



HAL
open science

Effectiveness of hybrid robotic rehabilitation system on upper limb recovery of people with central injuries: a systematic review with meta-analysis

Fernanda Rodrigues Martins Ferreira, Guilherme de Paula Rúbio, Lucas Oliveira Fonseca, Charles Fattal, Adriana Valladão Novais van Petten, Claysson Santos Vimieiro, Christine Azevedo Coste

► To cite this version:

Fernanda Rodrigues Martins Ferreira, Guilherme de Paula Rúbio, Lucas Oliveira Fonseca, Charles Fattal, Adriana Valladão Novais van Petten, et al.. Effectiveness of hybrid robotic rehabilitation system on upper limb recovery of people with central injuries: a systematic review with meta-analysis. PROSPERO - International prospective register of systematic reviews, 2021. hal-03130770

HAL Id: hal-03130770

<https://hal.inria.fr/hal-03130770>

Submitted on 3 Feb 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Effectiveness of hybrid robotic rehabilitation system on upper limb recovery of people with central injuries: a systematic review with meta-analysis

Fernanda Márcia Rodrigues Martins Ferreira, Guilherme de Paula Rúbio, Lucas Oliveira Fonseca, Charles Fattal, Adriana Maria Valladão Novais Van Petten, Claysson Bruno Santos Vimieiro, Christine Azevedo Coste

To enable PROSPERO to focus on COVID-19 registrations during the 2020 pandemic, this registration record was automatically published exactly as submitted. The PROSPERO team has not checked eligibility.

Citation

Fernanda Márcia Rodrigues Martins Ferreira, Guilherme de Paula Rúbio, Lucas Oliveira Fonseca, Charles Fattal, Adriana Maria Valladão Novais Van Petten, Claysson Bruno Santos Vimieiro, Christine Azevedo Coste. Effectiveness of hybrid robotic rehabilitation system on upper limb recovery of people with central injuries: a systematic review with meta-analysis. PROSPERO 2021 CRD42021227548 Available from:

https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42021227548

Review question

What is the effectiveness of hybrid robotic rehabilitation system on upper limb recovery of people with central injuries?

Searches

The search for relevant studies will be conducted on PEDro (Physiotherapy Evidence Database), EMBASE (Excerpta Medica Database), MEDLINE (Medical Literature Analysis and Retrieval System Online), CINAHL (Cumulative Index to Nursing and Allied Health Literature), COCHRANE (Cochrane Collaboration), AMED (Allied and Complementary Medicine Database), IEEE Xplore (Institute of Electrical and Electronics Engineering) and Compendex (Compendex Engineering Index) without language or date restrictions. In addition, a hand searching will be conducted in the reference lists of all eligible studies and previous reviews in this area. Search terms will be related to: "Hybrid Orthosis", "Upper limb" and "Randomized controlled trial" (see Appendix 1 on the Addenda for detailed search strategy).

This review will be included prospective randomized or quasi-randomized controlled studies including inpatients and outpatients from any primary, secondary or tertiary care setting and community. Studies will be eligible if they included participants with limited upper limb functioning caused by any health condition, regardless of age or sex (inpatients or outpatients from any clinical/hospital care settings including primary, secondary or tertiary services and community individuals). The intervention of interest will be HRRS, which is defined as the systems that rehabilitate or compensate motor functions through the combined action of muscle activation with FES and mechanical/electromechanical forces supplied to joints. Studies will be eligible if HRRS is compared with minimal intervention or other intervention (OI). We defined minimal intervention as when the control group received no intervention, received sham or placebo intervention, or was on a waiting list. We considered any other active intervention that was not hybrid orthosis, such as conventional therapy and physical therapy. The outcome of interest in this review will be related to body function and structure, activity and participation according to the International Classification of Functioning, Disability and Health

Types of study to be included

This review will be included prospective randomized or quasi-randomized controlled studies

Condition or domain being studied

People with upper limb disorders caused by central lesions

Participants/population

Studies will be eligible if they included participants with limited upper limb functioning caused by central lesions, regardless of age or sex (inpatients or outpatients from any clinical/hospital care settings including

primary, secondary or tertiary services and community individuals).

Intervention(s), exposure(s)

The intervention of interest will be HRRS, which is defined as the systems that rehabilitate or compensate motor functions through the combined action of muscle activation with FES and mechanical/electromechanical forces supplied to joints (DEL-AMA et al., 2012)

Comparator(s)/control

Studies will be eligible if HRRS is compared with minimal intervention or other intervention (OI). We defined minimal intervention as when the control group received no intervention, received sham or placebo intervention, or was on a waiting list. We considered any other active intervention that was not hybrid orthosis, such as conventional therapy and physical therapy.

