NEUROGYMTECH

NeuroGym® for Balance & Gait

Maintaining static and dynamic balance is a complex process involving the integration of visual, somatosensory and vestibular inputs. It depends upon the integrity of key physical parameters such as adequate strength and range of motion at the ankles, knees and hips. In addition, to be functional, the level of balance ability must be sufficient enough to adapt to changes in the environment and in the tasks or movements being performed.

Difficulties with static and dynamic balance and gait abilities are interconnected.Human gait involves both preparatory (control of upper body stability, head stabilization and coordination between upper and lower extremities and foot placement) and reactive postural control mechanisms (responses to perturbations or obstacles). The relearning of basic static balance as well as more complex dynamic balance control is a primary goal of neurological rehabilitation. In a recent research report reviewing physical therapist interventions for patients with stroke, Jette et al (2005) found that gait training consumed the largest percentage of therapy time compared to other treatment activities. The emphasis on balance and gait training highlights the importance of this aspect of rehabilitation and underscores the importance of providing to therapists the most effective and efficient means of achieving successful therapeutic outcomes.

THE SIT-TO-STAND TRANSITION

When mobility is extremely limited, as, for example, in patients making the transition from bed or wheelchair to independent standing, initiating sit-to-standing training is part of the early treatment plan. Such training, however, is often limited by patient weakness, reduced range of hip and lower extremity joint range of motion and difficulties in motor control and coordination.

To help overcome these obstacles and assist the therapist in optimizing this aspect of rehabilitative treatment, NeuroGym® Technologies offers the Sit-to-Stand Trainer. Its unique design enables patients to attempt standing from a sitting position by applying as much counterweight as is necessary to assist with a smooth standing motion. Unlike other equipment that actually pulls the patient to standing, with minimal individual effort, this device allows the therapist to adjust the counter-weight to apply the minimum amount of assistance necessary, thus promoting active, client-initiated movement. If mobility is compromised to the point that even such initial standing attempts are not possible, other tools, such as the NeuroGym® Trainer with pressure sensors interfaced with interactive biofeedback, the NeuroGym® Pendulum Stepper or Exercise Wheelchair, can be used to encourage seated training as a prelude to attempts to stand.

ESSENTIAL BUILDING BLOCKS

Strength and control at key joints such as the ankles is an important building block to balance. Often, ankle strength training is done with ankle weights or devices that do not isolate the ankle and foot from associated lower limb movement. For individuals recovering from neurological injury, this type of exercise may be difficult because of limited strength and reduced ability to target and control the required muscles. A device is needed that can train ankle mobility and strength in each of ankle eversion, inversion, plantar and dorsiflexion, even in individuals with extremely limited ankle strength and motor control.

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The NeuroGym® Ankle Trainer was developed to meet this challenge. The foot is secured in position and the device may be locked such that movement in only one plane at a time is allowed. The portability of the device and ease of connection to either elastic tubing or a pulley improves the ease of training. Often targeting and control of ankle muscles is an important therapeutic goal.With the addition of a position sensor, the Ankle Trainer can be used along with the NeuroGym Trainer system to allow for intensive motor learning through speed sensitive biofeedback training.

ENRICHING THE PRACTICE ENVIRONMENT

Following the development of sufficient strength and range of motion, therapeutic goals require intensive static and dynamic balance practice. Woollacot and Tang (1997) have suggested that exercise that emphasizes fast and powerful muscle activity generation, interlimb coordination and coordination between lower-extremity and upper-body movements would be most beneficial in training reactive balance control mechanisms.

This type of training would increase the number of balance response repertoires that could be used, for example, to supplement possibly inefficient early postural responses.

This is typically difficult to safely achieve without the assistance of multiple therapists or without the aid of expensive body-weight support equipment that is often only present in gait laboratories and fixed as an apparatus over a treadmill.

