Feasibility of a customized handgrip for a rehabilitation robot to meet specific needs

Lutong Li (1), Helen Dawes (2), Sarah Tyson (3), Glen Cooper (1), Andrew Weightman (1)

1. Department of Mechanical, Aerospace and Civil Engineering, School of Engineering, University of Manchester, United Kingdom;

2. Medical School, NIHR Exeter BRC, University of Exeter, United Kingdom;

3. School of Health Sciences, University of Manchester, United Kingdom.

INTRODUCTION

- Stroke accounts for around **42%** of long-term disability worldwide. Upper limb **robotic-assisted therapy** can improve motor control (P <0.05) [1].
- Most upper limb rehabilitation provide only a single handgrip [4], which cannot accommodate the range of weakness found and **variety of grips needed** in everyday life.
- **Bespoke handgrips** (e.g. customized size, shape and type) could meet the requirement of providing handgrips used in daily life.

AIM

This research aims to assess the technical and clinical feasibility of a customized handgrip for a rehabilitation robot, and to explore its potential benefits for stroke survivors, therapists, and manufacturers.

METHOD

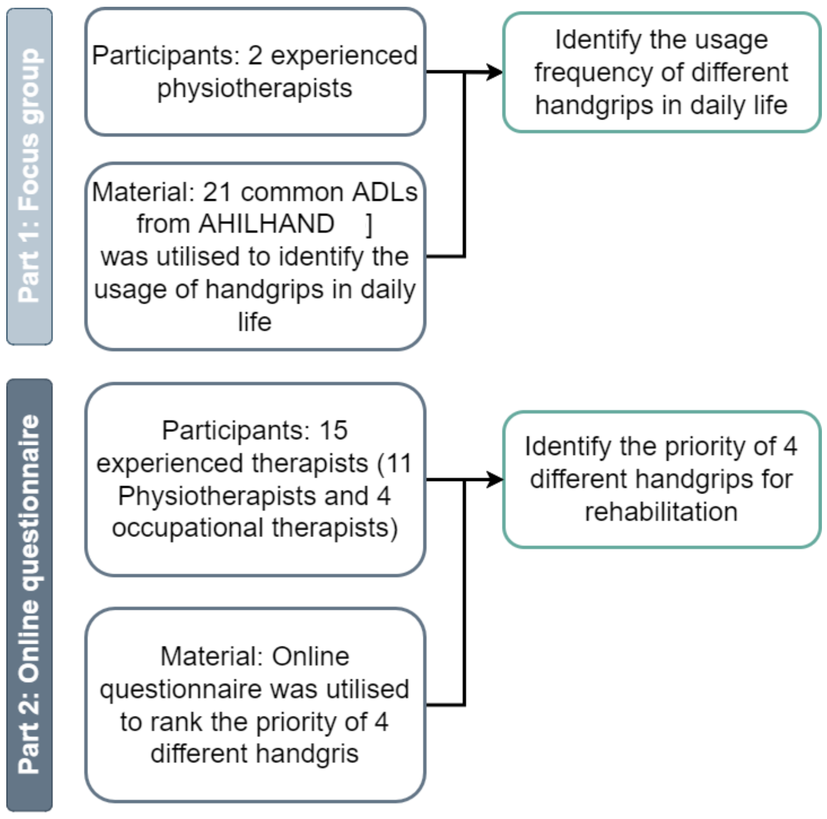


Figure 2: Flow chart of methods

RESULTS

Table 1: The frequency of human grips in activities of daily living and the importance level of rehabilitation

Type of grip	Illustration of grip	Frequency in daily life (%) [3]	Importance level[1]
Grasp grip		7 (33.3%)	1
Pinch grip		14 (66.7%)	2
Pencil grip		3 (14.3%)	3
Hook grip		1 (4.8%)	4

(*Note* [1]: Results were obtained from the online questionnaire with 15 therapists; the importance level from high to low is from 1 to 4).

