

Changing What's Possible - S.1 Ep.5 Transcript

Fri, Sep 30, 2022 2:56PM 44:29

SUMMARY KEYWORDS

device, kyler, walking, therapies, spark, cerebral palsy, technology, mobility, research, people, absolutely, muscles, wearable robots, zach, resistance, assistance, mode, benefit, important, study

SPEAKERS

Nicole Hastings, Dr. Marie McNeely, Dr. Zach Lerner

D Dr. Marie McNeely 00:01

Hello, and welcome to Changing What's Possible: The Disability Innovation Podcast brought to you by the Cerebral Palsy Alliance Research Foundation. I'm your host, Dr. Marie McNeely. And this season, we are excited to bring you remarkable stories of life-changing technology. Today we have with us Dr. Zach Lerner, Chief Technology Officer and Co-Founder of the company Biomotum. And Zach is going to tell us more about their work developing intelligent and intuitive wearable systems focused on improving human mobility for a wide range of users. And in the second half of our episode, listeners, we're going to hear from Nicole Hastings, who has experience with the Biomotum SPARK, as a parent of one of the children participating in their research studies for the past three years. So listeners, let's get started today. Zach, thank you so much for joining us on the show.

D Dr. Zach Lerner 00:53

My pleasure. I'm really happy to be here. And looking forward to talking with you.

D Dr. Marie McNeely 00:56

Well, we are delighted to have you here with us as well, can you start by telling me and our listeners a little bit more about the company Biomotum and your role there?

D Dr. Zach Lerner 01:04

So Biomotum is a rehabilitation robotics company. And we're really passionate about bringing life-changing mobility technology to make it available to individuals in need. The company came about in 2019, as a spin-off company from my academic research lab at Northern Arizona University. So I've been working on designing and testing wearable robots for rehabilitation for many years. And finally got to the point where I thought this technology really had to make it outside of the lab. So I partnered with my Co-Founder, Ray Browning to help commercialize the

technology, make it available. And I've been serving as the Chief Technology Officer, leading the engineering team and my role very shortly will change to Chief Scientific Officer as we've been able to grow and attract really top talent in terms of Director of Engineering. So yeah, that's how the company got started and what we do.

D Dr. Marie McNeely 02:00

Fantastic. So you mentioned this company was born out of some of the research that you were doing there in the lab. How did this interest area within your research get started?

D Dr. Zach Lerner 02:08

I've been interested in human movement and biomechanics for really, as long as I can remember growing up playing different sports and being kind of a lifelong athlete and having an interest in outdoor activities and things like that. And so my research really has married my interest in physical activity with robotics, which is another professional interest of mine. So combining robotics with this interest in biomechanics or mobility - I've been looking for a way to maximize the impact of this work. And I really enjoy working with children because there's so much potential to change their lives for the better and so, we started this work, partnering with children with cerebral palsy, and identifying the types of wearable robots that could be really impactful for them. That was what got us started in this research endeavor.

D Dr. Marie McNeely 02:57

Absolutely. And I think starting a company is no easy feat there. So how did you go about, I guess, making that transition from the purely research world into entrepreneurship?

D Dr. Zach Lerner 03:07

You're right! Starting a company, there are many challenges, it's also extremely rewarding. And the key for me was finding a co-founding partner who could really take on a large part in our general commercialization approach. So for me that was teaming up with Ray Browning, who I've known for over a decade. And I think I've learned the success of a startup really is dependent upon attracting the right people. It's finding and establishing a team of people that you want to work with towards a common goal.

D Dr. Marie McNeely 03:39

Absolutely. And just to reiterate, and kind of emphasize this common goal, what is the mission of Biomotum?

D Dr. Zach Lerner 03:45

The mission of Biomotum I think, is to deliver life-changing technology to any individual who

could benefit from the technology. This could be younger individuals, individuals with cerebral palsy, all the way through the lifespan to older adults who want to be more physically active. And we're really focused on kind of mobility and physical activity. And we accomplish that in really two key ways, which I'll get into when we talk more about the actual technology - the device.

D

Dr. Marie McNeely 04:14

Excellent. Well, I'd love to dive into the technology next, I can tell that you are passionate about this. So can you tell us, Zach, more about Biomotum SPARK, what are the different pieces in this system and how does it all work?

