FOCUSED QUESTION
Does the addition of mirror therapy to a traditional hand rehabilitation program, when compared to a traditional rehabilitation program alone, increase active range of motion (AROM) and decrease disability in those with AROM impairments secondary to orthopedic hand injuries?


CLINICAL BOTTOM LINE:
This study demonstrates that mirror therapy, when used as an adjunct to traditional hand rehabilitation, increases active range of motion and decreases dysfunction in individuals with orthopedic hand injuries. Although active range of motion (AROM) and function were improved in both treatment groups during the duration of the study, reinforcing the benefits of a customized hand rehabilitation program after orthopedic hand injury, the addition of mirror therapy contributed to greater improvement. The authors describe a specific mirror therapy treatment program that can be used by occupational therapists in the clinic. Despite significant results, the ability to generalize the findings is limited secondary to small sample study size and participant attrition.

Because mirror therapy is a neural-based technique, the results of this study support the role of neural influences in limitations post orthopedic hand injuries and the need for occupational therapists to consider the effects of immobilization and disuse on body mapping and motor control post orthopedic injury. However, the absence of brain imaging tools in this study limits conclusions regarding the specific mechanism of mirror therapy in remediating deficits after orthopedic hand injury. To develop optimal time frames, dosage, and technique of this treatment intervention, more research is indicated on sensorimotor cortical changes and neural inhibition after orthopedic injuries as well as the specific patterns of neural activation achieved during mirror therapy intervention.

RESEARCH OBJECTIVE(S)
List study objectives.
Determine the effects of mirror therapy in increasing AROM and function in individuals with AROM impairments following orthopedic hand injury.

Compare the effects of mirror therapy combined with traditional hand rehabilitation to those of traditional hand rehabilitation alone on individuals with AROM impairments following orthopedic hand injury.

**DESIGN TYPE AND LEVEL OF EVIDENCE:**

<table>
<thead>
<tr>
<th>Level I: Randomized controlled trial (RCT)</th>
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</table>

**Limitations (appropriateness of study design):**
Was the study design type appropriate for the knowledge level about this topic? *Circle yes or no, and if no, explain.*

YES/NO An RCT was appropriate, based on the results of previously published non-RCT studies. Because both treatment groups received an intervention, there were no ethical issues involved in selecting this design.

**SAMPLE SELECTION**

How were subjects selected to participate? Please describe.

Patients referred to local rehabilitation and hand surgery centers “with AROM impairments following orthopedic injuries affecting one or more digits of the hand were invited to participate” (p. 2). Participants were assigned to treatment groups via randomization with stratification.

**Inclusion Criteria**

18–65 years, pain-free, unilateral hand orthopedic injury (one or more digits), AROM limitations

(Presence of passive range of motion limitations were not discussed relative to inclusion or exclusion criteria.)

**Exclusion Criteria**

“Crush injuries, hand deformities, unhealed fractures and tendon ruptures, CRPS, psychiatric problems, neurological disorders, and impaired motor function because of a nerve lesion” (p. 2)

CRPS (Complex Regional Pain Syndrome)

**SAMPLE CHARACTERISTICS**

N=
% Dropouts | 23%  
---|---  
#/ (%) Male | 8 (27%)  
#/ (%) Female | 22 (73%)  
Ethnicity | NR  
Disease/disability diagnosis | Hand orthopedic injuries with AROM limitations  

Check appropriate group:  
<table>
<thead>
<tr>
<th>Group</th>
<th>Description</th>
</tr>
</thead>
</table>
| <20/study group | ✓  
20–50/study group |  
51–100/study group |  
101–149/study group |  
150–200/study group |  

**INTERVENTION(S) AND CONTROL GROUPS**

*Add groups if necessary*

**Group 1**

<table>
<thead>
<tr>
<th>Brief Description</th>
<th><strong>Mirror Therapy</strong> (MT): 30 minutes of observing reflection of uninvolved hand (5 minutes of AROM of uninvolved hand, 10 minutes of bilateral AROM, 5 minutes of resistive exercises, 10 minutes of dexterity exercises). This was in addition to 30 minutes of traditional customized hand rehabilitation each session and a home exercise program comprising observation of reflection of uninvolved hand.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td>NR</td>
</tr>
<tr>
<td>Who Delivered?</td>
<td>Occupational therapist (no specific qualifications discussed)</td>
</tr>
</tbody>
</table>
| Frequency? | During treatment period: 30 minutes of treatment intervention + 30 minutes of traditional hand rehabilitation 5 days/week AND 15-minute home program, 2x/day, 7 days/week.  
During follow-up period: 30 minutes of traditional hand rehabilitation 3 days/week. |
| Duration? | 3 weeks of treatment intervention, 3 week follow-up period |

**Group 2**

<table>
<thead>
<tr>
<th>Brief Description</th>
<th><strong>Control Group</strong> (CG): 30 minutes of observing involved hand [details not discussed; “directly observed the affected hand while performing different movements” (p. 3)]. This was in addition to 30 minutes of traditional customized hand rehabilitation and a 15-minute home exercise program comprising direct observation of affected hand.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td>NR</td>
</tr>
<tr>
<td>Who Delivered?</td>
<td>Occupational therapist (no specific qualifications discussed)</td>
</tr>
</tbody>
</table>
Frequency?  | During treatment period: 30 minutes of control intervention + 30 minutes of traditional hand rehabilitation x 5 days/week AND 15-minute home program, 2x/day, 7 days/week.
During follow-up period: 30 minutes of traditional hand rehabilitation 3 days/week.
Duration?  | 3 weeks of treatment intervention, 3 week follow-up period

**Intervention Biases:** *Circle yes or no and explain, if needed.*

**Contamination**

YES/NO

**Co-intervention**

YES/NO In addition to the studied intervention, each participant—regardless of treatment group—received non-standardized traditional therapy intervention that was customized to increase AROM.

