Neuroplasticity: Is it Achievable Through TeleTherapy?

By Cheryl A Fishman, MSPT, C/NDT

When picturing Neuro-Developmental Treatment (NDT), *hands-on* techniques come to mind, along with key points of control such as the rib cage, the hand, the foot, the humerus, the jaw, etc. When meditating on *neuroplasticity*, the brain stands out as the key point of control. Movement, but not just any movement or exercise – novel challenges. Participation. Participation that resonates with NDT.

In thinking about learning new languages, cognition is responsible for creating synapses. Movement paired with cognition can result in formation of new neural connections as well.[1] The brain is a learning machine. It craves newness, innovation, originality. It takes creativity and innovation by the therapist to spark inspiration and motivation in the child.

Principles of neuroplasticity can be utilized as a guide in establishing goals, creating treatment plans and ideas, and designing a home exercise or activity program.

As physical therapy meets technology, TeleTherapy is being introduced to the public rapidly. Is it possible to achieve the participation and neuroplasticity within sessions via video conferencing over the Internet?

THINKING ABOUT NEUROPLASTICITY

As therapists delve into this emerging world of TelePratice, being mindful of the principles of neuroplasticity is vital to making changes. When considering the word *neuroplasticity,* we think of the brain, cognition, synapses, connections, molding, learning, repetition, building in daily practice, foundation, experience. The brain is malleable, which makes it conducive to learning. The brain is *plastic;* it can be molded. Experience drives that malleability, that plasticity. Motor learning and practice are imperative to achieve neuroplasticity. [2,3,4]

The importance of novelty was suggested by Fabel and Kempermann[1] that exercise alone will not trigger neuroplasticity; rather, skill acquisition in the presence of cognitive complexity is necessary. Prerequisites for learning are repetition, practice, and task-specific training. Carry-over and generalizing an ability to function across different contexts continue the progression of learning and neuroplasticity, enhancing the synapses already established, while creating new ones.[3,4] Building upon what is already ingrained and the functional maps already in place by learning new strategies for carryover and refining skills also positively affects neural connections.

Habits are evidence of neuroplasticity (Kleim J. Neural Plasticity: Foundation for Neurorehabilitation [lecture]. NDTA Annual Conference, Memphis, TN, 2016; NDTA Distance Learning Video, www.ndta.org., 2017). They are proof of the connections that have been created, formed, strengthened, and can be changed, reformatted, and refined. Cognitive processes must be engaged in order to achieve neuroplasticity – the formation of or change in neural connections.

Rarely do I find myself considering *neural connections*

during treatment sessions, but what a profound concept to ponder this miraculous learning machine, the brain, that actually has the capability to alter its own structure and functioning in response to task-specific training and motor skill acquisition.[1,2,5] It is an amazing phenomenon that the brain can organize and re-organize itself physically and functionally depending on one's experiences.

Where do the physical structures of the brain fit into learning and neuroplasticity?

WHAT WE KNOW ABOUT NEUROPLASTICITY & THE BRAIN

There are many areas of the brain that contribute to neuroplasticity related to motor learning. One part of the brain, the cerebellum, has many responsibilities in motor learning. The cerebellum has three regions: the medial, the intermediate, and the lateral portions. The medial part is responsible for balance, locomotion, and stabilizing vision in conjunction with head movement. The intermediate section controls fluidity of movement and muscular balances between the agonist and antagonist. The role of the lateral region is cognition, motor planning, and motor learning.[4]

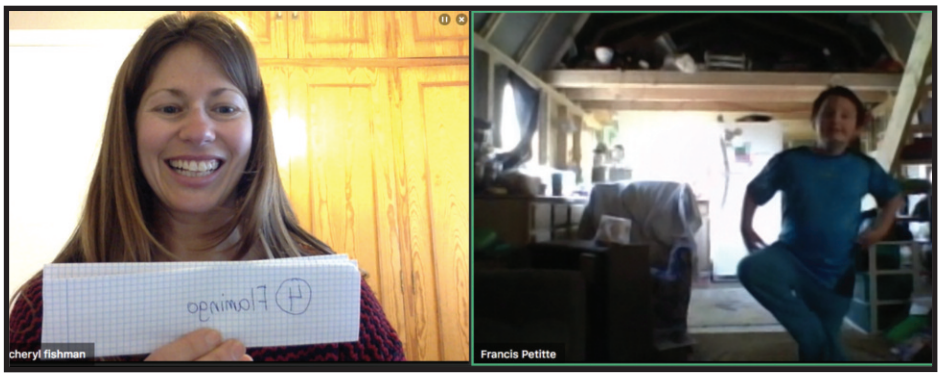
The intention to move is initialized in the cerebral motor cortex, where movements are selected based on external events.[6] Montgomery[4] states that Randolph Nudo showed skill acquisition results in remodeling of the motor cortex after skill training with squirrel monkeys.

