

CASE STUDY

Neuromuscular Electrical Stimulation with the NEUBIE Improves Strength, Function & Gait in a Patient Post Stroke

PERFORMED BY & LOCATION:

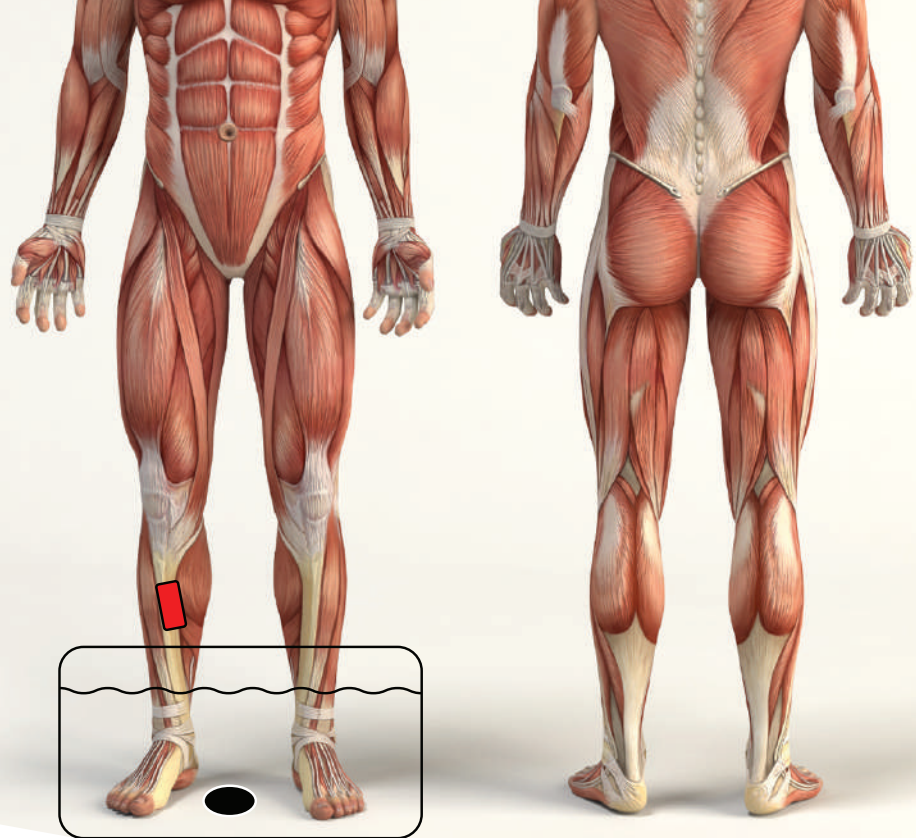
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KEY WORDS:

stroke, motor deficits, functional training, vestibular stimulation, NMES

DIAGNOSIS:

Patient suffered a SCI 25 years before beginning NeuFit Treatments.



TREATMENT AND OUTCOME

Upon initial evaluation (which was after he had undergone 3 months of inpatient rehab), the patient required a two person dependent assist to transfer from his wheelchair to the treatment table. After ~2 months of consistent PT sessions, which focused on isolated muscle strengthening of glutes, hamstrings, hip flexors, and lower leg, functional and gait training, and a unique vestibular setup to improve midline orientation, all with the use of the Neubie, the patient was able to ambulate household distances using a quad cane with supervision. After 2 months, he was able to ambulate community distances using a single point cane. 2 years post injury, with continued PT and use of the Neubie, he is able to ambulate independently without an assistive device, with improved weight shifting to his weak side and now lives a very full life and is able to travel with his family, including going on cruises and to the beach.

PATIENT INFORMATION/DIAGNOSIS

45 year old male who suffered a left hemisphere stroke caused by a stab to the carotid artery in August 2019. Prior to accident, he was independent and very active - he went to the gym daily and they called him "full stack" because he lifted such heavy weights. He presents to me on evaluation with weakness and increased tone in his right upper and right lower extremities, functional mobility and gait impairments, and expressive aphasia. For the purpose of this case study, we will focus on the treatment provided, and outcomes of, his right leg weakness and functional mobility impairments.