The NeuroGym® Bungee Mobility Trainer was designed by a physical therapist to overcome these obstacles and achieve optimal training requirements. Unlike other walking assists that support the client in a harness mechanism from above, this machine provides graduated support from a mobile seat underneath the client, allowing maximum mobility as well as the comfort of sitting to rest when necessary. In the Bungee Mobility Trainer, clients can practice a full range of static and dynamic balance tasks safely and with an ease of movement that closely approximates mobility without an assistive device. As a result, patients can experience dynamic destabilizing motions and safely re-learn protective backward and sideways stepping.

Retraining balance abilities requires intensive practice. Patient motivation is not a problem when the therapist has tools such as the Bungee Mobility Trainer. Any number of dynamic balance skills can be practice in the Bungee Mobility Trainer. Kicking a soccer ball or playing balloon volleyball while secured in the Bungee Mobility Trainer allows enjoyable, intensive practice of dynamic balance skills without the fear of falling.

Whether training basic weight shifting or higher-level mobility skills, intensive balance practice while in the Bungee Mobility Trainer can also be combined with the interactive biofeedback provided by the NeuroGym Trainer. The NeuroGym Trainer is a comprehensive biofeedback system that enables intensive, speed sensitive balance training. Information from pressure sensors placed under the feet is interfaced with computer games in which real-time weight shifting in all directions, on one or both legs or even in dynamic tasks such as jumping, is used to control the game.

The NeuroGym Trainer has the capacity to monitor weight shift (pressure sensors), postural control (position sensors) and muscular activity (emg sensors), either in combination or alone. The therapist can easily design a balance training session to target one or a number of treatment goals by adjusting the parameters that will control an interactive biofeedback game. For patients, then, balance training becomes an enjoyable and rewarding experience as they play a computer game, such as steering a racecar down a track or playing paddleball. They successfully perform weight shifting with pressure sensors underfoot and position sensors on the trunk to encourage the desired posture.

The NeuroGym line of enabling equipment has removed many of the limitations previously faced by physical therapists wanting to provide safe, intensive and enjoyable balance training. Designed by a physical therapist to specifically target the retraining needs of neurological patients, this line of enabling tools allows therapists to optimize therapy sessions. From initial attempts at standing to the practice of complex dynamic mobility and agility, the NeuroGym line of rehabilitation equipment provides therapists the means of translating the scientific evidence of neuroplasticity into effective clinical practice.

From the Sit-to-Stand Trainer to the Ankle Trainer, Bungee Mobility Trainer and the comprehensive NeuroGym Trainer, the NeuroGym tools each provide the means to effectively target and intensively practice balance & gait.

REFERENCES

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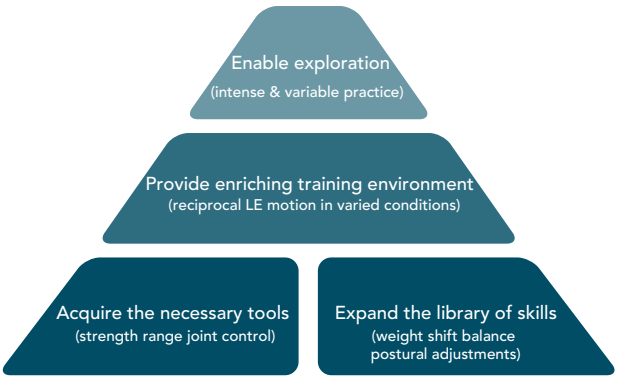
Physical therapy interventions for patients with stoke in inpatient rehabilitation facilities. Phys Ther. 2005; 85(3):238-48.

Woolacott MH & Tang PF. Balance control during walking in the older adult: research and its implications. Phys Ther. 1997; 77(6):646-60.

FIGURE 1: BALANCE & MOBILITY TRAINING



A pyramid of progression in balance and gait training. The initial stages of re-acquiring the necessary building blocks and basic skills needed to progress are followed by enriched practice in an environment that enables exploration of otherwise unavailable movement (e.g. in partial body weight supported conditions like the Bungee Mobility Trainer) in a variety of situations.

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