RESULTS

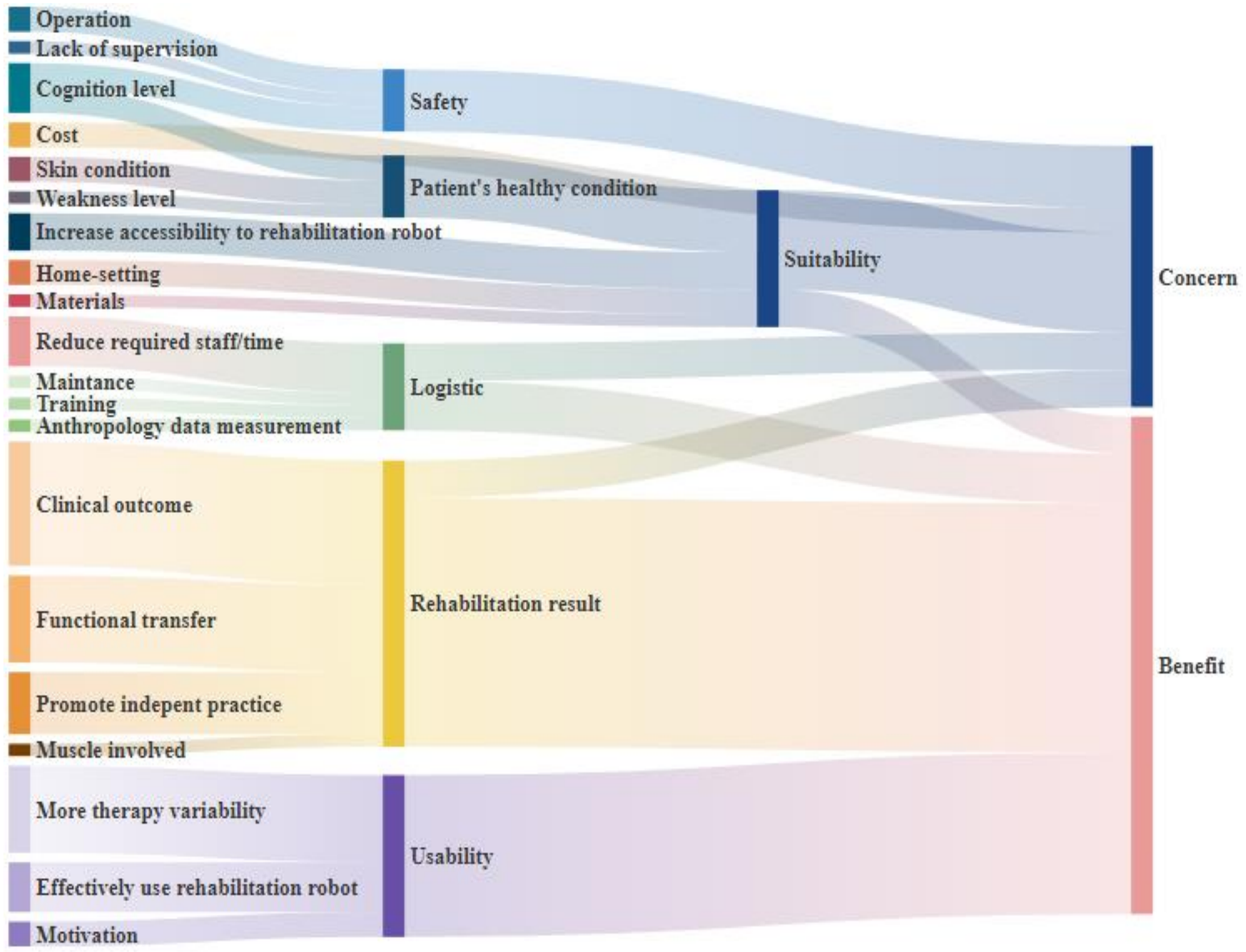
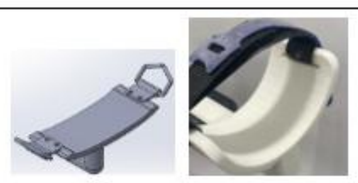


Figure 3: Sankey diagram illustrating the benefits and concerns of using a customised upper limb rehabilitation robot handgrip. The width of each theme represents its relative weight

Table 2: Conceptual design of customized handgrips for a rehabilitation robot

	Wrist support	Hemispherical handgrip	Vertical handgrip
Conceptual Design			
Target users	**1.** Severe or very severe weakness **2.** Wrist stiffness **3.** Cannot grasp at all	**1.** Mild to Moderate weakness **2.** Finger stiffness **3.** Can do some hook or grasp grip	**1.** Mild to Moderate weakness **2.** Can do some grasp, pinch, pencil or hook grip

DISCUSSION

- Analysis of ADLs showed the most prevalent grip was the pinch grip (66.7%), but rehabilitation robots also needed to accommodate a grasp grip.
- Pencil and hook grips were lower priority for rehabilitation as they required more complex motor re-learning.
- This suggests that better therapy outcomes could be achieved by using bespoke handgrips with current rehabilitation robots.
- Robotic-assisted rehabilitation may be enhanced by developing bespoke (e.g. size, shape and type) handgrips based on stroke survivors' needs (e.g. impairment and rehabilitation goal).

REFERENCE

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CONTACT INFORMATION

LinkedIn Google Scholar

Lutong Li lutong.li@manchester.ac.uk