Mirror Therapy in Stroke Rehabilitation

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Overview

Mirror Therapy is a form of Imagery in which a Mirror is used to convey visual stimuli to the brain through observation of one's unaffected body part as it carries out a set of movements.

It was first described by V.S Ramachandran.(7) The underlying Principle is that movement of the affected limb can be stimulated via visual cues originating from the opposite side of the body.Hence, it is thought this form of Therapy can prove useful in Stroke patients who have lost movements of an arm or leg.

Key Words

Stroke, Mirror Therapy,Visual Feedback

Introducation

Mirror Therapy helps in Stroke Rehabilitation.Stroke Rehabilitation has been revolutionized in the last decade through a combination of new techniques looking at brain recovery. Advances in basic sciences and clinical research are beginning to merge and show that the human brain is capable of significant recovery after Stroke, provided that the appropriate treatments and stimuliare applied in adequate amounts and at the right time.(6)

What is particularly exciting is the introduction of new therapies to further enhance thatrecovery.One of the newest therapy currently under study is Mirror Therapy in Stroke Rehabilitation.

Individuals with Hemiparesis typically demonstrates spasticity, muscle weakness and a persistent deficit in Movement co-ordination.Such in-cordination occurs at least

in part because the neural circuitry responsible for mediating an action intention , and an executed action that precisely reflects that intention, is no longer intact either as a consequence of brain injury or secondary to immediate disuse. [1,5]

Visual Stimuli enhances Neuroplastic changes within the brain.Evidence of cortical reorganization of primary somatosensory cortex by visual feedback.(Mai Hofner et al 2003-04).. When normal somatosensory feedback is missing , visual feedback restores the information flow from the posterior parietal cortex to the Pre-motor cortex (Altschuler et al,1999). Recruting the Premotor Cortex or rebuilding the Motor Programme in the Premotor cortex by Providing Visual feedback could reduce pain and facilitate the limb movement(Rothgangel,2004)..To achieve visual feedback, patients can be treated with Mirror Therapy in which their limbs are separated by a Mirror.By looking in the Mirror at the unaffected side, patients can be 'fooled' in believing that the affected limb is moving effortlessely (Ramachandran and Hirstein,1998). [11]

Mental images of movement can be generated independent of overt behavioral output of a paretic limb. Humans are equipped with a simulation network that positions the motor system in anticipation of movement execution and provides the self with information about the possibility and meaning of upcoming actions.

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[2,4] The processes underlying motor imagery are similar to those active during actual movement. Actions generated using motor imagery adhere to the same rules and constraints that physical movements follow and the neural network involved in motor imagery and motor execution overlap, primarily in the premotor and parietal areas, Basal Ganglia and Cerebellum. [5]

How It's used

Using a Mirror Therapy is easy, by placing the affected limb(hand or foot) in the mirror box and unaffected limb in front of the mirror .Then using both limbs to do the gentle symmetrical exercises. It is very important to practice symmetrical movements only when the using the Mirror.Asymmetrical movements for e.g keeping the hand still and moving the hand outside the box or vice versa , may make the condition worse. Some patients may find using the Mirror difficult at first and more painful.If you find this then consider practising to visualize moving the limb first , think about easy movement initially such as clenching of toes or fingers and then move onto visualizing more complex and this may take several weeks. Improvement comes with repeated exercises.This Mirror box is made up of high quality polystyrene mirror which is foldable , making it truly portable , collapisible and light weight, this helps the patient to do exercises wherever and whenever patient wish.(V.S Ramachandran).

Literature Review

Various Research groups described the use of Mirror Therapy For Stroke Rehabilitation: Yavuzer G., Selles R., Sezer N., Sütbeyaz S., Bussmann J.B., Köseoglu F., Atay, M.B., Stam H.J.(2008):40 patients, mean age 63.2, within 12 months post stroke were recruited and randomized to one of two treatment groups. The mirror group (n=20) participated in non-paretic