D

Dr. Zach Lerner 04:26

So I am extremely passionate about the technology. Our first product is called the SPARK. It's a battery-powered ankle exoskeleton but maybe an ankle exosuit is a better term for it. It's extremely lightweight, it's a low profile, and it utilizes motors to deliver torque to the ankle joint and we can deliver this torque or this assistance or resistance and perform two key activities. So on one hand, we can program the device to make walking easier. So as an assistive aid, this may be you used by a child to walk to the park or walk to school, participate in physical activity or gym class or something like that. We've also been developing a way to control the device that we call resist to restore. So in this other way to control the device, we actually make walking more difficult. So we're resisting the ankle plantar flexor muscles, like our calf muscles. And by incorporating this resistance with something that we call biofeedback, which is a way to inform the user of their performance during gait training, we're actually able to improve the way that the body controls this really important muscle group. So maybe I should start with a really key piece of information, which is, it turns out that the ankle joint is really important for how we walk. For efficient walking. It's really important. And so that's where this Biomotum SPARK device is focusing on the ankle.

D

Dr. Marie McNeely 05:51

Absolutely. And you mentioned it as a particularly lightweight system. Can you maybe give us some details? How much does it actually weigh, and what is it made of that allows you to keep it so lightweight?

D

Dr. Zach Lerner 06:01

We've worked really hard to make the device extremely lightweight, because anytime you put on weight or mass to the body, it actually makes it more difficult to walk. Think about going to the beach and wearing big boots and your boots fill up with sand or water. It's really difficult to reposition your legs and to walk without expending a ton of energy. So when you're trying to make walking easier, or create a rehabilitation robot that people actually want to use, it's really important that it's as light as possible. So the way that we've accomplished this goal is by using lightweight materials, so things like carbon fiber, which have a really high strength-to-weight ratio, and through what we think is elegant mechanical design, allowing us to place some of the

heavier components of this product at the waist where it's less burdensome to carry, and then transmitting the power from the motors down to the ankle joint using cables. So we keep the part of the device that is near the ankles, feet and calf as light as possible by having a little fanny pack that clips around the waist, which houses the heavier components. So it's much easier to walk when you say carry 10 pounds in a backpack versus 10 pounds on your feet. And so that general principle has guided the design of the technology.

D

Dr. Marie McNeely 07:19

Definitely. So it sounds like you've got this wearable piece that kind of clips onto the leg. And then you've also got the kind of fanny pack - I like that term - for where the batteries and perhaps the motors are. What are the other pieces of the system? How do you control it?

D

Dr. Zach Lerner 07:31

So we have an onboard microcontroller that takes in sensor data to inform the device how it should operate. So one really key piece of information is knowing whether or not the leg is on the ground. Because when you're walking, you go through a stance phase and a swing phase. Stance phase and a swing phase and that cycles. So it's really important that the device distinguishes between the stance phase, which is when the leg is supporting the body and the swing phase, which is when it's moving forward and getting ready for the next step. It's important that we can distinguish those phases, because the torque required by the device is different for each of those phases. So you can imagine that when the leg is on the ground, it's really important that we provide assistance during the push-off phase. So think about when your calf muscles are active and propelling yourself forward. So we use special sensors beneath the foot to help us determine when the foot is on the ground or whether it's swinging through the air. So our microcontroller takes in the sensor data, we have a control algorithm that is designed to provide assistance suitable for any possible terrain, and it automatically adapts to an individual's walking pattern. It's also a control strategy that we think is pretty easy to set up. So one of the guiding principles of this device in our technology has been coming up with a practical solution that could actually be deployed outside of a research environment. So with entering someone's body mass, can they essentially just start walking and start receiving assistance in the assist-and-go strategy or in the resist-to-restore operation in the device and start receiving resistance?

D

Dr. Marie McNeely 09:05

Okay, interesting. And I love this point that you brought up because I think you're absolutely right. Making it easy to use is critical that people actually using it. So there's not all these steps, these calibrations, these things that people have to do before they can start enjoying the technology. And then I understand there's an app as well. Can you tell us a little bit more about the app?

D

Dr. Zach Lerner 09:21

Yeah, so right now we control the operation of the device through a smartphone application. And the application was designed and geared towards a physical therapist. So our initial market

for the device will be in physical therapy clinics. So physical therapists will work with an individual with cerebral palsy to control the device. So a therapist will pull up the smartphone application, enter some participant details and then be able to start a training session. And so they're able to view how the device is functioning in real time, they're able to modify the settings and the parameters of the device. So for example, there may be a child who will complete a session with device providing assistance and then maybe halfway through, the child is ready to start receiving resistance to help start to train the recruitment of the calf muscles. So this handheld or smartphone application allows someone to change the mode of operation, allows to change some of the really important settings that allow us to fine-tune the delivery of the assistance or resistance.

D

Dr. Marie McNeely 10:24

Very cool. And Zach, I know there's a lot of cool technology coming out in this kind of wearable robotics space. So can you tell me and our listeners a little bit more about what makes Bio motum SPARK really different from some of the other technologies that are available for other physical therapists or people with disabilities?

