The Use of Motor Learning Rehabilitation Principles During an Acute Care Orthopedic Ankle Fracture: A Case Report

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Background and Purpose

- Ankle fracture is one of the most common lower limb fractures.
- The primary focus of physical therapy of an acute surgical case is to return the patient to optimal functional ability to assure a safe discharge.
- Neuroplasticity and motor learning are ways to organize therapy and challenge the patient to learn and perform functional movements include principles of motor learning and neuroplasticity.
- Neuroplastic changes occur over the entire lifespan in both healthy and dysfunctional brains.
- These principles are commonly used in treating patients with neurological deficits.
- Limited studies have looked at the connection between the motor learning in rehabilitation and orthopedic conditions.
- The of this case report is to outline the framework of motor learning strategies used in an orthopedic post-surgical case and show how it helped optimize patient performance and retention during gait and mobility training. It highlights the lack of information and research on the use of motor learning principles in orthopedics.

Case Description

A 74 year old male with no significant medical history was admitted to a local hospital three weeks post compound right ankle fracture. The patient was examined by the orthopedic team who diagnosed the presence of acute osteomyelitis and performed a surgical ankle irrigation and debridement, and an open reduction of right ankle fracture dislocation. The right ankle was placed in a multiplane external fixator as well as a wound vac. Physical therapy was ordered post-operatively and evaluation was administered.

Methods

Interventions consisted of two different intervention approaches:
- The first approach (plan 1: 2 weeks) consisted of patient education, seated and supine strengthening exercises, and whole part transfers from bed to chair. (Figure 3)
- The second (Plan 2: 4 weeks) consisted of similar patient education, seated strengthening exercises, and included a motor relearning plan to enhance rehabilitation and retention for functional tasks (bed mobility, sit to stand, and ambulation with a rolling walker). (Figure 4)
- In order to target neural networks the following were used: (1) whole/part task training (2) appropriate feedback (3) task attention to enhance rehabilitation and retention for functional tasks (bed mobility, sit to stand, and ambulation with a rolling walker). (Figure 4)
- Implementing the concept of motor learning when addressing coordination of functional movements has the potential to promote neuroplastic processes.
- Each part of the task was practiced in order for the patient to become familiar with them before attempting sequencing them together.
- Plan 1, was an impairment-based intervention plan, emphasized a more standard strength and endurance program, which seemed to increase capacity in body systems and lead to compensations.
- Functional movements and coordination likely improves secondary to the ability to produce muscle forces, to move joints through a greater range of motion.
- This case helps demonstrates that incorporating Neurological rehab concepts can be beneficial when used with patients with orthopedic conditions that impact functional mobility.
- Using motor learning principles led to an improvement of both retention and execution of functional skills.

Outcomes

The pt. demonstrated limited improvements during Plan 1. Interventions were adjusted (Plan 2), and the pt. demonstrated improvement in both performance and retention. The pt. progressed to supervision assistance in bed mobility and sit to stand transfers and minimal assistance during ambulation.

Discussion

Neuroplastic changes occur over the entire lifespan in both healthy and dysfunctional brains. Neuroplasticity and motor learning are ways to organize therapy and challenge the patient to learn and perform functional movements. The integration of structure motor learning in post-surgical repairs of an ankle fracture leads to improved performance and retention of function compared to a standard rehabilitation exercise plan. PTs should consider utilizing a customized intervention plan with attention to progression according to the principles of motor learning to optimize learning and functional performance with orthopedic conditions, however, further research is needed in orthopedic cases as well as motor learning parameters in general.

References