It has been shown that aerobic exercise is beneficial in that it increases oxygen and blood to the brain, augmenting memory and cognition.[4] Research shows a positive effect on neurogenesis (increased strength between neurons) and synaptogenesis (the forming of synapses, which is how the brain learns and changes and recovers) with aerobic activity, especially in the hippocampus, which is responsible for short-term memory.[1,4] This implies a relationship between aerobic exercise and cognition in regards to academic performance.[4] Research has demonstrated observable functional changes in rats or animals as a result of training 20 minutes per day.[4]

Treatment is an opportunity to tap into the plastic properties of the brain. Youth lends itself to accelerated plasticity; however, the brain's ability to transform its structure and utilization is a life-long phenomenon. Novelty is paramount to provoking this phenomenon. Feed the brain new challenges, add obstacles, add distractions. It takes a certain degree of difficulty. If the task is too easy, a decreased change occurs. Thus, therapists aim to target the *just-right challenge*. Fabel and Kempermann[1] state that simply exercising is not sufficient to drive neural changes, rather "physical activity in context of cognitive challenges"[1p59] is necessary to generate neuroplasticity.

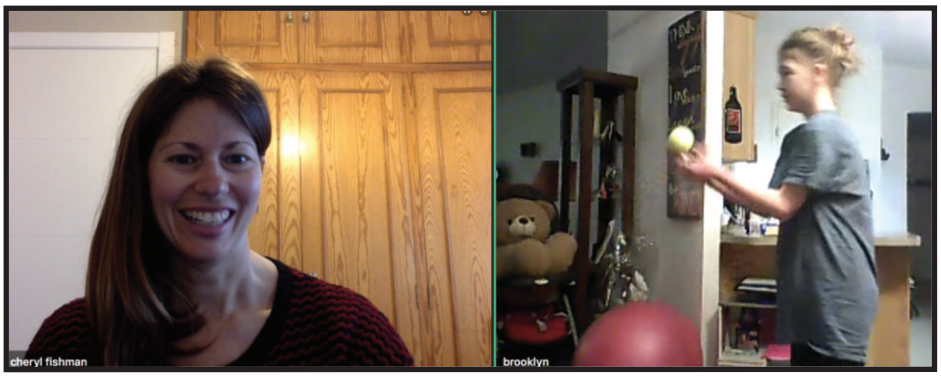
Factors for success in stimulating neuroplasticity include specific objective feedback and monitoring, salience, attention, sensory input, skilled exercise and experience, intensity, sufficient repetition in a certain timeframe to reorganize, and general

Neuroplasticity: Is it Achievable Through TeleTherapy? (continued)



Left: My patient, Chad, playing a game by choosing a number and then pretending to be that animal – in this instance, a flamingo.

Right: Another patient, Brooklyn, is about to catch a tennis ball during a series of catching activities with her mom.



aerobic exercise to feed the hippocampus for cognitive processes.[3,4]

TELEPRACTICE AS A VIABLE MEANS TO REACH PATIENTS?

In examining TelePractice and the elements necessary to achieve neuroplasticity, TeleTherapy can meet the requirements to drive neuroplasticity. While it may not be the gold standard nor appropriate for all patients, it may be a viable option for specific circumstances. Clinical indications may include instructing in, monitoring, and progressing home activity programs; patient and family education; postural assessment and strengthening; assessing and modifying the home environment. TeleTherapy can provide check-in for a physical therapist if a physical therapy assistant is treating the patient, depending on the criteria in the residing state. Due to logistical obstacles, it may provide access to care when otherwise none is available, particularly when the family lives in a rural setting. For students who attend Virtual Academy (free online education in the US for students K-12), virtual therapy is their natural environment. TeleTherapy fits well with using a coaching model. It is applicable for education-dominant sessions or consultative practices, when perhaps a patient has just a few questions. It offers convenience, flexibility, and access.

APPLYING NEUROPLASTICITY TO TELETHERAPY: A LOOK AT THERAPY IN THE VIRTUAL ACADEMY

Principles of neuroplasticity can be utilized as a guide in establishing goals, creating treatment plans and ideas, and designing a home exercise or activity program. Involve the student and/or parent in formulating the goals, developing the care plan, and tailoring the treatment. Discuss and consider the student and family's aspirations, goals, lifestyle, vocation, daily activities of enjoyment, and leisure. Having their input can be helpful to encourage their participation and follow through. Buy-in by the student and family is paramount. If the student is seen only once per week or every other week, there has to be an innate desire or reward. He or she needs a reason to strive to reach the specified outcome; whether it is a sense of accomplishment or an individual goal, it must be relevant.