CLINICAL FINDINGS ON EVALUATION

PROCESS: Due to motor planning deficits and presence of increased tone, accurate manual muscle testing was difficult to assess, but observed movement against gravity/volitional movement at each muscle group. Also observed patient performing functional movements including transfers, sit to stands, and rolling. Performed a scan. Due to aphasia, not able to get fully accurate subjective feedback from scan, but was able to note the patient's reactions (change in facial expression, "ow," curse, etc) and also noted those areas that increased tone or caused a muscle contraction in an area that was observed to be weak during observation of volitional movement.

FINDINGS: Patient demonstrated moderate weakness in right quads and glutes and significant weakness in right hip flexors, hamstrings, and lower leg. During the scan, noted diminished sensation in his right lower leg and foot, which suggest decreased sensation in these areas. Hot spots were noted at his right VMO, gastroc, top of foot and hamstrings. Functionally, patient was dependent for wheelchair <-> mat transfers and was able to stand only briefly with maximal assistance. He used a wheelchair for mobility (not able to self-propel).

ASSESSMENT: Patient is limited by both increased tone and weakness in his right leg, which will require the use of both high frequencies (to address increased tone/lengthen muscles) and middle frequencies (to address weakness/strengthen muscles) using the Neubie. He will require isolated muscle strengthening on the weak muscles as well as functional training to address these deficits. Aphasia and motor planning deficits will be challenges, but not barriers, to treatment, as patient responds well to demonstration and repetition.

PATIENT REPORT AFTER INITIAL EVALUATION: "DUDE... DUDE!!!!" As patient is aphasic, he was not able to report in detail how he felt, but he was very excited after our initial session. His family was present and stated that he tends to get bored in therapy, but could tell that he enjoyed the session a lot and felt like they saw activations of muscles on our evaluation that they had not seen since the stroke.

SUBSEQUENT TREATMENT SESSIONS

PROCESS: 2-3x/week consistently October of 2019 - October 2021, with a few 1-2 week breaks

TECHNIQUES USED IN FOLLOW UP SESSIONS: We combined the following treatment techniques throughout our sessions. During early sessions, the emphasis was on stretching the tight/spastic muscles and performing isolated strengthening of the weak muscles. As he progressed, sessions evolved to working on advanced, compound strengthening and functional activities.

- **Glove Work to patient's lower leg** - Using electric glove attachment of Neubie at 500pps, I manually worked patient's lower leg, ankle, and foot, in order to decrease tone as well as provide these areas with stim/input in order to encourage more movement.

CHANNEL 1 = Red (grounding) right hamstring / **Black** plugged into glove on therapist's hand.



- **Stretching at 500pps** - With electrodes on areas of interest found during the scanning process, performed manual stretching to patient's right hip, quads, hamstrings, and gastroc.

- **Isolated Muscle Strengthening at 40, 55, 75 pps** - With electrodes on the areas of interest found during the scan, we worked on isolated muscle strengthening of the glutes (*bridges, clams*), hip (*assisted hip and knee flexion, ab/adduction, marching*), hamstrings (*prone curls*), and dorsiflexors. Initially, these exercises were more passive due to patients decreased ability to initiate contractions, but as strength began to improve, these exercises became active/active assisted. Used a Work Time of between 3-5s and a Rest Time of between 3-10s in which I had the patient contract and hold while the stim was on and relax when the stim was off. This allowed him to 1) have a cue of when to begin the movement, 2) not have to work through the movement eccentrically against the stim (*which would be the case if it ran continuously*), and 3) rest between reps to allow for better/more quality movement.



