Title: Mirror Therapy shows limited support for use with adults less than 12 months post CVA

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CLINICAL SCENARIO:

Client population: Adult patients in the acute or subacute stages of CVA between 0-12 months post-onset of CVA participated in these studies. Patients were required to be in stages I to IV of Brunnstrom or have severe hemiparesis. Patient ages ranged from 25 to 80 years. All patients were required to understand and follow simple verbal instructions in order to participate.

Treatment context: Treatment occurred in both inpatient and outpatient settings.

Problem or condition: The studies addressed decreased motor control and ADL performance of the hemiparetic UE following a CVA. Motor control included the ability to initiate and carry out movement and was assessed based on the quality of movements. Functional ability was the level of independence in performing self-care tasks.

Why this is an appropriate occupational therapy intervention: All of the articles reviewed used mirror therapy as a preparatory exercise to address motor/praxis skills performance skills and neuromusculoskeletal and movement related client factors (AOTA, 2008). Although not used in these studies, purposeful activities can also be performed while implementing mirror therapy. Mirror therapy is thought to improve the motor and functional ability of the affected upper extremity, which could potentially improve participation in desired occupations.

Intervention: During mirror therapy, the patient is seated and a mirror is placed vertically in the patient's mid-sagittal plane. The patient's affected upper extremity is placed behind the mirror, occluded from vision. The patient's unaffected upper extremity is placed in front of the mirror and covered. When looking into the mirror the patient sees the reflection of the unaffected limb as a visual illusion of the affected upper extremity. The movement of the unaffected limb is perceived as movement of the affected limb during bilateral exercises. According to the articles reviewed, mirror therapy sessions last between 25 minutes and 30 minutes per day for four to six weeks.

Science: One explanation for the effects of mirror therapy is the mirror neuron system. The mirror neuron theory indicates that motor imagery can cause cortical reorganization in the affected hemisphere and improve function of the affected limb (Michielsen et al., 2010). The mirror neuron system involves motor imagery which causes neural changes in the brain's motor areas in both the affected and unaffected hemispheres. Mirror neurons give the ability to learn a new skill through observation as these neurons "are active during action observation, mental stimulation (imagery), and action execution" (Yavuzer et al., 2008). Another explanation involves the impact of bilateral training on the neural pathways promoting inter-hemispheric activity. This neural activity occurs with bilateral exercises and promotes the recovery of the injured hemisphere through practice and repetition of cross-cortical communication (Luft, A.R. et al., 2004).

FOCUSED CLINICAL QUESTION:
Patient/Client group: Adult patients 0-12 months post CVA presenting with hemiparesis
Intervention: Mirror Therapy
Comparison Intervention: Conventional therapy
Outcomes: Improved motor control and ADL performance

SUMMARY:
PICO Question: Is Mirror Therapy effective for improving motor control and ADL performance of the UE when compared to conventional therapy for adult patients 0-12 months post CVA presenting with hemiparesis?

Search: We searched six databases and retrieved eight relevant articles. Three were systematic reviews, one was an individualized randomized control trial, and four were low quality randomized control trials. We chose three of the low quality randomized control trials because they focused on acute and subacute stages of stroke.

Summary of findings There is limited evidence supporting the use of mirror therapy to improve motor function and preliminary support for the use of mirror therapy to increase ADL performance in individuals less than 12 months post CVA.

CLINICAL BOTTOM LINE:
There is limited evidence supporting the use of mirror therapy to improve motor function in individuals less than 12 months post CVA. There is preliminary support for the use of mirror therapy to increase ADL performance with only one article showing statistical and clinical significance.

LIMITATIONS OF THIS CAT:
This critically appraised topic has been reviewed by occupational therapy graduate students and the course instructor.

SEARCH STRATEGY:

Table 1: Search Strategy

Databases Searched	Search Terms	Limits used	Inclusion and Exclusion Criteria
Ovid EbscoHost Cochrane EbscoHost Cinahl EBSCOhost: Health Professions Database OTSearch PsycBITE	Mirror Therapy Systematic Review Mirror Therapy Mirror Neuron Mirror	+CVA +hemiparesis +systematic review	After 2012, English only

RESULTS OF SEARCH:

Table 2: Summary of Study Designs of Articles Retrieved

Level	Study Design/ Methodology of Articles Retrieved	Total Number Located	Data Base Source	Citation (Name, Year)
Level 1a	Systematic Reviews or Metanalysis of Randomized Control Trials	3	Ebscohost: Cochrane EbscoHost Cinahl Plus Ovid	Thieme, H. Mehrholz, J., Pohl, M., Behrens, J. & Dohle, C. (2012) Ezendam, D., Bongers, R. M. and Jannink, M. J. (2009) Rothgangel, A. S., Brauna, S. M., Beurskensa, A. J., Seitzg, R. J., and Wadee, D. T. (2011)
Level 1b	Individualized Randomized Control Trials	1	EbscoHost Cinahl Plus	Michielsen, M. E., Selles, R. W., Jos N., G., Eckhardt, M., Yavuzer, G., Stam, H. J., & Bussmann, J. J. (2011).
Level 2a	Systematic reviews of cohort studies			