D

Dr. Zach Lerner 10:39

One of the first things that makes the Biomotum SPARK different from other technologies is that there really isn't powered rehabilitation robot geared towards children and young adults. So we feel like this is an area that we can make the most impact. And it's also an underserved area. There are a lot of design challenges. When you try and scale down these wearable robots to young children, it's really important that we have devices that work with young children, because oftentimes, the earlier you're able to intervene with effective therapy, the better the long-term outcomes. So we're really motivated by pushing the limits of kind of how young of a child we can work with. That's one aspect of how we're different. And the other aspect of how we're different is we've taken this really holistic approach. So talked about these two modes of operation, the assistance mode, that's like the assistive aid, it's kind of like an AFO. It's offloading the body, it makes walking easier, you can use it to walk further or to keep up with your peers or your family. But there's also this resistance mode. And this is a functional gait training mode or a functional walking training mode, where we're actually trying to improve the function of the body. So we're training the muscles to fire to activate at the right time. And so, we understand that really, no one wants to wear an exoskeleton all day, every day for the rest of their lives. Although if it's impactful enough, if it really is life-changing, I think people will, but ultimately, people just want their bodies to become more effective. So this is the approach that we've taken. This holistic approach where there are certainly times when people will benefit from a powered assistive aid, an assistive aid that can be used during walking and help in interaction with our environment. But there are also I think, there's this place for wearable robots to be used as walking training tools to actually improve how the body is functioning, improve the function of the muscles, so that the individual completing the training actually gets better. And with this combination of this resistive torque, so the motor is actually resisting the body, you can kind of think about it like functional strength training. So you increasing the strength of the muscle, we incorporate that with what I mentioned earlier, is called biofeedback. So this is a way to motivate the person to meet some performance metric. So maybe the metric is how hard they push into the ground? We can provide them feedback on how they're doing, and incentivize that through things like gamification. So telling them what

their score is, their success rate, and really trying to get them interested in their performance. And we think that's a really key piece for working with children, particularly children who might get bored easily with their traditional physical therapy. So it's really important that we can engage them, make the training fun, make it something that they want to do and providing a reward structure where they will complete enough training to get better.

D

Dr. Zach Lerner 12:18

Excellent. Now, Zach, you mentioned that this product is unique, and that it's sort of scaled appropriately to be used by children and young adults. But do you see this technology also being useful, for example, for adults with cerebral palsy?

D

Dr. Zach Lerner 13:40

Absolutely. The I see great potential for the technology to assist really across the lifespan. One of the things we realize when you're designing a device for children, adolescents and young adults is you effectively have to design a device that works for people across the entire lifespan, because kids turn into young adults and adults and an 18 year old with CP has the same height and body mass as someone who might be 50 or 60. And so fortunately, the device works across these heights and age ranges.

D

Dr. Marie McNeely 14:12

Excellent. So I guess when you're working with maybe adults, is there any additional or different challenges that you run into or that you have to sort of account for?

D

Dr. Zach Lerner 14:20

I don't really anticipate any additional challenges. I think, if anything, adults have greater attention spans, and they're able to engage in the therapy a little bit more effectively. Early intervention is really important because it can change this trajectory across the lifespan of someone's walking ability. Adults may have to have more frequent kind of top off therapy. That's something that comes to mind but I'm absolutely convinced that older adults can benefit from the targeted training that the device can provide. When the device is functioning in assistance mode, I think it has the potential to offload joints and so things like joint pain and joint degeneration crop up and as we age, particularly for individuals with CP, I think it could be really helpful in that regard to help people stay ambulatory and pain free.

D

Dr. Marie McNeely 15:06

Definitely. And is the device right now sort of a one size fits all? Or do you foresee that you'll have to kind of have different sizes of in particular, the part that clips onto their leg?

D

Dr. Zach Lerner 15:14

We do have three sizes, a small, medium and large. And it allows us to work with basically anyone who walks in the door. And I imagine that as this device turns into a product that people can buy for themselves to use at home and in their community, it will be sized appropriately. So there will be a wider range of sizes so that it fits generally perfectly for each person, or perfect enough.

D

Dr. Marie McNeely 15:36

Definitely, well, it sounds like you've put a lot of thought a lot of work into developing this unique product. And I understand there's quite a bit of research behind it. So can you tell us a little bit about just the scope of the research that went into developing this?

