. But forget to your point regarding how much input there needs to be for the clinician, if you're a busy clinician, and you've got a dozen patients who are using the axon system, you don't want to be going on to the portal every day and looking to see make sure they're okay. But what you might do is say, let's schedule a zoom catch up or face to face, catch up, four weeks in, and then I can have a quick look at that. And then we'll see exactly what your trends are. And the software will then give you that so it will print out on this the screen. Okay, this is where you were this way you are now how do you feel? Okay. The other thing is there is the subjective, you've got the objective part a bit, because it's subjective feedback, because they fill out every time you log on to a session, there's a little scroll bars that say, Where's your pain today? Did you get sleep last night, etc, doo doo doo doo. Okay, so you've got your proms fed back. And so you can then look at the problems automatically. So you get that coming through every time you want to look at them. Again,

Jon Graham
one of the things I did in the New Zealand trial is they modified the software, the software, so the software would send people a text in the morning, say, Oh, don't forget, schedule, your brain stage of brain training. And then if they didn't, it could send them a second text saying later on, don't forget your brain, your your brain train, they call it brain training. And I think as the as the the end of day, we've got we've gone from proof of concept 2021 To a large trial, it's still very much an emerging tech product, and as well as as well as technology. So one of the things you might have is rather than you sitting watching all your clients, you might have the system set up. So it will tell you, if one of the people who you thought we should be using it for for six title in might say, well, actually, you know what? Patient A is not switch this device on for five days. And you get the text or the email from the software. So you might say, well, actually, you know what, I'm gonna give that patient a ring and find out what's going on. What's what's going on.

Steven Bruce
Some people have asked about other applications. Paulie says, could this help in diagnosis of Parkinson's disease? And Imran says, Have you tried it on MS patients or patients with stroke?

Jon Graham

So we were excluded from the proof of concept trial, and it was excluded from the RCT MS and stroke, simply because the question would be, to what extent in a brain that's been been affected by another pathology, to what extent with the learning ability and the neuroplasticity be be affected? But given that in both in both conditions, pain can be a big can be a big issue, I think. I think it will work for those separate trials in their own right. And they can potentially down the line, they'll be separate. They will be separate trials. But it's not it's not diagnostic. No, no, it's not.

Nick Birch
The first thing is it's not diagnostic. That's that's the first thing. The second thing is it is it likely to be beneficial in neurological conditions that are known to be not only organic, as in, you've got Parkinson's with your, your dopamine changes, but you've also got significant affective disorders. And we know that people with Parkinson's very frequently have a psychological deterioration. And that's them partly it's going to be neural network, and it's partly going to be a reaction. Will they get benefit from that there's a possibility they might do. But the big problem with Parkinson's is that this requires you to be still. So unless you are typical Parkinson's with Brady Kinesia. Rigid, that's perfect. Okay, that's fine. But if you if you're Parkinson's, or you got a tremor, it's going to be very difficult to use a Neurofeedback system to to help them.

Steven Bruce
Darren says, I think we ask that you asked answered this question. And Darren says what were the results like in terms of time, six months or 12? months after follow up, but

Nick Birch
we haven't got there? Well, yeah, we have we got there for the proof of concept for the proof of concept. So larger trials, the answer?

Jon Graham
So the I think they were still present at six months, that's three to three months. And then I think it was there was in it was a slight diminish in that at that six, but it's

Nick Birch
well, we know, we know what the three month results is because we published that in the frontiers in pain researcher paper. And that was that there was a tiny tiny drop off and results at three months. That was the 12 weeks post trading. So that was that was 20 weeks after they started the process. Then the six months, results were coming through. And that time as Jon said there was a slightly further drop off. What we have got that as you've got four patients who've continued to use it and you've continued to have good results.

Steven Bruce
I was gonna say that that eight month follow up. I think you said there was actually six months after they lost more than heads yet. So maybe there's a there's a reason for the drop off.

Nick Birch
Yeah, absolutely. And we would expect that to enter proportionately in the patients to have reverted back. Because we're not we're not going to change the Fundamental in terms of their genetics, or their psychological profiles, and so something else might happen that then pushes them back over. So

Jon Graham
the other thing was it was in the, in the depression anxiety, we used the hads scale, and hospital anxiety and depression scale. Yep. And though, then classifies the degree of anxiety and depression. And there were people that were actually their answers were beyond the they weren't just there at the clinical threshold.

