J Integral Sci, 2019, Volume 2, Issue 2, 19-23. ISSN: 2581-5679

www.jisciences.com

Review Article

Journal of Integral Sciences

A Review on the Effects of Mirror Therapy in Stroke Patients with Partial Paralysis

Chiluba BC[1,*], Kalumbi J[2], Lloyd T[2], Mphanza M[2], Nyambe JM[2]

[1] Epidemiology and Biostatistics Unit, School of Health Sciences, The University of Zambia, Lusaka, Zambia.

[2] Department of Physiotherapy, School of Health Sciences, The University of Zambia, Lusaka, Zambia.

* Corresponding Author: brian.chiluba@unza.zm. Mobile: +260 977896377.

Received: 8th May 2019; Revised: 13th May 2019; Accepted: 15th May 2019

Abstract

Paralysis of the arm or leg is common after stroke and frequently causes problems with activities of daily living such as walking, dressing, or eating. Mirror therapy is a rehabilitation therapy in which a mirror is placed between the arms or legs so that the image of a moving non-affected limb gives the illusion of normal movement in the affected limb. By this setup, different brain regions for movement, sensation, and pain are stimulated. However, the precise working mechanisms of mirror therapy are still unclear. Research for literature in various databases is still on-going but some progress has shown that this therapy at least aids the patients. This study reviews the evidence of the Effects of Mirror therapy in Stroke Patients with Partial paralysis. This review article was conducted basing on the previous studies published in English from the years 2009-2016, retrieved from the electronic data: PubMed and Google scholar crossing the keys words "mirror therapy" and "stroke" found in studies which were read and analysed. Only articles that focused on the Effects of Mirror therapy on stroke patients with partial paralysis were included. Mirror Therapy may be beneficial in improving some of the motor functions of the hemiplegic stroke patients. However, there is limited evidence for its optimal use and specific treatment regimens at different stages of stroke.

Key words: Mirror Therapy, Stroke, Mirror Neurons

1. Introduction

Stroke, the number one cause of neurological disability worldwide, is characterised by both cognitive and motor impairments, as well as balance impairment, which may lead to functional dependence and reduced quality of life (WHO, 2015). In particular, because of abnormal muscle tone, coordination disorder, and associated reactions, hemiplegic patients experience a considerable decrease of motor function in affected limbs (WHO, 2015). The impaired lower extremity motor function commonly leads to functional limitations and disability (WHO, 2014). Damage to balance ability after a stroke decreases stability in the standing position, causing difficulty in walking and performing functional activities. Hence, balance ability is the basis for independent movement and functional performance (Ramachandran *et al.,* 1995). Treatments to improve function of stroke patients include constraint-induced therapy mental imagery training and robotic-assisted rehabilitation (Altschuler *et al.,* 1999; Yavuzer *et al.,* 2008; Rossiter *et al.,* 2015). However, most intervention protocols are labour intensive, making the provision of intensive treatment for all patients difficult. Mirror therapy, with its low cost and simplicity, may be a suitable alternative (Ramachandran and Altschuler 2009; Deconinck *et al.,* 2015). Ramachandran and Rogers introduced the use of visual illusions created by a mirror as a treatment for phantom pain (Freysteinson, 2009).A mirror is placed in the patient's midsagittal plane, with the unaffected limb in front of it, so that the affected limb is blocked and the patient can only see the reflection of the intact limb (Rothgangel *et al.,* 2011). Movement of the intact limb gives the patient the illusion in which inputs are perceived through the affected limb behind the mirror. Studies on the effects of mirror therapy in stroke patients, including a 2012 Cochrane analysis, identified methodologically appropriate randomised controlled trials (Buccino *et al.,* 2001; Fadiga and Craighero, 2004). In addition, Altschuler *et al.*,

(1999) implemented mirror therapy with stroke patients and proved the beneficial effects of mirror therapy on the range of motion of upper extremity joints, motion velocity, and accuracy. Sathian *et al.*, found that, after 2 weeks of mirror therapy, achronic stroke patient recovered hand function and grip strength in the paretic limb (Luft *et al.*, 2005).

In previous research, mirror therapy focused mainly on the upper limb functions. However, since damage to lower limb function after stroke affects the independent daily functions, more studies are required to explore the issue of mirror therapy and the effects it has on stroke patients. This study was conducted to examine the effect of mirror therapy on stroke Patient with partial paralysis.

2. Methodology

This review article was conducted basing on the previous studies published in English from the years 2009-2016, retrieved from the electronic data: PubMed and Google scholar crossing the keys words “mirror therapy” and “stroke” found in studies which were read and analysed. Only articles that focused on the Effects of Mirror therapy on stroke patients with partial paralysis were included.