D

Dr. Zach Lerner 15:48

Yeah, we've been researching the development of this device, and then the clinical application of the device for many, many years now. And this research spans everything from the mechanical design, so how do you make a design that is really lightweight, it's really usable, a device that children can put on themselves and start to operate? Control the device themselves. We've been researching how well the device can adapt to each person's walking pattern, how well the device can adapt to changes in the environment. So typically, when these types of devices are developed in a laboratory, you start by testing them on a treadmill. So your participants will walk on a treadmill at a set speed, and then you fine tune how the device is providing assistance or resistance to the user. The problem is that we don't conduct our daily lives on a treadmill, right? We're constantly walking up and down stairs or up and down ramps to coming up with a control strategy that's both safe and effective for these different terrains was really challenging for us. Coupled with the fact that the control strategy needs to be practical. So if you're using something called electromyography, which is where you measure the muscle activity from the user to control the device, that's not really practical for a device that's going to be used at home or in the community. So we needed to come up with different ways to control the device so that when you're walking to the top of a staircase, and then starting to take steps down the staircase, the device isn't catapulting you down the stairs and causing potential injury. So we've been researching these control strategies for many years, making sure that it's both safe and effective.

D

Dr. Zach Lerner 17:27

Another kind of aspect of our research is in the clinical application of the device. So we want to make sure that the device is relevant, it actually has some clinical application. And so we've conducted studies looking at how is the device helpful, both in terms of the assistive mode as the mobility aid, but also in the resistive mode as the gait training tool. So we conduct research studies looking at what are the types of terrains where the device is helpful? And it turns out on graded terrains like walking uphill, or up a staircase, that's where the device really shines. So more challenging terrain, higher intensities, is where the device really seems to provide a lot of benefit. And then we also conduct research to see how best should we develop an intervention, particularly for this resist-to-restore mode where we're providing resistance and biofeedback, having the user engage their own muscles, retraining their own muscles.

D

Dr. Zach Lerner 18:22

So how do we deliver this intervention? Is it overground, walking over ground? Is it on a treadmill? How many times per week do we need to deliver it? And ultimately, is it more or less effective than the standard of care, which might be working with a physical therapist without the device? So those are the types of research challenges, questions, problems that we've been working to tackle.

D

Dr. Marie McNeely 18:47

Phenomenal! Zach, I'm really glad to hear you say that you've had these practical scenarios and considerations for everyday life in the forefront of your mind as you're developing and testing this product, because I think that's so important. So I guess thinking bigger picture here, can you describe the impacts that Biomotum is either having right now or maybe has the potential to have for users?

D

Dr. Zach Lerner 19:07

Yeah, we've been really pleasantly surprised with how effective the device can be. And this spans both as a mobility aid. And I kind of alluded to this previously, for some individuals, when they use the device, and it's providing assistance, it can make walking 30% more energy efficient. So these individuals use 30% less energy.

D

Dr. Marie McNeely 19:28

Oh, wow!

D

Dr. Zach Lerner 19:29

Which may or may not sound like a lot depending on your perspective. But imagine being able to go 30% farther or walking roughly 30% faster using the same amount of energy. It can take a child with cerebral palsy from not being able to keep up with their friends to being able to keep up with their friends. So walking from a really slow speed to walking at a speed that would be considered on par with typically developing children. We have also seen really remarkable results when the device is used as a gait training tool. So we've conducted studies where an intensive four week training protocol with the device providing resistance and biofeedback to engage the user, that we've seen pretty drastic changes in the baseline function of the individual. So just how the individual's muscles are functioning. And we're seeing improvements in strength, in walking speed, and energy consumption, in their posture. And so a lot of these research findings that really motivated the commercialization of the product, we just think the technology is too good and too impactful to be stuck in a lab. And so that's why we started this company, which was to help make the technology available and really, that you have to commercialize the technology - it has to be offered at a competitive price point, you need to offer things like service, and then obviously, the device needs to be available. And so it's been a really big challenge navigating that commercialization process. But we're really

motivated by the fact that the device works, the technology works. Now it's a matter of being able to offer the product. And there are many challenges on the way. So when you're developing a medical device, getting FDA clearance, and worrying about manufacturing. And so it's been a fun learning opportunity, tackling these new non-research challenges.

D Dr. Marie McNeely 21:16

Definitely. And Zach, it sounds like you've got some really exciting findings there. And I'm happy to hear that you're so dedicated to bringing this product to people who could benefit from it, because it sounds like there are many different applications, a wide range of people who could potentially benefit from this. So if our listeners out there are interested and maybe are wondering if this is something that might eventually be a good fit for them, where can they learn more about Biomotum?