Level 2b	Individualized cohort studies and low quality RCT's (PEDRO < 6)	4	Ebscohost: Cochrane Ebscohost: Cochrane Ebscohost: Cochrane EbscoHost: Cochrane	Lee, M. M, Cho, H., & Song, C. H. (2012) Matsuo, A., Tezuka, Y., Morioka, S., Hiyamizu, M., & Seki, K. (2008) Yavuzer, G., Selles, R., Sezer, N., Sutbeyaz, S., Bussman, J., Koseoglu, F., & Stam, H. (2008) Dohle, C., Püllen, J., Nakaten, A., Küst, J., Rietz, C., & Karbe, H. (2009).
Level 3a	Systematic review of case-control studies			
Level 3b	Case-control studies and non-randomized controlled trials			
Level 4	Case-series and poor quality cohort and case-control studies			
Level 5	Expert Opinion			

STUDIES INCLUDED:

Table 3: Summary of Included Studies

	Study 1 Lee, M. M, Cho, H., & Song, C. H. (2012)	Study 2 Dohle, C., Püllen, J., Nakaten, A., Küst, J., Rietz, C., & Karbe, H. (2009)	Study 3 Yavuzer, G., Selles, R., Sezer, N., Sutbeyaz, S., Bussman, J., Koseoglu, F., & Stam, H. (2008)
Design and PEDRO rating	RCT, 2b- 4/8	RCT, 2b- 3/8	RCT, 2b- 5/8
Population	26 patients that had an acute CVA within 6 months of study and were in the Brunnstrom	36 patients with serve hemi-plegia due to first ever ischemic stroke confined to the middle	40 patients who had their first unilateral CVA within the last year with no severe

	stages I-IV participated. The mean age of participants was 55.6 and the mean time since the CVA was 3.5 months.	cerebral artery that were less than 8 weeks post CVA participated. Participants ranged in age from 25 to 80 years.	cognitive deficits, and in the Brunnstrom stages I-IV participated. The mean age of participants was 62.7, and the mean time since the CVA was 5.5 months.
Intervention Investigated	Mirror therapy +standard rehabilitation	Mirror therapy +standard therapy	Mirror therapy +conventional therapy
Comparison Intervention	A standard rehabilitation program	Standard therapy +sham mirror therapy	Conventional therapy +sham mirror therapy
Dependent Variables	1. Upper limb motor recovery 2. Coordination	1. Upper limb motor function 2. Upper limb functional ability	1. Motor Recovery 2. Spasticity 3. Hand-related motor functioning
Outcome Measures	1. Fugl-Meyer Assessment 2. Brunnstrom stages 3. Manual Function Test	1. Fugal-Meyer Assessment 2. FIM 3. ARAT	1. Brunnstrom Stages 2. Modified Ashworth Scale 3. FIM
Results	Upper limb motor recovery was improved in all individuals, but there was significantly significant improvement in the experimental group. There were no statistically significant differences in coordination.	There was a statistically significant improvement in distal motor control in the mirror therapy subgroup of initially plegic patients. There was also a statistically significant improvement in neglect scores in the mirror therapy group. There were no statistically significant differences reported in ADL performance.	There were statistically significant differences between the control group and the intervention group for motor recovery and UE functioning for both 4-weeks post-treatment and the 6-month follow up. There was no significant difference in spasticity between the two groups.
Effect Size	Effects sizes for the Fugl-Meyer assessment ranged from 0.58-0.782 in the upper limb and were 0 for coordination. Effect sizes for the Brunnstrom motor stages ranged from 0.58-0.77 and Manual Function test effect sizes ranged from 0.63-0.77.	Effect size for the Fugl-Meyer in initially plegic subgroup was 0.78. Effect size for the ARAT for entire mirror therapy group was 0.078. For the initially plegic subgroup, the effect size was 0.64. Effect sizes for the FIM ranged from 0.52 to 0.63 Effect size for improvement of hemi-neglect was 0.99.	Effect size for the Brunnstrom stages ranged from 0.69-1.0 and the effect sizes for the FIM ranged from 0.82-1.2. Effect sizes for the Modified Ashworth Scale were -0.55 and -0.75.
Conclusion	The study supports that mirror therapy is beneficial in upper limb motor recovery and functioning in patients with acute CVA. Standard treatment was effective, but not as effective as the mirror therapy.	This study concludes that mirror therapy is effective in acute stroke, especially in improving motor recovery of distal muscle groups.	Mirror therapy when compared to just conventional therapy alone was more effective in improving motor recovery and hand-related functioning.