3. Interventions

Evidence suggests that effective therapeutic interventions for regaining motor function should potentially focus on the practice of functional tasks (Lee *et al.*,, 2012). However, task-oriented training strategies, such as constraint-induced movement therapy, require some degree of voluntary movement, and are therefore not applicable for people with severe paresis after stroke (Lipert *et al.*, 2001). Novel training strategies for this patient population use electromechanical training devices, electrical muscle stimulation or repetitive passive or assistive movement stimulation (Taub, 1980).

As an alternative treatment approach, mirror therapy has been proposed as potentially beneficial. In contrast to other interventions, which employ somatosensory input to assist motor recovery, mirror therapy is based on visual stimulation. During mirror therapy, a mirror is placed in the person's midsagittal plane, thus reflecting the non-paretic side as if it were the affected side (Thieme *et al.*, 2018). By this setup, movements of the non-paretic limb create the illusion of normal movements of the paretic limb. One of the advantages of mirror therapy is the relatively easy administration and the possibility of self-administered home therapy, even for people with severe motor deficits. Clinical studies reported effects of mirror therapy on pain reduction in arm amputees or CRPS-type I (Toh and Fony, 2012). Furthermore, mirror therapy was claimed to alleviate hemiparesis after stroke, which was confirmed in a pilot study (Ezendam *et al.*, 2009).

Recently, some authors have described 'mirror-like' video or computer-graphic setups, where a video or computer-graphic image of the moving limb is presented as if it were the opposite one.

4. Results

Nine articles were identified from three databases: Pub Med (n=3), Cochrane (n=2) and Google scholar (n=4). Of these nine articles, only 7 publications were selected, mainly due to overlap. A further two articles were excluded because the full-text version was not available and one of them was a thesis (Figure 1).

4.1 Effects of Mirror Therapy on Motor Performance

Improvement was shown in motor performance of the subjects after Mirror Therapy. The outcome measures used across the five studies varied among the seven articles. Two studies showed improvement in motor recovery according to the Brunnstrom stages recovery model. One study used the Fugl-Meyer Assessment to measure the effectiveness of MT (Taub, 1980; Abo Salem and Huang, 2015). The Functional Independence Measure (FIM) was used in one study (Su¨tbeyaz *et al.*, 2007). Used a motion analysis device to show improvement in single stance, step length and stride length after MT. One study showed improvement in ankle passive range of motion, which was measured by goniometry and gait speed using a 10-metre walk as the outcome measure (Sub”tbeyaz *et al.*, 2007). There was one study that showed no improvement and another that demonstrated improvement in Functional Ambulation Categories. Two studies (Abo

Salem and Huang, 2015) found no effect on spasticity. One study showed no effect on foot function and ankle active range of motion (Abo Salem and Huang, 2015; Wada *et al.*, 2011).