D Dr. Zach Lerner 21:38

Yeah, a great place to learn more would be at our website, biomotum.com. And you're absolutely right. I think there are many applications beyond cerebral palsy, healthy aging, individuals that have suffered a stroke or spinal cord injury or Parkinson's disease. I see anyone who is struggling with their ability to walk has something to potentially benefit from the technology. So I'd really encourage you to look us up and to find out more.

D Dr. Marie McNeely 22:06

Phenomenal. Well, Zach, thank you so much for joining us and telling us more about Biomotum today. We appreciate your time.

D Dr. Zach Lerner 22:12

My pleasure. Yeah, thank you so much for inviting me.

D Dr. Marie McNeely 22:14

Well, it's been great to hear from you and listeners, stay with us. We'll be right back with you after this short message. Listeners if you've been enjoying our show is Changing What's Possible, then we'd like to share another podcast we think you may like: Remarkable Insights is created by Remarkable, the innovative Australian startup accelerator made possible by Cerebral Palsy Alliance, an organization that works closely with CPARF. This podcast explores the intersection between innovation and disability giving listeners around the world a chance to learn from disability tech pioneers who push the boundaries of innovation, business and social norms. Listen and subscribe to Remarkable Insights on your favorite podcast platform and visit remarkable.org.au/events/insights to learn more about how disability drives innovation.

D Dr. Marie McNeely 23:07

Welcome back. And I am excited to introduce you all to our second guest today. Nicole Hastings. Listeners, Nicole is the mother of a wonderful son who has been participating in Biomotum's research on the SPARK device. So hello, Nicole, and thank you so much for joining us today.

N

Nicole Hastings 23:24

Hello, Marie. Thank you for having me!

D

Dr. Marie McNeely 23:26

Well, we're excited to learn more about you and more about your in your son's experience with the Biomotum SPARK. So, can you start by telling me and our listeners a little bit more about yourself and your son?

N

Nicole Hastings 23:37

So my name, as you said is Nicole Hastings. I am a mother of two children. My oldest son is 14 years old and his name is Kyler. And Kyler was born premature and he had a few brain injuries surrounding his birth. And so he was diagnosed with cerebral palsy when he was around eight months old. And he has triplegic cerebral palsy, which means that he has three limbs affected by the CP. So for him, it affects both of his legs and one of his arms as well. So what mobility looks like for Kyler is he can walk independently, but he does have some gross motor delays. He wears a AFOs on both of his legs, and those helped give him a lot of support and stability when he's walking. And he uses a wheelchair for longer distances. Like if we're going out of town, we use it in airports or museums, things like that. So he's been involved in a lot of therapies for his whole life and that helps him to progress. He's just been really busy and working hard in all of his therapies.

D

Dr. Marie McNeely 24:40

Absolutely. And you mentioned that Kyler has experienced a lot of different kinds of therapies. How did you specifically find out about Biomotum?

N

Nicole Hastings 24:47

We found out about Biomotum through one of Tyler's physical therapists. She had heard about a research study that was happening locally nearby where we live and they were looking for children with cerebral palsy to participate. So she had shared that information with me. And that research study was looking at the effects of using a robotic exoskeleton on kids with cerebral palsy to see how that affected their walking. But what's funny about our story with Biomotum, is that I almost didn't call about this research study at all. And by the time I did call, it was almost too late. So they were wrapping up gathering participants and told me that they weren't really taking any new participants, but we had discussed Kyler. And then they talked

with their team, and thankfully, they accepted him. And he was able to go through the entire study. Now, the reason I didn't call sooner is because at that time in his life, Kyler was really struggling in his therapies. He was unmotivated, he didn't want to work. He was probably bored. I mean, he was 11 years old at the time. And he had been in therapy since he was an infant in the NICU. And so as an 11-year-old boy, he was uninterested in therapies anymore. So I was concerned that he would not participate in the research study in the way that they would need him to. But we were able to start that study. And he had some great results. And he's now been participating in these research studies with Biomotum and using the SPARK device for three years.

D Dr. Marie McNeely 26:17

That is amazing. And Nicole, do you remember what was Kyle's reaction the first time he used Biomotum SPARK in that very first study?

N Nicole Hastings 26:25

I do remember the first study, I think I was more nervous than Kyler. I guess that I was afraid he wasn't going to do anything. But the first time he used the SPARK device, I don't think he really had much of a reaction, he was pretty neutral. And it's such a different type of device than anything he had ever used. As humans, we're not used to strapping robotics onto our bodies. So it's a very unusual mode of therapy that they're using. So it took some adjustment to it. But it wasn't hard or difficult. The shape of the device is very similar to an AFO. And so the feel of it was already very familiar to him. So he didn't have any issues with really the way it felt. Just the motors and the mechanics controlling it were kind of different. But the research team did a great job of making sure that Kyler had a fun experience. They kept him motivated and engaged. I could appreciate the technology behind the device, but Kyler was too young to really understand what it was doing. So I think for him, it started out similar to any other therapy session just with some more gadgets involved. But to him, it was more like just a normal therapy.

