Mirror therapy as an intervention for children with spastic hemiparetic type of cerebral palsy: a systematic review

Sarah Dickey, SPT; Laura Henderson, SPT; Jennifer Hilmer, SPT; Emily Kemp, SPT; Elizabeth Schuppert, SPT
Faculty advisor: Laura Case, PT, DPT, MS, PCS, C/NDT

Duke University Doctor of Physical Therapy, School of Medicine, Division of Family and Community Medicine, Durham, NC 27708

Background
- Current uses of mirror therapy (MT):
  - Pain in phantom pain and complex regional pain syndromes
  - Function in upper extremity (UE) in adults post-stroke
- Theory: MT reduces additive cyclical negative effects that may result from visualizing an aberrant movement pattern

Purpose
- To analyze the following aspects of quality of movement (QOM) of the UE in children with hemiparesis when utilizing MT:
  - Matching accuracy/joint position sense
  - Electromyography (EMG) activity of UE musculature
  - Neuromuscular (NM) activation
  - Grasp strength
  - Movement velocity
- To compare effects of various visual conditions to MT, including screen condition (SC), glass condition (GC), or sham treatment (no altered visualization)

Literature Search

Records identified through database searching (n = 329)
Records after duplicates removed (n = 268)
Records screened (n = 268)
Records excluded (n = 123)
Inclusion criteria:
1. RCT or quasi-experimental
2. Participants ≥ 21 years of age
3. Presentation of hemiparesis
4. Intervention included mirror therapy with visual feedback from a mirror
5. Performed on humans
6. Written in English

Full-text articles assessed for eligibility (n = 10)

Full-text articles excluded, with reasons (n = 3)

Studies included in qualitative analysis (n = 7)

Matching Accuracy
- Improved accuracy occurred with visual feedback of less impaired (LI) limb with both mirror therapy (MT) & screen condition (SC), with no significant difference between MT & SC but with significantly increased accuracy over shorter distances (Smorenburg et al., 2012)
- Improved accuracy occurred in 15/23 participants with MT but there was no statistical difference between MT and SC (Smorenburg et al., 2011a)
- Increased accuracy with visual feedback of LI limb plus knowledge of results in both MT & SC with no difference between MT and SC (Smorenburg et al., 2013)
- Improvements in accuracy were not retained after 1-week period (Smorenburg et al., 2013)

EMG Activity
- Shorter periods of eccentric activity in biceps brachii brevis and concentric activity in triceps brachii longus of more impaired (MI) limb when visualizing the LI limb during MT and SC compared to glass condition (GC) (Fetham et al., 2010b; Smorenburg et al., 2011b)

Neuromuscular (NM) Activation
- Decreased NM intensity in deltoid of LI limb with MT (Fetham et al., 2010b)
- Greater NM efficiency of LI limb with MT (Fetham et al., 2010b; Smorenburg et al., 2011b)

Grasp Strength
- Increased grasp strength with MT compared to sham treatment (Gygas et al., 2011)

Movement Velocity
- Visual condition did not affect velocity (Fetham et al., 2010a)

Other Effects
- Improved UE function on all subscales of Shriners Hospital for Children Upper Extremity Evaluation with MT compared to sham treatment with statistically significant improvements on dynamic positional sense subscale during MT (Gygas et al., 2011)
- Improved bimanual coupling during MT compared to GC and SC (Fetham et al., 2010a)
- No difference in bimanual coupling during MT compared to GC and SC (Smorenburg et al., 2011b)

Visual Conditions

Circular task (left) and matching task (right) with mirror condition, visualizing the less impaired limb and its mirrored reflection

Circular task (left) and matching task (right) with screen condition, visualizing the less impaired limb only

*Not pictured: glass condition, visualizing both limbs

Matching Task

Maximum Reaching Distance

Conclusions

Emerging evidence on the efficacy of mirror therapy shows improved quality of movement in the pediatric population after 1 session, though all improvements were not significantly different from other conditions tested. MT is an additional intervention that may be beneficial to add to the treatment of children with spastic hemiparesis.

Clinical Relevance

Mirror therapy is an inexpensive treatment option provided by physical therapists that demonstrates no negative effects and shows potential in improving QOM in some children with spastic hemiparesis.

Future Research

Further research is needed to identify the effects of multiple treatment sessions, to compare MT with other interventions, and to identify an optimal and applicable patient population.

References available upon request