EMG Biofeedback: Joseph Miller, DPT

Intro

I'm Joe Miller, a physical therapist. I have a bachelor's degree in physical therapy from Arcadia University and a doctorate from Arcadia University. I'm a Sports Certified Specialist through the American Physical Therapy Association. I've been a physical therapist for 33 years. I have had a private practice now for seven years in the Reading, Pennsylvania area.

Why is it important to know which muscles are activated?

It's important to know what muscles are activated based on what your goals are. So if we're looking to facilitate a specific muscle after an injury or after surgery, it's important to know exactly what muscles you're trying to target. It's important for the patient as well to have some feedback in terms of how they're doing and whether or not they're recruiting the proper muscle group. And so for us, it's really, it's imperative from our standpoint as a clinician and from a patient's standpoint to get a clear understanding of what muscle groups we're trying to use and fire.

What techniques, tools, and/or devices do you use to determine muscle activation?

We do a lot of hands-on manual therapy here. So there's a lot of hands-on work, whether we're doing PNF [Proprioceptive Neuromuscular Facilitation] with a patient. And we can tap that muscle group if we're trying to facilitate that muscle group. So some of the manual techniques that we use are certainly important, so the hands-on techniques. And certainly the mTrigger has played a huge role in us trying to make sure that we're facilitating the right muscle groups, whether we're trying to facilitate quadriceps, the VMO [vastus medialis oblique], or that we're trying to facilitate someone's anterior deltoid, whether we're trying to facilitate the middle deltoid, their rotator cuff. And so both- I would say both manual techniques that we've utilized and then the technology of the mTrigger has played a huge role in our practice.

Why do you use the mTrigger?

So initially we use the mTrigger quite a bit for our post-op knee patients. So if we would see someone who came in after a knee scope and a knee arthroscopy, where they were unable to fire their quad or didn't quite understand how to do that, the mTrigger has been extraordinarily valuable. Placing the electrodes on the quad and having them be able to both visually and auditorily, from an auditory standpoint, be able to get an understanding of how to fire that muscle. That's played a huge impact. Also makes things more interesting for patients. Quite frankly, you know, when you just have them do a quad set or have them do an exercise and they're going through the motions-- it's not quite as engaging as the mTrigger would allow it to be. The mTrigger has played a huge role in quadriceps rehabilitation for us after some of our post-op knee patients and also some of our post-op shoulder patients. For those folks who are having a difficult time raising the arm, having a difficult time to understand how to do an isometric contraction of their deltoid, we'll put the mTrigger on their anterior deltoid and have them do a front punch we call it or trying to elevate the arm- so to isolate that deltoid, anterior deltoid. For some of our post-op patients who had a reverse shoulder replacement, and the deltoid muscle is the primary mover-- it's worked wonders for us in that regard. And also the lateral deltoid, the middle head of the deltoid-- being able to do an abduction movement and for them to understand exactly what muscles they're recruiting. And I will tell you that we have had patients who had a difficult time raising the arm, we'll use the mTrigger, and then they'll see their middle deltoid working, take the mTrigger off, and then the next thing you know, they're able to get their arm into abduction. So those are a couple of clinical ideas and clinical pearls, so to speak, that we've used, and it's worked out great.

Compare the mTrigger with other techniques.

So as I said, we do a lot of hands-on work, and so there's nothing like putting your hands on a patient. And you can- you as the clinician- can get a feel of what you're trying to accomplish. You are also evaluating the patient's ability to recruit that muscle group. So in terms of manual hands-on PNF, we call it, work, there's nothing like putting your hands on a patient. However, the mTrigger works for the patient in terms of them seeing visually exactly the muscle group they're trying to fire. So I can tell them, and I can put my hand on that particular muscle group and tell them I want them to work that muscle group, which is the basis behind PNF; however, that's more auditory and more feedback from me- and sometimes that's effective. But the mTrigger, when it's actually on their skin, so they're feeling that- and they're also able to see- based on the red, yellow, or green lights- when they can visually see that in order to recruit the muscle. I think that's been just a huge, huge bonus for us. And we love it because then the patient will come back and they'll say, I wasn't able to get into green as much as I liked to. The next time they come back, they can. It's a win-win for them. And then the next time we go back and do PNF, they're actually facilitating that muscle like we wanted them to manually. So just like anything else, one size doesn't fit all. So some folks respond well to hands-on PNF work, some don't, and some respond to both. And so you have to kinda feel out which one works best for the patient. But the mTrigger has been wonderful in terms of the patient being able to hold the iPhone, see a number or see the color and be able to facilitate that muscle group.

Are there any locations where the mTrigger is not useful?