D Dr. Marie McNeely 27:37

Oh, yeah, here we go again. Right?

D Dr. Marie McNeely 27:40

So Nicole, it sounds like Kyler has been able to participate in a variety of different research studies. Can you talk about some of the different activities that he's done with this Biomotum SPARK, maybe some of the different things that they've targeted in these studies?

N Nicole Hastings 27:40

Exactly!

N

Nicole Hastings 27:53

Yes, some of the studies, they use the device in assistance mode, which helps them to walk, kind of give them that extra boost. And then some of the studies, he uses the device in resistance mode. And resistance mode has actually been really, really neat. And it gives him a lot of added strength and mobility with his muscles. And so some of the things they do when he trains in resistance mode, as they are teaching him how to engage very specific muscles. And that would be hard to do in a traditional therapy, because it's hard to understand exactly what muscle - there are so many little tiny muscles in the body - you know, sort of tell a child especially like, oh, activate this one specific muscle. They don't know what that means. I mean, I as an adult, have a hard time saying, let me activate this one specific muscle.

N

Nicole Hastings 28:45

And so in resistance mode, they were able to, they put sensors on his legs, and so they can tell when the correct muscle is activated. And so they would put a screen up to kind of give Kyler some visual feedback as well. And then sometimes they would give audio feedback as well. They would spend time teaching him and training him on this is how you need to move your foot or they'll give his prompts. "Like when you take your set, make sure you're pushing off really hard." And so when he would do that, and his muscle would activate, then he would hear this chime. And that would tell him, "Yes, you did it!" And they would even have kind of like a chart on the screen. And so he could see the level of activation he was getting so he could get small activation. And they'd say, "That was great! That was the right movement. Now next time, just try and do it a little bit harder." So he could try. And then he could see that the bar moves up higher. So then they always had this goal. And that goal was individualized for each participant depending on where their level was. And so for Kyler, they would kind of see what his baseline was and then raise the bar and so then he was always trying to get his little thing to go up to the bar and hit it and once it did after so many times then they would increase that bar then they're trying to like slowly raise the level of muscle activation he's getting.

N

Nicole Hastings 30:02

And by doing that it's training his muscles to work and be stronger, but also teaching him how to use and activate muscles in his body. That is also a valuable technique that he has now been able to use in his other physical or occupational therapies, of just understanding the body and understanding how it feels using different muscles.

D

Dr. Marie McNeely 30:25

Absolutely. And I love that it sounds like you can develop this really personalized therapy, then that can adjust as the individual as your son is sort of gaining more experience, being able to do these movements and activate these specific muscles better. And I think this immediate feedback kind of makes it fun kind of makes it more like a game.

N

Nicole Hastings 30:43

It makes it so much more fun. I think not only for kids, but for adults, too, because a lot of people have whether you have a disability or not has been in therapy for any number of reasons, injuries, or whatever. And physical therapy is kind of boring, why not make it fun? So they would add in some sound effects. Sometimes it sounded like he was collecting Mario coins every time he would hit the right level. And yeah, it just makes it fun so that you want to do it. Nobody wants to do something that is boring.

D Dr. Marie McNeely 31:14

Absolutely. I couldn't agree more. So now has his reaction changed? You mentioned you've been involved with Biomotum for three years now, as he's continued to get used to the device and to use it. And if so, how?

N Nicole Hastings 31:26

It has changed over time, Kyler has really grown to love this device, the adjustment period is not very long at all. But like most things, I think it just takes time to get used to the feel of it, and then trust that the device is going to work for you. But the more he uses it, the more he's adjusted to it. Over the years of participating in the research studies, there have been times where he's wearing the device three times that week. But there have been other times where he will go maybe nine months between wearing it. And it seems that once he adjusted to it, it didn't really matter how much time he went without wearing it, he was able to put it back on and jump right back into full function with it, which was really, really neat that he didn't have to relearn every time. And the more he uses it, now he can see the changes that it makes in his gait. So part of the research study is that they have Kyler repeat the same task, both with the device assisting him, and then without the assistance. And every single time Kyler consistently says that walking feels easier with the SPARK assisting him and that he feels less tired after using it. And I also think that is why he loves using it now, because he knows that whatever he is going to be asked to do, it will become easier with the assistance from the device.