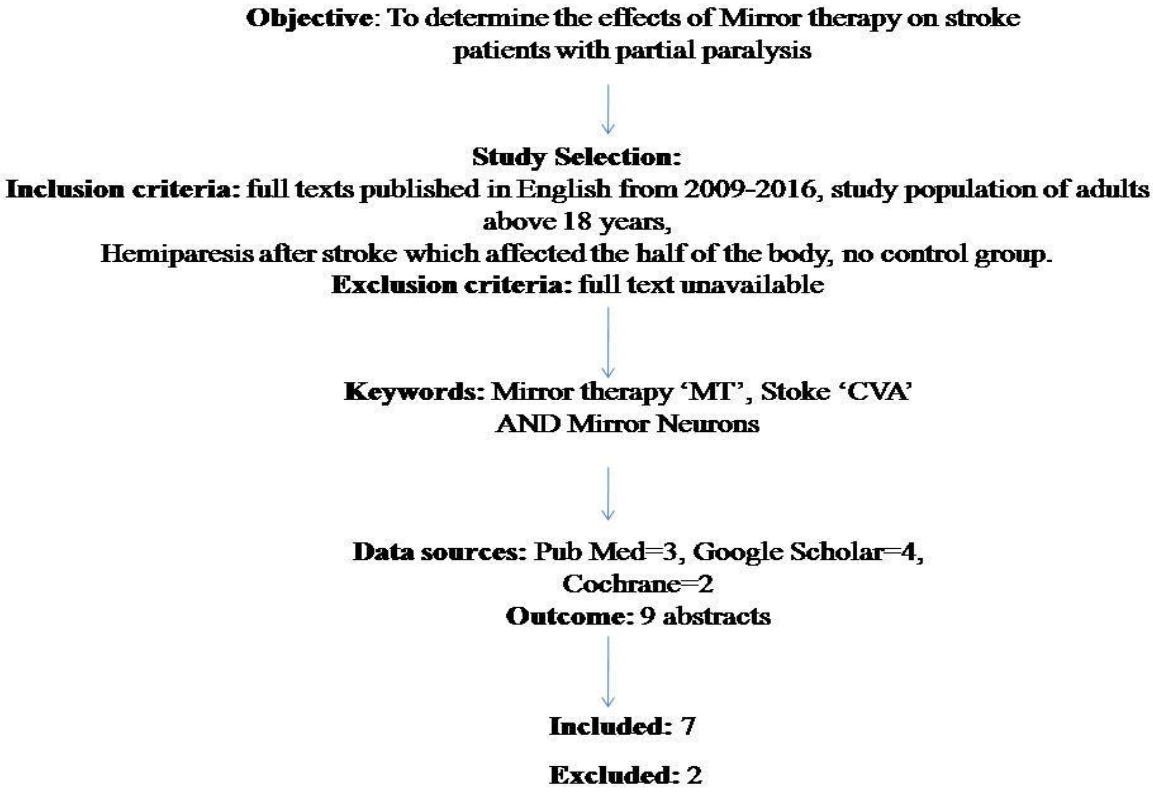

Fig. 1. Flowchart of the literature search and selection process.

5. Discussion

5.1 Effects of Mirror therapy in Stroke patients

The main purpose of this review was to evaluate the effects of mirror therapy in stroke with partial paralysis. We found moderate-quality evidence that mirror therapy improves motor function and motor impairment. Furthermore, with low-quality evidence we found reduced pain after stroke and improved motor impairment six months after the end of the intervention in one of the articles used during this study. Results for motor function after six months were not statistically significant and were of low-quality evidence. Acceptability of the intervention was high, without significantly more dropouts from the intervention groups compared with control groups, and with no reported adverse events during or after mirror therapy.

Among the studies we chose for this study, some evaluated the effect of mirror therapy on motor function of the upper extremity, and other studies evaluated the effect of mirror therapy on the lower extremity. Mirror therapy was effective in improving both upper and lower limb motor function.

Based on a subgroup analysis, significant effects on motor function in those studies that compared mirror therapy with a sham intervention using a covered mirror (thus avoiding any view of the affected limb), but not in studies that used unrestricted view (no mirror or a transparent Plexiglas) or no additional intervention in the control groups. However, there were no statistically significant differences between subgroups with different control interventions.

In a further subgroup analysis, we compared studies that included participants in the acute/sub acute phase after stroke (within six months after stroke) and participants in the chronic phase (more than six months after stroke). Mirror therapy was effective for both subgroups of participants.

MT can be effective in improving various functions, but it needs to be further investigated. Motor recovery ,ADL function , gait pattern , and gait speed and ankle passive range of motion are

among the functions that have been shown to improve as a result of the use of MT with the LE (Mohan *et al.,* 2013). It can be observed that MT, as a short-term visual feedback mechanism, aids cortical reorganization of the brain after injury to promote lower-limb function. Muscle tone, balance function, foot function and ankle active range of motion functions were not shown to improve with the application of MT. A systematic review by indicated that MT in the upper extremity has no effect on spasticity. This could serve as a reference for future studies (Ji *et al.*, 2015).

Two studies yielded conflicting results on walking ability as measured with the Functional Ambulation Categories. The studies focused on different stroke stage, which may have affected the results. In addition, both studies used different criteria for the Brunnstrom stage of their participants. Including those with stages 1e3 or stage 2 and above may have affected the effectiveness of MT in terms of ambulatory capability. Participants with lower functional ability but with better mobility recovery in the acute stage experienced more positive effects on walking ability after MT training (Hamdy *et al.*, 1998).

5.2 Possible Side Effects

None of the studies showed that the treatment had any side effects. However, one study that was excluded from this review mentioned that MT may aggravate lower back pain if the client had it before stroke. More studies are needed to investigate the risks of MT and to identify adequate precautions (Crosby, 2015).

6. Limitations

The review study had a limitation on the number of study articles used for this paper. Little evidence for applying MT was found for each stage. Due to the limited number of studies and differences in treatment regimens, the optimal duration of Mirror Therapy cannot be determined. Moreover, no conclusions about the carry-on effects of Mirror Therapy can be drawn due to inadequate follow-up in the studies included in this review.

7. Conclusion

This review shows that Mirror Therapy may be beneficial in improving some of the motor functions of the hemiplegic stroke patients. However, there is limited evidence for its optimal use and specific treatment regimens at different stages of stroke. Therefore, no firm conclusions can be made about the effectiveness of Mirror therapy until more evidence is available.

Conflict of interest

All contributing authors declare that they have no conflicts of interest.

Acknowledgements

The authors express their appreciation to the coordinator of this write up and guidance help in locating reference materials.

References

Abo Salem HM, Huang X. 2015. The effects of mirror therapy on clinical improvement in hemiplegic lower extremity rehabilitation in subjects with chronic stroke. *International Scholarly and Scientific Research & Innovation*, 9(2), 163-166.