I would say we really don't use the mTrigger much for the spine. And I'm not quite sure why. Quite frankly, I guess I just, I haven't had really the need to use the mTrigger much in that regard. So I would say that the spine has been a difficult place. I shouldn't say difficult place, but it's been an area that really has been maybe underutilized by us maybe because I don't see a ton of back patients. You know, it's very versatile. So we use it on the musculature in the calf. We use it for, as I mentioned, the quad and the shoulder. We've used it for some patients in their wrist. I'm not gonna give you a good answer there because I think it's very versatile. I would say, you know, access points like your spine, like maybe the upper area of the hip—may be just a little awkward to use it, but we've used it. I can't say there's an area that we really have not used it.

Which populations benefit most from the mTrigger?

Everyone has responded well to it. Quite frankly, I think it's easy to use. Again, there's both the visual and auditory feedback. We haven't- we- I have had my knee replacement patients, who could be in their 70s or 80s and use it-- I would say sometimes the iPhone and holding the iPhone- and we use an iPhone at the office for its use with patients- sometimes just because of the technology, some of our older folks may have a little bit of a difficult time understanding it. But really it's user-friendly, it's simple. We have used it in our pediatric patients up until our patients who are in their seventies and eighties that had a knee replacement. It's very versatile, so we have not really had anyone that has not responded well to it, quite frankly.

What is the process to set up the mTrigger?

So the set of process is that the patient will come in, we'll discuss with them exactly how we'll be using the mTrigger, what it is, what the purpose is. And occasionally we will use an alcohol pad to wet down that area. We have specific- every patient has their own set of electrodes with their names on them. So they'll use those each time. The initial setup is we'll explain to the patient exactly what we're doing. We'll apply the device, and then we'll run through the idea of trying to calibrate the machine to their quadricep. If we have to, adjust the pads a little bit so we get a better connection. Then we'll try just some- just a trial run of a few contractions and we'll see where their threshold is. And then we'll adjust the mTrigger so they get just into the green. And then we'll document that to make sure we know exactly where we are

with millivolts. And then we'll have them go through the exercise routine. Typically, it depends on the patient, it depends on their strength and their tolerance of exercise, and their endurance-- we will typically do two to three exercises with them for their particular whatever muscles we're trying to fire. And then we're finished, and we'll put the machine back and make sure it's charged because a lot of times, well, that's another glitchy problem-- is that we forget to charge it. Although it does last little while. And that's, that's kinda how this setup works.

How long do you use the mTrigger?

As an example, so someone who comes in after a knee arthroscopy, we will use it once their swelling goes down a little bit because sometimes we have noticed that if we put the mTrigger on early on after their knee surgery and their knee remains with effusion, the mTrigger may not respond quite as well because I think of the effusion that may be in their suprapatellar pouch area. So if we tried to put it on their VMO, sometimes it doesn't quite- the sensitivity is a little off. However, once their swelling goes down, we will use it for at least the first five to six sessions until they can really get an idea of how to fire their quad. And then we will also use it with some resistance training. If we're trying, if it's someone that maybe has some patella instability, we're trying to isolate the VMO. Or if we just feel as though someone's not doing a great job with a straight leg raise program, and they're using more of the hip flexor than the quad. Or same thing on the leg press- if they seem to be someone who is compensating in some way, we can again use it for them so they're specifically targeting the muscles that we want to target. So I would say we definitely use it early on in the rehab probably more often. And then as they become more independent and stronger, we don't use it quite as often.

Are there scenarios other than swelling/effusion where the signal quality is weaker?

I think that's the most extrinsic reason why. Intrinsically, there seems to be an occasional little glitch, perhaps, where it seems to be situated well, the patient doesn't have swelling, and for some reason there's not a great connection. Again, whether that's because the patient maybe has some lotion or some other reason that the conduction or the connection is not there. And then sometimes just, you know how sometimes technology can be glitchy. But that's more of the exception.

How do you use the data provided by the mTrigger?

So I'll be honest with you, in a busy clinic, I just tell the patient, Hey, listen the idea here- here's the goal: get in the green and hold it in the green, regardless to what exercise you're doing. And so I don't- we don't put as much emphasis on the numbers and the output. That would be nice, actually. If there was a bit more, maybe some detail. And maybe shame on me because I haven't looked at the- some of the other workings of the mTrigger. I'm not sure it has that. But if there would be some more detailed information, whether it'd be a number, I guess it'd have to be in some type of a number form that allows us to print off or see what someone is doing. Here's the bottom line: it's about function, and it's about getting that quad muscle back, it's about getting that deltoid muscle back, it's about getting your calf muscle back. And patients certainly want to see progress. They want to note progress. And they can see that with the mTrigger just captured in that moment. And that's important. But it would also be important, and I think helpful, if we had maybe some more detailed information about it. This is how long the contraction was able to last. This is the amount of power you had in the contraction-- whether that would be some kind of a number or some other readout. So I would say as a clinician, I don't put as much emphasis on the actual number output. I'm just more worried about them visually being able to see the indicator go into the green, noting that they're getting a better quad contraction or whatever contraction they are.