IMPLICATIONS FOR PRACTICE, EDUCATION and FUTURE RESEARCH:

PICO Question:

Is Mirror Therapy effective for improving motor control and ADL performance of the UE when compared to conventional therapy for adult patients 0-12 months post CVA presenting with hemiparesis?

Overall Conclusions:

All three studies reviewed were randomized controlled trials. The three studies examined motor control and performance of ADLs. The client factor, motor control, was the performance of movement based on initiation, quality, and completion of the movement. ADL performance was the level of independence in performing self-care tasks.

All studies found statistically significant increases in distal motor control with moderate to strong effect sizes after mirror therapy. Lee et al. (2012) and Yavuzer et al. (2008) found statistically significant improvement in the proximal, as well as the distal, upper extremity with moderate to strong effect sizes. These findings may be due to differences in treatment protocol, mirror therapy treatment time, and the amount and type of conventional therapy. Yavuzer et al. (2008) also demonstrated statistically significant improvement in motor control at a six month follow-up. The mean outcome measure scores showed sustained gains for the mirror therapy group at follow-up with sustained strong effect sizes between post-treatment and follow-up.

Yavuzer et al. (2008) and Dohle et al. (2009) evaluated ADL performance of the upper extremity and both studies found moderate to strong effect sizes. Yavuzer et al. (2008) reported statistically significant improvements in ADL performance for participants receiving mirror therapy compared to a control group at post treatment and at six month follow-up with strong effect sizes. Despite effect sizes, Dohle et al. (2008) reported no statistically significant improvement in ADL performances. The differences between the two studies may be due to variances in treatment protocols and treatment time. Lack of statistical significance in the Dohle (2008) study may be due to decreased sensitivity of the FIM assessment.

Mirror therapy and control groups both received conventional treatment. Conventional treatment in the three studies varied in the types of treatment and amount of hours provided. Lee et al. (2012) provided therapeutic exercise and neurodevelopmental treatment, occupational therapy, and electrical stimulation for a total of 35 hours during the study. Dohle et al. (2008) provided an average total of 44 hours of physical therapy, occupational therapy, and ADL training during the study. Yavuzer et al. (2008) provided neurodevelopmental treatment, physical therapy, occupational therapy, and speech therapy if needed for a total of 80-100 hours during the study.

In addition to the conventional treatment, mirror therapy was also provided to the intervention groups. Lee et al. (2012) provided the intervention group with 8.3 hours of mirror therapy, with the control group receiving no therapy other than the conventional therapy. Dohle et al. (2008) provided the intervention group with 15 hours of mirror therapy, and the control group with 15 hours of sham therapy with no mirror present. Both groups performed the same ten proximal to distal upper extremity movements. Yavuzer et al. (2008) the mirror therapy group received 10 hours of the intervention, and the control group received 10 hours of sham therapy which meant the non-reflecting mirror was on the non-affected limb. Both groups performed the same movements of wrist and finger flexion, and extension movements of both the affected and non-affected side.

In conclusion, there is limited evidence supporting the use of mirror therapy to improve motor function in individuals less than 12 months post CVA. All studies showed statistical significance and clinical meaningfulness me for improvement in distal motor control. Two studies showed statistical significance and clinical meaningfulness for improvement in proximal motor control. There is preliminary support for

the use of mirror therapy to increase ADL performance with only one article showing statistical significance and clinical meaningfulness. It is unclear whether the mirror therapy or differences in treatment protocol, mirror therapy treatment time, or the amount and type of conventional therapy accounted for these changes. Due to the lack of rigour in the three randomized control trials included in this CAT (PEDro score of 5 or lower), there is limited evidence for the use of mirror therapy to improve motor control and ADL performance.

Boundaries:

There were 98 participants ranging from 25 to 80 years of age in all three research studies. All patients were in the acute or subacute stage of CVA with the amount of time post CVA ranging from zero to 12 average time post CVA months. The mean time from onset of CVA ranged from 26.2 days to 5.5 months. All studies required participants to understand and follow simple verbal instructions. Yavuzer et al. (2008) only included participants with their first unilateral CVA. Dohle et al. (2009) only included participants who had severe hemiparesis due to first ischemic CVA confined to the middle cerebral artery.

Implications for Practice:

These studies demonstrated statistical significance and clinically meaningful effects in proximal and distal motor control. There was inconclusive evidence for improvements in ADL performance. Administration between the studies varied from 8.3 to 15 hours of mirror therapy treatment, and 35 to 100 hours of conventional therapy. Despite statistical significance and clinical meaningfulness, there is limited support for using mirror therapy to improve motor control and increase ADL performance. This may be due to the rigour of the studies, differences in treatment protocols, and conventional treatment.

Further research is needed to determine optimal treatment protocols for improvement in ADL performance and motor control. Although not conducted in these studies, purposeful activities may be used during mirror therapy. Exploration is needed to determine the effectiveness of functional activities in mirror therapy protocols.

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