Nick Birch
Yeah, I mean, they were the people who actually had anxiety or depression, because with the hands you have either normal, borderline, or actual state anxiety or state depression. Those all are the ones that were state anxiety, state depression, came back down to either borderline or normal after training. So it was it was quite astonishing. And then there was just a couple then crept back above a threshold into the borderline, by the end by the end of the 12 weeks.

Jon Graham
So another another study this year, is going to be so I'm going to be next year. Now traditionally, threes is is looking is one of London's psychiatric hospitals is looking psychiatric services looking at just using it for depression, and anxiety, and not pain, pain at all. We found went, one of the things that you found was that because you've got a revealing, you've got a touch of tinnitus, and you did feel after one of your sessions, that your tinnitus wasn't ringing as much. So we did a quick literature research and again, in lab in a lab based setups, they have used it and found that there has been changes in in tinnitus using slightly different parts of the of the brain. So I think one of the developments that exalgo The actual company behind it will be looking at is how could we set up the the electrode array to pick up the part of the brain that seems really implicated in in that because that, for some people, that's quite a mess. It's, it's, it's there's quite a large population. Do you suffer from that?

Nick Birch
Well, it is. I mean, of course, the interesting thing about tinnitus is that the treatment for it is exactly the same as primary chronic pain. And that is CBT and acceptance, Commitment Therapy. It'll, it'll, it'll get better, it won't bother you so much as tight as time goes by it My ears are ringing. Now when my tinnitus doing it, it doesn't bother me just get on with it. That's obviously fine. But for a lot of people, actually it's highly intrusive, and it ruins their lives. So if we can, if we can do something to help, then that's going to be a major advance,

Jon Graham
I think. And he also was thinking along things like smoking sensation cessation does actually, rather than you know, does other areas of the brain that are kind of involved in in, in addiction such that you you're put rather than the Nicorette or whatever you just do eight weeks of brain training.

Steven Bruce
Interesting stuff are two quick questions we before we finish, because we are up against the clock. During like some clarification. He says, I think I may be misunderstanding this. But if the patient's had an injury and this turns to chronic pain, there will be structural changes to the peripheral nervous system leading to this central central sensitization bypassing this area and changing brain frequency surely will be short term until you deal with the area causing the bombardment and hence over sensitization.

Nick Birch

Well there. I mean, the thing with that is that by definition that the orange injury that caused the initial change, healed a long time ago, that's by that's the definition of chronic pain. And the pain has gone on for more than three months and the injury has healed. He's absolutely right. That's where it originated. And he's absolutely right, you get peripheral sensitization as well as central sensitization. And the two go hand in hand. And sometimes they're quite difficult to treat. It is likely that if you can get the primary central sensitization primary central pain reduced because of your descending pain management system that is intrinsic to your spinal, your brain spinal cord, that in its own right will then down regulate the over sensitization in the dorsal root ganglion and in the peripheral nervous system, and therefore the you'll get that that synergistic improvement. That's what we what we do know is that when central sensitization there was a dramatic improvement in the patients, all of our patients were centrally sensitised and in the proof of concept, and there's dramatic improvement, that central sensitization when we looked at between the beginning and the end, and nobody was an extreme group at the end, having had four people in extreme that beginning,

Steven Bruce
which is very encouraging. The final question came from Sarah earlier on and she's asked what happened to your wrong trousers, equipment? In other words, the RX map that we demonstrated on the first show,

Jon Graham
every time someone says or on a puppy dies. So yeah, it's still very much in in clinical in clinical year.

Steven Bruce
So there will be people who didn't see that show. And I think one of the things you told us during that show is that there was a very moving episode when two people paralysed I think from the waist down, for the first time where people had standing standing up, which was I mean, I'd recommend people to look back at the recording. But that's all we got time for. We've had 457 people watching, so we're getting above our normal average for an evening shape. So it was clearly of interest to everybody and lots of feedback. I've certainly enjoyed

Jon Graham
And you're given the reference to the papers and move and download.

Steven Bruce
Yes, if you will get it. I'll share those. That's it for tonight. Hope you had a good time this evening and I look forward to you joining me next year. Good night