As I said, in a busy office, it's difficult sometimes-- and this is the reality of healthcare today-- I don't necessarily have time to sit there with the patient, watch them do every single contraction. And then write down exactly what the numbers were. So at the end of a treatment session, sure. If I could push a button

and be able to text that to something else or be able to email that, so there would be more data, I think that would be great. I think for two reasons. Number one, again, then we can sit down with the patient, while they're icing or after their treatment. Say hey, listen, your maximum contraction last time was 17, now it's 24. Or from an insurance company perspective- insurance companies constantly want data. What was the tug test? What was their manual muscle strength test? And some of that can be very subjective. I love our dynamometer that we use. I have a nice handheld dynamometer that provides us with instant feedback in terms of how many pounds of pressure they're pushing for whatever exercise. And insurance companies and adjusters love that. Because hey, well now they had seven pounds of deltoid strength two weeks ago, now they're a nine-- What's your prediction for the future in terms of how many more visits we can get from the therapy, et cetera. So the objectivity of it is important. But again, just remember, like in busy, busy offices, you- I don't have time to sit there and watch the patient and to say, Hey, you got to this, that, and the other number. But at the end of the day or for that particular patient to be able to get some specific numbers, that would be wonderful.

What type of information are insurance companies interested in?

So insurance companies typically look for data to show improvements, or if there's not improvements, then they want to know why there's not improvements in a certain area. So insurance companies typically will look for data in terms of objective data. Unfortunately, manual muscle testing today is very subjective and not everybody understands what a three out of five or two out of five, or a three-plus out of five is. And my three-plus out of five for manual muscle testing can be different from the next therapist. So, however, when you have clear, concrete data, such as, as I mentioned, a dynamometer, that would say the patient has 15 pounds of external rotation strength. And then the next week they have 17 pounds, the next week 19 pounds. And that information also allows us to progress them, if we know that their one-rep max for the dynamometer is a certain amount, then we can start to increase their resistance with certain exercises. And so insurance companies will typically look for any objective numbers, any data that they can use to justify additional visits or potentially refuse additional visits if the patient is not making progress. So the more clear picture that you can provide to an insurance company for reimbursement is very important. So if you're just limited by just dynamometer measurements, it's not enough. You have to do some other testing, whether that be a subjective test that will an outcome measure of some sort, or additional numbers based on muscle contraction, based on fatigue, based on endurance, etc. So that's typically what they're looking for as far as approving additional visits. And then if you ever would get audited at some point, making sure you can justify why you were doing the treatment.

What are some challenges with using the mTrigger device or facilitating rehabilitation?

Frustrations- I would say with the device would be the electrodes. We'll use them two or three times, and then after that, they seem to lose some of their stickiness. And that can be a little bit of a frustrating process. Other than that, we really haven't had, other than the occasional time where for some reason it doesn't seem as though it's syncing well with the iPhone for some reason.

I would just say that the typical frustrations with possibly patients doing things at home-- that's always frustrating, making sure that they're compliant with doing exercises at home and carrying over what we what we do in the office with them. That's certainly important. And that can be a source of frustration if the patient's not following through like we'd like them to.

How could the mTrigger be improved?

I think ease of use is important as we get busier and busier. And as I'm thinking about it, there is that little bit of a delay now with the mTrigger when we have to have the machine calibrate- it takes like thirty-seconds, which again isn't a big deal. Time is of the essence typically in office settings. So anything that would make that process go a little smoother- I think would be helpful. The wearables, yeah. I think

something that would maybe stick better. Perhaps something that, again, unfortunately, I think we've noticed with the mTrigger is that oftentimes the electrodes, if the edge of the electrode is just not sticking well, then it can maybe alter some of the feedback. So if there's a way to manage to keep that electrode on there- we haven't got into taping them, but we occasionally think about doing that, but again, that takes an extra couple of seconds, you've got to run and grab some tape, et cetera. So I think in terms of wearables, I think something that makes sure that it stays where it should stay for the duration of the treatment. And to make it more interactive. I do know that mTrigger has some games. We did have a patient one time who was a bicyclist, hurt his shoulder, and there was a bicycle game that we used to use with the mTrigger- haven't used it recently. But to make it more interactive. So just the red, yellow, green is nice. But I did know that that one patient did enjoy the interactive nature of the game, where he had to contract his muscle in order to jump over something. So and as we get into the metaverse, and we get into making things more realistic and life-like-- perhaps that would also be something that would be interesting. As opposed to holding an iPhone, would a patient put goggles on while they're using the mTrigger? And don't forget, too, a lot of times with the mTrigger, we're in a stationary position. Obviously the patient's using their leg, but perhaps if there were- I'm just thinking if they were doing a specific exercise and had a wearable something on their head- like the Oculus type of situation- and they could move the arm in a certain area that would make it a little bit more interesting as well.