**Timing**

YES/NO Length of time since surgery was a clinical characteristic that was analyzed between groups with no significant difference found. Therefore, even if time did have an effect on results, this influence should have been relatively equal between the groups.

**Site**

YES/NO NR. Site of treatment intervention was not specified. There was no attempt to assess compliance with performance of program component at home.

**Use of different therapists to provide intervention**

YES/NO NR. “An occupational therapist was responsible for delivering treatment programmes in both groups” (p. 3). The article does not specify whether treatment was delivered by the same or different therapists.

**MEASURES AND OUTCOMES**

Complete for each relevant measure when answering the evidence-based question:

Name of measure, what outcome was measured, whether the measure is reliable and valid (as reported in article – yes/no/NR [not reported]), and how frequently the measure was used.
**Total active motion (TAM)** was assessed with manual goniometry (no specifications of goniometer reported) and was utilized as the measure for AROM. The specific method used for measurement was recommended by the American Society of Hand Therapists. No information regarding reliability/validity was reported in article. The measure was used prior to intervention, after the 3-week intervention period, and after the 3-week follow-up period.

Name of measure, what outcome was measured, whether the measure is reliable and valid (as reported in article – yes/no/NR [not reported]), and how frequently the measure was used.

**Disabilities of Arm, Hand, and Shoulder (DASH)** was used to measure hand function. The article reports that the DASH is validated and clinically responsive to change but does not provide specific psychometric data. The measure was used prior to intervention, after the 3-week intervention period, and after the 3-week follow-up period.

Measurement Biases
Were the evaluators blind to treatment status? *Circle yes or no, and if no, explain.*

**YES/NO** The evaluators were blinded to treatment group.

Recall or memory bias. *Circle yes or no, and if yes, explain.*

**YES/NO**

Others (list and explain):
Use of different evaluators to perform assessments?

**YES/NO** The same evaluator performed all manual goniometry, eliminating potential concerns with interrater reliability.

**RESULTS**
List results of outcomes relevant to answering the focused question
Include statistical significance where appropriate (*p < 0.05*)
Include effect size if reported

ANOVA demonstrated a positive change in AROM relative to time (*p < 0.01, ES = 0.96*) and the interaction of group and time (*p = 0.04, ES = 0.42*). As per paired t-tests, TAM increased from pretest to posttest for both treatment groups (*p < 0.05*). Independent t-tests demonstrated “a significantly higher changes in TAM scores for MT compared to control group at the post-test session” (*p < 0.001; p. 3*). Mean change from pre- to posttest was **154°** for MT and **64°** degrees for CG. No significant difference was found between groups in mean change in TAM at the follow-up session as compared to posttest (*p > 0.05*). Mean change from posttest to follow-up was **27°** for MT and **26°** for CG.
In terms of DASH, ANOVA demonstrated an increase in function relative to time \((p < 0.01, ES = 0.85)\) and the interaction of group and time \((p < 0.05, ES = 0.32)\). Independent \(t\)-tests demonstrated higher reduction in DASH score for MT group compared to CG at posttest \((p = 0.001)\) and follow-up \((p = 0.02)\). Mean change of DASH score from pre- to posttest was \(-34\) for mirror therapy group and \(-15\) for control group. Mean change of DASH score from posttest to follow-up was \(-5\) for MT and \(-10\) for CG.

Was this study adequately powered (large enough to show a difference)? \textit{Circle yes or no, and if no, explain.}

<table>
<thead>
<tr>
<th>YES/NO</th>
<th>NR. Despite the small sample size, statistical analysis found significant results.</th>
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</thead>
</table>

Were appropriate analytic methods used? \textit{Circle yes or no, and if no, explain.}

<table>
<thead>
<tr>
<th>YES/NO</th>
<th>A biostatistician who was blinded to the purpose of the study completed the analysis.</th>
</tr>
</thead>
</table>

Were statistics appropriately reported (in written or table format)? \textit{Circle yes or no, and if no, explain.}

<table>
<thead>
<tr>
<th>YES/NO</th>
<th>The statistical analysis of the outcomes was appropriately reported and presented. However, the raw data (i.e., TAM and QuickDASH scores) were not presented. In addition, although the authors state that they completed statistical analysis of baseline demographics and clinical characteristics and found no significant differences between groups, the specific methodology of this analysis is not reported.</th>
</tr>
</thead>
</table>

**CONCLUSIONS**

State the authors’ conclusions that are applicable to answering the evidence-based question.

| A regularly scheduled course of mirror therapy combined with traditional customized hand rehabilitation was effective in improving AROM and hand function in patients with orthopedic injuries. Although both the treatment and control groups improved in measures of active motion and function from baseline, the addition of mirror therapy produced significantly greater change, which was maintained during the follow-up period. The authors hypothesize that gains in AROM secondary to mirror therapy may be related to activation of motor neural pathways that were inhibited secondary to immobilization and guarding. They speculate that improvements in the control group during the study period may be related to minimal to no previous participation in rehabilitation and/or poor quality of previous therapy. They state that further research is recommended to determine the effects of mirror therapy on a neural level as well the benefits of mirror therapy in the acute stages of orthopedic hand injuries. |
This work is based on the evidence-based literature review completed by Brocha Z. Stern, OTR/L, Kessler Rehabilitation Center, Ocean Township, NJ.


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