side wrist and finger flexion and extension movements (while viewing a mirror image of the non-paretic limb in a mirror placed vertically between hands) in conjunction with standard rehabilitation. The control group (n=20) underwent standard rehabilitation in conjunction with a placebo version of the mirror treatment described above, where the mirror treatment was the same except that the unreflective side of the mirror was used. The treatments were carried out through a period of 4 weeks with a follow-up at 6 months (both real and placebo mirror treatments were 30 minutes per day, and standard therapy was 5 days per week, 2-5 hours per day). Assessments at baseline, 1 month (post-treatment) and 6 months (follow-up) were obtained on hand and upper extremity motor recovery as measured by the Brunnstrom stages, on hand related function as measured by the self-care items of the Functional Independence Measure, and on spasticity as measured by the Modified Ashworth Scale. Immediately following treatment, patients who received mirror therapy in addition to conventional therapy showed significant improvement in scores of the Brunnstrom stages for the hand and upper extremity as well as in the FIM self-care score (all p<.01). The above measures also showed statistical significance in favour of the mirror group for between-group differences measured from post treatment to 6 months follow-up (all p <.05). No significant between-group differences in improvement were found at either measured time for spasticity (p=0.925 - 4 weeks, p=0.875-6 months follow up)[12] Sütbeyaz S., Yavuzer G., Sezer N., Koseoglu B. F. (2007): 40 patients, mean age 63.5, within 12 months post stroke were recruited and randomized to one of two treatment groups. The mirror group (n=20) underwent non-paretic ankle dorsiflexion movement (while viewing a mirror image of the non-paretic limb in a mirror placed on the mid- sagittal plane and imagining it to be the paretic limb that was moving) in conjunction with standard rehabilitation. The control group (n=20) underwent standard rehabilitation in conjunction with a placebo version of the mirror treatment described above, where the mirror treatment was the same except that the unreflective side of the mirror was used. The treatments were carried out through a period of 4 weeks with a follow-up at 6 months (both real and placebo mirror treatments were 30 minutes per day, and standard therapy was 5 days per week, 2-5 hours per day). Assessments at baseline, 1 month (post-treatment) and 6 months (follow-up) were obtained on lower-extremity motor recovery as measured by the Brunnstrom stages, on motor function as measured by the functional Independence Measure, on spasticity as measured by the Modified Ashworth Scale, and on walking ability as measured by the Ambulation Categories. At 1 month, patients showed significant improvements in all categories and continued to improve to follow-up. Statistical analysis for between-group differences was only provided for improvement from baseline to follow-up (6 months). At follow-up the mirror therapy group showed significantly more improvement compared to the control group according to the Brunstrom lower limb stages (p=.002) and the Functional Independence Measure score (p=.001). No significant between-group differences in improvement were found for spasticity (measured by the Modified Ashworth Scale, p = .102) or walking abilities (measured by the Functional Ambulation Categories, p = .620).[9]Garry M.I., Loftus A., Summers J.J. (2004): 8 neurologically healthy individuals performed index-thumb opposition on one hand in each of the 4 following conditions: active (viewing the active hand), inactive (viewing the inactive hand), central (viewing a piece of tape midway between the hands) and mirror (viewing the mirror image of the active hand in a mirror placed in the mid-sagittal plane). A TMS pulse was aimed at the subjects' primary motor cortex in order to induce a muscle contraction of the contralateral hand (inactive hand), in the conditions measured above, and at rest. The occurrence and the intensity of the muscle contraction, and thus of M1 activity, were measured using EMG of the first dorsal interossei muscle. The mirror condition yielded the best results in terms of excitability, and reached statistical significance (p < .05) when compared to all studied conditions other than the active condition (p=0.069) which approached significance. This observation suggests that

watching the mirror image of the active hand superimposed over one's inactive hand increases the likelihood of a contraction to being produced by TMS of the primary motor cortex (M1 area), implying that the activation threshold of the M1 motor neurons is decreased by mirror therapy in healthy subjects[3]Stevens J.A., Stoykov P.M.E. (2003):Two individuals with post-stroke upper limb hemiparesis, 14 months post-stroke (patient #1) and 6 years, 2 months post-stroke (patient #2) received a motor imagery training program: imagining movements of the wrist (extension, pronation, supination) and receiving mental stimulations of reaching as well as manipulating objects using a mirror box apparatus (the patient sits perpendicular to a mirror and watches their non-paretic arm move through space, while using the mirror to imagine that it is their paretic arm that is moving). This one hour training program was done 3 times per week for 4 consecutive weeks. The outcome measures include two standardized clinical assessments (Fugl Meyer Upper Extremity Motor Function Test, arm and hand dimension of the Physical Impairment Inventory of the Chedoke-McMaster Stroke Assessment), grip strength, wrist movement and 3 standardized measures of wrist functionality (Jebsen Test of Hand Function: light object, Jebson: heavy object, Jebson: card turning). Both patients showedan improvement (no p value indicated) in the performance of their paretic limb after the intervention, with patient #1 showing greater improvement. These improvements for both patients remained stable at 3 months follow-up.[10] Sathian K., Greenspan A.I. & Wolf S.L. (2000):A 57 year old male, 6 months post-stroke who reported difficulty moving his right side, and right-sided paraethesias, received a program consisting of weekly physical therapy visits at home (intensity of intervention is unknown). The initial intervention was to use a "motor copy" strategy that involved using a mirror to attempt bimanual upper extremity movements. As a progression to this intervention, the patient closed his eyes and focused on somatosensory cues from the intact limb and residual cues from the affected one. As the patient's motor functionbegan to improve, daily activities using the affected limb (forced use) were implemented.Outcome measures were grip strength, shoulder flexibility and time to complete common daily tasks (e.g.. pick up a pen, fold a towel into quarters etc). Following this progressive regimen, the patient improved in all these areas and was better able to use his affected hand in daily activities, such as dressing and inserting a key in a lock with greater precision and ease of movement. [8]

Discussion

The purpose of this article is to synthesize the relevant literature about Mirror Therapy in order to facilitate its integration into Physical Therapist Practice.

The literature suggests that the encouraging effects of Mirror Therapy improves the functional outcomes after Stroke by Facilitating Plastic re-organization of the cortex in the brain in response to Visual feedback.

Thus, Mirror may provide a valuable tool to access the Motor network and improve outcome after Stroke.

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