D Dr. Marie McNeely 32:45

Absolutely. And I think having that positive reinforcement can be really great, not only for in the moment, but in continuation and sticking with a therapy over time. So I'm curious, does Tyler's relationship with his Biomotum SPARK differ from how he thinks about or how he views, other interventions or other therapies that he's tried?

N Nicole Hastings 33:03

It is very different from his other therapies. But I think it also works very, very well, in conjunction with his other therapies, it has a much different approach. But I don't think that one could really replace the other, they really complement each other. One thing that's different about the SPARK is that it's much more focused on giving assistance than a typical therapy would be. So for example, Kyler struggles to step up onto a tall curb. So while his traditional physical therapy would spend time working on strength, and balance and coordination with

that, the SPARK device essentially just gives his foot that extra boost it needs to be able to step up onto that curb. That's one of the great benefits of the device is it can really enhance the things that he's already working on in his other therapies.

D

Dr. Marie McNeely 33:51

Absolutely. And Zach had mentioned in the first half of our interviewer, this device kind of has two modes. It has this assistance mode where it does provide that extra boost, but it also has this training mode where it can make it a little bit harder and force you to work a little bit harder to do that same movement. Has Kyler tried both?

N

Nicole Hastings 34:07

Yes, Tyler has. So his very first study that he participated in was actually all in resistance mode. And now uses both - assistance a lot more recently than resistance. But when they do those studies where it's more predominantly resistance, the results from those studies are quite amazing. So to see Tyler's strength, and his endurance increased, he's not using as much energy to walk as he was when he first started. And there's actually on the Biomotum website they have several videos on there and Kyler actually is one of those videos and that was after his training in resistance mode where you can see it's labeled visit one and visit one he is holding on to the treadmill, his walking - you can see it's just kind of difficult, a little more slow and sluggish. And then by his visit 12 after training for 12 visits in resistance mode, he was able to walk quite easily, at a quicker pace without holding on to the treadmill. And that strength has stayed with him over the years. I feel like he doesn't lose that strength he gains in these studies, it stays with him and that transfers over to all of his other therapies.

D

Dr. Marie McNeely 35:18

That is phenomenal. And I love how you describe that it has this sort of complementary relationship with the other therapies that he's having. It sort of targets things that might be a little bit different, his endurance is improving. And it's in addition to the strength and balance that maybe are improving with physical therapy, which I think is amazing. And you mentioned all these positive impacts and results that you're seeing with this Biomotum SPARK. So, I'm curious, Nicole, what is it been like for you watching Kyler use this Biomotum SPARK over the past few years?

N

Nicole Hastings 35:46

it has been just an incredible experience to watch him use Biomotum SPARK and be involved with this company. First of all, the technology is quite amazing, especially considering how they have made it so compact, and user friendly. And over the years, it just gets better and better. They keep making adjustments or modifications. And it's a really, really neat device. But watching Tyler's progress over the past three years has been really, really neat for me as his mother. I mentioned before that he was struggling to work in his therapies before he participated in that very first research study. And one of the most incredible things for me to see was how quickly his motivation came back once he started using the device. So all of a

sudden, he was willing to work hard and put forth effort in all of his therapies. And I think what changed is that by using the SPARK, he was able to see another side of his mobility that he hadn't seen before. He could instantly see that he was walking faster. And that excited him, that's an exciting thing to see that, wow, I can now walk faster! And I think that helped him to see some hidden potential within himself. And it wasn't a struggle, the SPARK was very easy to use, it made working easier for him. So all of a sudden, for really the first time in his life, he could be more active with less effort. And for an 11-year-old boy, that was huge. That was a major, major impact in his life.

D

Dr. Marie McNeely 37:15

Absolutely. I think even very small changes in mobility can have an enormous impact, particularly on growing children. So I guess could you talk a little bit more about some of the positive impacts that you or Kyler have noticed? And if so, what are these changes?

N

Nicole Hastings 37:30

I think the biggest change that we've seen is his confidence skyrocketed from that very first study and every study since it just continues to grow. And that is not what I would have expected to see from using a mobility device. But he is now very athletic. He does therapies almost every day. He plays sports, he does athletic training, weight training, he loves being active and moving his body. And Kyler's cerebral palsy still affects him in the same way that it always has, that hasn't changed. But now he's willing to try new things. He's willing to be more active, and he's willing to do something that maybe feels uncomfortable with his body, but to work through it and get better and stronger. And the SPARK showed him that what he thought maybe it would not be possible maybe actually could be possible. And I think one of the most exciting things about it is that it makes these tasks just a little bit easier for him. So he still has to work hard. It's not doing all the work for him. But it increases his efficiency. And it reduces his fatigue, which helps in all of the day to day activities that he would be doing.