VIDEO EXAMPLE:

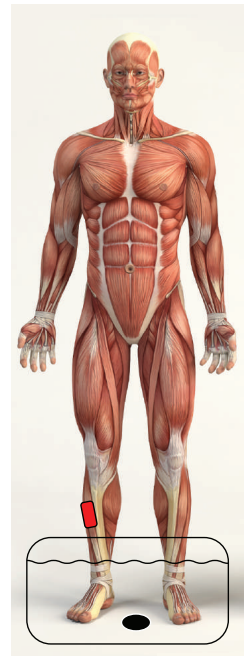
[Stability Ball Hip & Knee Flexion](#)

- **Foot Bath at 500pps** - Electric foot bath to increase blood flow, decrease swelling and tone, and increase input to ankle and foot. **Channel 1 = Red** (grounding) on right anterior tibialis / **Black** carbon fiber electrode floating in water

- **Functional Mobility Training at 500 pps** - With electrodes on areas of interest found during the scan, as well as additional muscles groups we wanted to target, performed functional exercises including rolling, sit to stands, pre-gait, and gait activities. **Video Example:** [Sit to Stands](#)

- **Vestibular Input** - As an additional tool to assist with re-educating the nervous system to proper midline orientation (which had been abstracted due to consistent preference to left side since stroke), we placed electrodes over the mastoid process in a setup that allowed us to “trick” the body to think it is falling towards his left/strong side, which helped him shift more weight onto his right/weak side. **Channel 1 = Red** right mastoid process /

Black left mastoid process



RESULTS OF PAST TREATMENT & CURRENT RESULTS

On initial evaluation, patient required a two person assist to transfer from his wheelchair to the treatment table and had no trace movement in ankle and minimal movement in hip and hamstring. He now has regained some movement against gravity at his ankle, can perform prone hamstring curls unassisted, and is able to perform hip flexion in supine, seated, and standing. He is able to perform complex functional movements including sit to stands with right bias from a very low surface, step ups/downs, and now ambulates community distances without an assistive device over uneven surfaces. He travels with his family and is able to navigate cruise ships and beaches. Patient continues therapy today, and is working a lot on regaining function of his right arm and hand, as well as continued work on fine-tuning his gait pattern.



DISCUSSION

One of the biggest observations and take aways to come out of this case study is the significant change made in patient's function after the initial 1-2 months of using the Neubie with PT, compared to the prior 3

months of working in acute care/ inpatient rehab. After 3 months in inpatient rehab he still required dependent assist for transfers; after less than 2 months of using the Neubie, he was walking household distances with a cane. The speed at which his mobility improved after introducing the Neubie was astonishing to me, as he was one of my first patients I was able to use the Neubie with. Comparing the changes/progress I, myself, was able to help patients make in a traditional inpatient/outpatient neuro setting prior to using the Neubie, with how I was able to help this patient with the Neubie, was eye opening.

Additionally, in traditional neuro rehab, I always find that patients progress, then plateau, then they come back for another bout of therapy and might progress a little bit more, and the cycle continues. Another major observation gained out of this case study is that over the course of the two years of treatment documented here, the patient consistently made progress every single session, every single week. He never once hit a plateau, which is something I had not been able to help patients accomplish prior to using the Neubie. Along these same lines, when he did take 1-2 week breaks in therapy, when he returned, he showed no signs of diminished strength or mobility..

Patient continues to require PT to improve strength and function of his right arm and hand as well as to improve the quality of gait pattern. He is still seeing improvements in these areas over 3 years post stroke.

PATIENT PERSPECTIVE

Again, as patient is aphasic, he is not able to give a full verbal account, but he is motivated and excited to come to therapy every day. He likes to say “Stronger every day!” In an interview with him and his brother when asked how the Neubie has helped with his recovery,, his brother states:

- “In terms of the progress being made since starting at Neufit... it was a matter of weeks, maybe a month that he was out of a wheelchair and walking in here. That was a big step. And it’s been steady progress ever since.”
- “The gains are significant in his mobility and his ability to feel in certain areas. It’s a steady slope (of progress) that just goes up. Improvements are strong and steady with treatment.”
- “(The Neubie) has been a blessing in terms of maintaining strength in his whole body. You worry about people (after stroke) losing strength and muscle tone, but he hasn’t.”
- “We know we wouldn’t be anywhere near here without Neufit. Initially we had other treatments that were provided... I’m not saying they were inadequate, but they were just not to the level that we have received here (with Neufit). Realistically he would not be walking without a cane without Neufit.”
- For full testimonial: [Patient post-stroke testimonial](#)