TeleTherapy fits in well with the use of a coaching model. It allows for educating, reviewing, adapting, and assisting in the process along the way. Demonstration by the therapist can be utilized, along with videos on the Internet. The focus is on education.

Overall, as in any realm of rehabilitation, participation by the student is sought. Find ways to encourage and invite the

Left: Chad is pretending to be a monster truck driver, driving after climbing into his "truck."

Right: Brooklyn practices coordination activities, including jumping jacks.

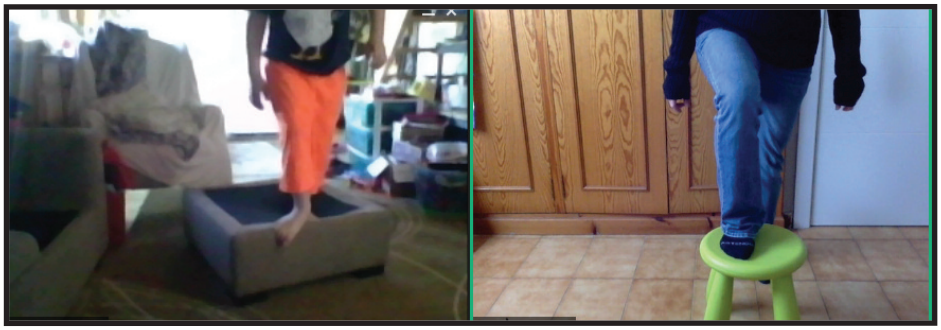
child to participate, remembering that specific objective feedback must be provided. Children are sponges. They are adaptable. When presented with different activities or sequences of movement, they are capable of absorbing, learning, and applying the introduced patterns within their potential. Beyond the session, the therapist will want to build in daily practice for learning to occur and solidify so that the task becomes hard-wired. A functional component is required for children to learn.

CHALLENGES AND ADVANTAGES PRESENTED IN TELEPRACTICE WITH CONSIDERATION TO NEUROPLASTICITY AND THE STUDENT RECEIVING VIRTUAL THERAPY

Challenges may be faced with behavior and attention on behalf of the student. These can be challenges in traditional physical therapy settings as well. Motivation, ingenuity, and perseverance on the therapist's part are necessary to ignite enthusiasm from the student for give-and-take to occur throughout the session. The already ingrained habits of a child and/or family can be difficult to change, requiring persuasion through education, awareness, and desire by the child and family, followed by hard work and diligence.

Along with habits we consider the lifestyle of our patients. A true-to-TeleTherapy-challenge is the absence of the clinician when not being able to use tactile cueing to correct, direct, or guide exercises, gait, or postures. Another obstacle presented by TeleTherapy is the inability of the therapist to set up the environment. Usually the therapist selects the tasks and structures the environment to one's own liking to meet the intended purposes. In TeleTherapy, the therapist must team-up with the parent or teacher who is with the student to explain and educate the task set-up, the design, and the structure required for the activity. Changing environments for generalization and carryover can be a hindrance and may require educating the family in how they can present the newly learned skill within different contexts or surroundings. This model of service delivery offers novel experiences through the Internet without equipment and lacks control and manipulation of environment, which must instead be relayed and completed via explanation and feedback. The therapist should have experience in the clinic and in face-to-face situations, as well as know when to refer patients.

Although disadvantages exist, there are advantages as well. One is that the parent or teacher is present for sessions. Assuming that the parent is participating by setting up the



Left: Chad performs step-ups at an ottoman as his therapist demonstrates.

task and/or encouraging the child to participate, he or she is learning also. The parent, as well as the child, is being exposed to activities that can benefit the child. Maybe the student is preparing the room for therapy. What great participation, just as in a regular therapy session. Perhaps the student and parent together can create a Therapy Toolbox of items they have around the house that can be suitable for different therapeutic activities. In this instance, they are creating activities that they can easily repeat at home beyond their TeleTherapy sessions. Tapping into the resources that the family has access to in their homes presents the family with awareness of the tools they possess and how they can use seemingly irrelevant items as a therapeutic purpose. Having an opportunity to view the home environment is a luxury that typically therapists do not have when working in other settings. It is an inside look at the student and family's reality and everyday life. The child may have increased availability and control regarding scheduling. With all the hype over technology these days, some kids may be excited to use a program on the computer and to participate even more-so than in person.

CONCLUSION

The same objectives of participation and achieving motor learning through exposure and practice to accomplish neuroplasticity are targeted. TeleTherapy is using what was learned in the clinic, and adapting it to the computer, adapting to the future. Families are already using the Internet to determine their own healthcare. While TeleTherapy should not replace direct treatment, there is a place for it in the future of healthcare. Physical therapy meets technology. While human touch and human contact cannot be replaced, the fountain of knowledge that the therapist possesses can offer an abundance of resources, even via the Internet. ■

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