D

Dr. Marie McNeely 38:43

Absolutely. I think just motivating and encouraging him to be more active has all of these downstream benefits on just overall health, well-being. So I think that is absolutely amazing. So Nicole, how do you hope this technology will maybe continue to change your son's life and his future?

N

Nicole Hastings 39:00

I hope this technology will change the lives of many children and adults living with movement disorders. I hope that SPARK device can give people access to experiences that they don't have the ability to maybe do on their own right now. Our family recently went on a hike together. And it ended up being a bit more difficult than we originally thought it would be. Some of the online reviews made it sound much easier, even for me, than I thought it was going to be. And Tyler he did great. He worked through it and he enjoyed it. But that experience really got me thinking about how if we had access to devices like the SPARK on an everyday basis, maybe

Kyler could go do an even more difficult hike that he wouldn't be able to do right now. And another thing that Kyler really enjoys is he loves to go to football games with his dad. But it can sometimes be a difficult and very long walk from the car into the stadium and then you got to get by all the bleachers, and he doesn't necessarily want to take his wheelchair to an event like that, because that kind of limits where he's able to sit. So having a device that could assist him to walk and get up all those stairs and then be able to sit in the stands and not be exhausted by the time he got there. So he can really just sit and enjoy the game. I think having a device to be able to do things like that for people in their everyday lives could really, really changed a lot of things for a lot of people.

D Dr. Marie McNeely 40:30

Absolutely. And I think just like you said, reducing the fatigue, allowing people to do more, do more of the things that they love in life, I think is so powerful. So I'm curious, we mentioned that the SPARK is a unique device, are there particular features that I guess Kyler really enjoys?

N Nicole Hastings 40:46

Kyler enjoys a lot about it. His favorite thing about wearing this device is that he can walk fast when he's wearing it. When he says he walks fast. He walks fast. Let me tell you, he participated in a research study just a few weeks ago, actually. And when that device was in assistance mode, I was really struggling to keep up with Tyler I was out of breath trying to keep up with him, it makes walking so much easier for him. And he notices that he enjoys that. And what I like about the device is that it also helps to pick his feet up off the ground while he's walking, so that he's not dragging his feet. And that makes it much easier for him to walk. And it's less of a trip hazard. But especially on stairs, it makes a really big difference. So normally walking up stairs, Kyler needs a lot of momentum to get up the stairs. And so he leans his body forward while he walks. And then he typically hits each step with his toes first. But when he has the SPARK device and assistance mode, he can stand completely upright, walking up the stairs with ease, he hits the steps with his heel first on almost every single step. And he doesn't add a faster pace than he normally would. It's just an incredible thing to watch that you essentially flip a switch, you turn it on, and he can easily fly up this flight of stairs. now,

D Dr. Marie McNeely 42:10

That is amazing, I think such a wonderful success story for Kyler. And it sounds like there are many ways in which he has benefited from this device. But I guess thinking a little bit bigger picture Nicole, who all do you think might benefit from using Biomotum SPARK?

N Nicole Hastings 42:23

I think anyone adult or child with any sort of gait deficiency or movement disorder can benefit from using the Biomotum SPARK. And the great thing about it is that it can be adjusted to the individual using it. So it doesn't matter their level of abilities or their age. So Kyler has grown and progressed from the three years from when he started as an 11-year-old and now he's 14 years old. And the device continues to keep up with him at where he's at. And so you don't

have to worry about is he going to outgrow this device, and then we won't be able to use it in the future. It has the ability to keep up with what the person needs in the moment. And so I think that really can lead it to a broad range of people that could use this device.

D

Dr. Marie McNeely 43:14

Oh, absolutely. And I think this is one of the benefits that it just really is applicable for people with a wide range of mobility impairments and mobility levels. So I think that makes it a fantastic device. So for our listeners out there who might be interested in trying this themselves, Nicole, do you have a message you'd like to share with them?

N

Nicole Hastings 43:33

I want to encourage anyone to try it. And I think it's like any other type of therapy or intervention. It might work better for some people than for others. But you never know how it might affect you until you try so I would encourage anyone that has access to it and is able to give it a try.

D

Dr. Marie McNeely 43:52

Well, that is a fantastic message for our listeners out there. Nicole, we appreciate you joining us to share your insights and your son's experiences with everyone today. So thank you again so much for your time.

N

Nicole Hastings 44:04

Thank you, Marie!

D

Dr. Marie McNeely 44:05

And listeners, it's been wonderful to have you with us as well. When you have a moment please subscribe and leave us a rating or review on your favorite podcast platform to let us know what you think of the show. And we look forward to connecting with you again in our next episode of Changing What's Possible.