Robot – assisted therapy integrated with virtual reality for rehabilitation of hand function after stroke: a clinical case study

Gastaldo M, Azzolin I, Campagnoli M, Filipovic I, Pasquero F, Desilvestri M, Capacchione P, Massazza G.

University of Torino, Italy

Maritim Hotel, Berlin
June 19th – 23rd 2015
Case Diagnosis

The patient, F.M., was a 68-year-old female with left hemiparesis (mainly distal paresis of the left upper arm) secondary to a right hemispheric stroke occurred 8 months prior to examination.

Case Description (1)

- A customized rehabilitative intervention with Gloreha® hand rehabilitation glove in a chronic stroke patient
- Outpatient setting:
  5 sessions of 25 minutes each per week (4 weeks)
  *mirror box therapy*¹ (daily)
  physical therapy (2 sessions/week)

- No transcranial magnetic stimulation (EEG: irritative signs)
- No botulinum toxin injections
- Clinical outcomes measured by the same operator before and after 20 sessions of robotic therapy

Case Description (2)

Physical examination before treatment:
- mainly distal paresis of the left upper arm
- hypertonia of elbow, wrist and fingers flexors
- proprioceptive deficits
- mild cognitive impairment

<table>
<thead>
<tr>
<th>Measures</th>
<th>Before</th>
<th>After 4 wks</th>
</tr>
</thead>
<tbody>
<tr>
<td>m-Ashworth</td>
<td>Wrist flexors</td>
<td>2/4</td>
</tr>
<tr>
<td>Flexor digitorum superficialis</td>
<td>2/4</td>
<td>1/4</td>
</tr>
<tr>
<td>Flexor digitorum profundus</td>
<td>1/4</td>
<td>0/4</td>
</tr>
<tr>
<td>MRC</td>
<td>Wrist flexors</td>
<td>3/5</td>
</tr>
<tr>
<td>Flexor digitorum superficialis</td>
<td>3/5</td>
<td>4/5</td>
</tr>
<tr>
<td>Flexor digitorum profundus</td>
<td>2/5</td>
<td>4/5</td>
</tr>
<tr>
<td>Flexor pollicis longus and brevis</td>
<td>2/5</td>
<td>3/5</td>
</tr>
<tr>
<td>Extensor digitorum communis</td>
<td>1/5</td>
<td>3/5</td>
</tr>
<tr>
<td>Thumb to index pinch grip</td>
<td>1/5</td>
<td>3/5</td>
</tr>
<tr>
<td>Chedoke – McMaster Stroke Assessment Measure</td>
<td>Arm</td>
<td>5/7</td>
</tr>
<tr>
<td>Hand</td>
<td>3/7</td>
<td>4/7</td>
</tr>
<tr>
<td>Motricity Index</td>
<td>49/100</td>
<td>72/100</td>
</tr>
<tr>
<td>Wolf Motor Function Test</td>
<td>30/85</td>
<td>52/85</td>
</tr>
<tr>
<td>Fugl – Meyer (Upper extremity motor function)</td>
<td>23/66</td>
<td>43/66</td>
</tr>
<tr>
<td>Action Research Arm Test</td>
<td>14/57</td>
<td>25/57</td>
</tr>
<tr>
<td>Barthel Index</td>
<td>80/100</td>
<td>90/100</td>
</tr>
<tr>
<td>Stroke Specific Quality of Life Scale</td>
<td>120/260</td>
<td>180/260</td>
</tr>
<tr>
<td>Mini Mental Status Examination</td>
<td>24/30</td>
<td>24/30</td>
</tr>
</tbody>
</table>

Discussion

**Gloreha® hand rehabilitation glove:**

- exoskeleton device

- high intensity repetitive and customizable sensorimotor robotic training

- single and synchronous mobilization of the metacarpophalangeal and interphalangeal joints (counting, grasping, pinching, sequential exercises)

- movement of the hand associated with digitally enhanced visual and auditory feedback to deliver sensory reinforcement
According to previous research, robotically-assisted integrated rehabilitation devices may affect short-term functional recovery after stroke with additive effects relative to conventional therapy in patients with chronic stroke.

**Improving**  
- proprioception  
- motor planning  
- neuroplasticity

**Reducing** spasticity

**Preventing** damage due to immobilization

Robotically facilitated rehabilitation program for our chronic stroke patient: short-term improvements of upper extremity function
- No complications
- High patient compliance

**Further steps**

- Recruitment of acute and sub–acute stroke patients
- Home therapy
- Design of a new study

---


---

Thank you