Altschuler EL, Wisdom SB, Stone L, Foster C *et al.*, 1999. Rehabilitation of hemiparesis after stroke with a mirror. *The Lancet,* 353(9169), 2035-2036.

Buccino G, Binkofski F, Fink GR, *et al.,* 2001. Action observation activates premotor and parietal areas in a somatotopic manner: an fMRI study. *Eur J Neurosci*, 13, 400-404.

Crosby LD. 2015. Mirror therapy for the lower extremities post-stroke.

Deconinck FJA, Smorenburg ARP, Benham A *et al.*, 2015. Reflections on mirror therapy: a systematic review of the effect of mirror visual feedback on the brain. *Neurorehab Neural Re*, 29(4), 349e361.

Ezendam D, Bongers RM, Jannink MJ. 2009. Systematic review of the effectiveness of mirror therapy in upper extremity function. *Disabil Rehabil*, 31, 2135-2149.

Fadiga L and Craighero L. 2004. Electrophysiology of action representation. *Clinl Neurophysiol,* 21(3), 157-169.

Freysteinson WM. 2009. Therapeutic mirror interventions: an integrated review of the literature. *J Holist Nurs*, 27(4), 241-252.

Hamdy S, Rothwell JC, Aziz Q, Singh KD, Thompson DG. 1998. Long-term reorganization of human motor cortex driven by short-term sensory stimulation. *Nat Neurosci*, 1, 64-68.

Ji SG, Kim MK. 2015. The effects of mirror therapy on the gait of subacute stroke patients: a randomized controlled trial. *Clin Rehabil*, 29(4), 348-354.

Lee MM, Cho HY, Song CH. 2012. The mirror therapy program enhances upper-limb motor recovery and motor function in acute stroke patients. *Am J Phys Med Rehabil*, 91, 689-700.

Lipert J, Dettmers C, Terborg C, Weiller C. 2001. Inhibition of ipsilateral motor cortex during phasic generation of low force. *Clin Neurophysiol*, 112, 114-121.

Luft AR, Forrester L, Macko RF *et al.*, 2005. Brain activation of lower extremity movement in chronically impaired stroke survivors. *Neuroimage*, 26(1), 184-194.

Mohan U, Babu SK, Kumar KV *et al.*, 2013. Effectiveness of mirror therapy on lower extremity motor recovery, balance and mobility in patients with acute stroke: a randomized sham-controlled pilot trial. *Ann Indian Acad Neurol*, 16(4), 634-639.

Ramachandran VS, Altschuler E. 2009. The use of visual feedback, in particular mirror visual feedback, in restoring brain function. *Brain*, 132, 1693-1710.

Ramachandran VS, Rogers-Ramachandran D, Cobb S. 1995. Touching the phantom limb. *Nature*, 377(6549), 489-490.

Rossiter HE, Borreli MR, Borchert RJ, Bradbury D, Ward NS. 2015. Cortical mechanisms of mirror therapy after stroke. *Neurorehab Neural Re*, 29(5), 444-452.

Rothgangel AS, Braun SM, Beurskens AJ, Seitz RJ, Wade DT. 2011. The clinical aspects of mirror therapy in rehabilitation: a systematic review of the literature. *Int J Rehabil Res*, 34(1), 1e13.

Su¨tbeyaz S, Yavuzer G, Sezer N, Koseoglu BF. 2007. Mirror therapy enhances lower-extremity motor recovery and motor functioning after stroke: a randomized controlled trial. *Arch Phy Med Rehabil*, 88, 555-559.

Taub E. 1980. Somatosensory deafferentation research with monkey: implications for rehabilitation medicine. In: Williams, Wilkins, editors. Behavioural psychology in rehabilitation medicine: clinical applications. Baltimore: L.P. Ince, 371-401.

Thieme H, Mehrholz J, Pohl M, Behrens J, Dohle C. 2018. Mirror therapy for improving motor function after stroke. *Cochrane Database Syst Rev*, 11(7), CD008449.

Toh SFM and Fong KNK. 2012. Systematic review on the effectiveness of mirror therapy in training upper limb hemiparesis after stroke. *Hong Kong J Occup Th*, 22, 84-95.

Wada Y, Kondo I, Sonoda S *et al.*, 2011. Mirror therapy for severely affected ankle joints of stroke patients. *JJCRS*, 2, 71-76.

World Health Organisation. 2012. World health statistics 2012. Retrieved November 2015 from http://www.who.int/gho/publications/world_health_statistics/2012/en/.

World Health Organization. 2014. Global status report on non communicable diseases 2014. Retrieved November 2015 fromhttp://www.who.int/nmh/publications/ncd-status-report-2014/en/.

Yavuzer G, Selles R, Sezer N *et al.*, 2008. Mirror therapy improves hand} function in subacute stroke: a randomized controlled trial. *Arch Phy Med Rehabil*, 89(3), 393-398.