Learning and dementia: An incorporation of neuroplasticity theory in physical therapy treatment.

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Background: The physical therapy treatment of a patient with impairments in attention, memory, and other cognitive processes can be challenging as retention of topics learned in therapy may not be probable. Patients with dementia can be particularly challenging to treat as their cognitive impairments likely coincide with other physical and psychological factors. Certain principles of plasticity such as salience, repetition, and transference have been used to increase neuroplasticity and improve outcomes in patients who are being primarily treated for neurological impairments. There is also low-level evidence to support the application of various forms of task practice to improve ambulation of those with attentional impairment as a result of brain hemorrhage\(^1\), but this may not apply to a patient with dementia or other non-traumatic cognitive impairment. The purpose of this case report was to examine the effects of the application of neurotherapeutic theories on the outcomes of a patient with dementia being treated for increased incidence of falls.

Methods: Treatments and data collection were completed at the Schuyler Hospital outpatient physical therapy clinic in Montour Falls, NY from March-May of 2017. A student physical therapist under the supervision and guidance of a licensed doctor of physical therapy provided the treatments.

Interventions were selected in order to increase balance and safety during functional tasks such as ambulation in order to reduce the risk of falls. Because the patient presented with decreased attention and other cognitive impairments, we relied on interventions that incorporated strategies of motor learning theories such as those presented by Kleim and Jones in the Journal of Speech, Language, and Hearing Research\(^2\). We chose exercises that were easy to understand or were similar to something the patient already knew how to do to increase his ability to complete the task. Examples of exercises include: playing catch, stacking cups, riding a bike, and walking over obstacles. Due to varying levels of attention during treatment sessions and a lack of retention from previous sessions, a specific protocol could not be followed. We decided to progress/regress the difficulty of our interventions through constant re-evaluation of the patient’s status throughout each session. The patient was closely guarded and monitored symptomatically for his safety. Additionally, outcome measures challenging balance during gait, standing, and transfers were utilized several times throughout the plan of care in order to track meaningful changes over time.

Results: The patient demonstrated improvement in most areas including: muscle strength, balance, walking, and functional mobility. He also showed statistically significant improvements in most outcome measures while areas that remained unchanged may or may not have been a result of cognitive impairments restricting his understanding of the test.
**Discussion:** At the initiation of the course of treatment, our main goal was to find interventions and activities that the patient could be capable of both performing and cognitively understanding. Each session presented somewhat as a trial and error to find exercises appropriate for the patient’s variable abilities. Upon reflection, it became clear that the interventions that were most successful were strongly intertwined with these three principles of neuroplasticity: repetition, salience, and transference.

Kleim and Jones describe repetition, salience, and transference as follows: “Repetition matters: induction of plasticity requires sufficient repetition. Salience matters: the training experience must be sufficiently salient to induce plasticity. Transference: plasticity in response to one training experience can enhance the acquisition of similar behaviors.” These three ideas were present in all of the patient’s interventions that had the most impactful and meaningful outcomes.

These findings suggest that even those with cognitive impairments affecting their safety can make significant improvements with physical rehabilitation and improve their quality of life. This information is highly relevant as many physicians, rehabilitation specialists, and caretakers may assume, if the patient cannot retain instructions or if s/he has poor safety awareness, that therapy may be rendered ineffective. This patient’s success not only gives insight into physical therapy treatment of those with dementia, but also those with other cognitive impairments such as developmental disabilities, memory loss, or brain injury. More importantly, the strategies used in this case could be implemented to enhance learning across both medical and non-medical fields including; nursing, occupational therapy, teaching, counseling, and even parenting.

**Resources:**