Main outcome(s)

The outcome of interest in this review will be related to body function and structure, activity and participation according to the International Classification of Functioning, Disability and Health (SIVAN et al., 2011; WORLD HEALTH ORGANIZATION, 2001). Body function and structure are considered as the physiological functions of body systems, including psychological function and body structure, i.e., anatomical parts of the body, such as organs, limbs and their components. Activity refers to execution of a task or action by an individual and participation is involvement of an individual in a life situation (WORLD HEALTH ORGANIZATION, 2001).

* Measures of effect

Sample size, mean and standard deviation (SD) for each group will be extract at short, medium- and long-term follow-ups when available. Pooled effects will be estimated using standardized mean differences (SMDs) with 95% confidence intervals (CI).

Additional outcome(s)

Subgroup qualitative analysis will be conducted to investigate the impact of methodological quality issues on the pooled effects. Studies with PEDro scores of at least 6 out of 10 were considered high quality in this review.

* Measures of effect

Sample size, mean and standard deviation (SD) for each group will be extract at short, medium- and long-term follow-ups when available. Pooled effects will be estimated using standardized mean differences (SMDs) with 95% confidence intervals (CI).

Data extraction (selection and coding)

Data will be extracted by a reviewer (FMRMF) and double checked by a second reviewer (GPR). Disagreements will be resolved by consensus. Authors will be contacted to clarify eventual doubts. Data extracted at baseline will include: number of participants; mean age; percentages of males and females; cause of the upper limb disorder and its duration, evaluated joints; type of HRRS; comparison groups; frequency and total duration of intervention; and outcome measures. The outcome data extracted will included the sample size, mean and standard deviation (SD) for each group at the short-, medium- and long-term follow-ups, when available. When multiple time points are available within the same follow-up period, the time point closer to the end of the intervention will be considered.

Risk of bias (quality) assessment

The GRADE (Grading of Recommendations Assessment, Development and Evaluation) system will be used to summarize the overall quality of evidence for each outcome (BALSHEM et al., 2011) . We will rate evidence from the high-quality level and downgrade it one point if one of the following prespecified criteria is present: low methodological quality (average PEDro score < 6); inconsistency of estimates among pooled studies ($I^2 > 50\%$) or when its assessment is not possible (no pooling); indirectness of participants (over 50% of the studies do not describe inclusion criteria); and imprecision (pooling < 400 participants for each outcome) (HIGGINS; GREEN; COCHRANE COLLABORATION, 2008).

Strategy for data synthesis

Data for each outcome will be pooled when there is sufficient homogeneity among studies. Heterogeneity

among studies will be assessed using I^2 statistics = $[(Q - df)/Q] \times 100\%$, where Q is the χ^2 statistic and df is its degrees of freedom (HIGGINS et al., 2003; HIGGINS; THOMPSON, 2002). Low heterogeneity is defined as $I^2 \leq 50\%$, and moderate to high heterogeneity is defined as $I^2 > 50\%$ (HIGGINS; GREEN; COCHRANE COLLABORATION, 2008). Pooled effects will be estimated using standardized mean differences (SMDs) with 95% confidence intervals (CI). A fixed-effects model will be used to conduct the meta-analysis when $I^2 \leq 50\%$, and a random-effects model otherwise. To judge the clinical relevance of HRRS, the effect size will be assessed using Cohen's d coefficient according to the following parameters: 0.2 as small effect, 0.5 as medium effect, and 0.8 as large effect (COHEN, 1988). A funnel plot will be used to investigate publication bias when at least 10 studies are pooled (HIGGINS; GREEN; COCHRANE COLLABORATION, 2008). The meta-analysis will be performed using the software Comprehensive Meta-Analysis, version 3.3.070.

Analysis of subgroups or subsets

Central tendency and variability measures will be extracted for short-, medium- and long-term effects. Standard deviation (SD) will be imputed using 95% CI.

Contact details for further information

Fernanda Ferreira
fernandaferreira.to@gmail.com

Organisational affiliation of the review

Universidade Federal de Minas Gerais

Review team members and their organisational affiliations

Mrs Fernanda Márcia Rodrigues Martins Ferreira. Graduate Program in Mechanical Engineering, Bioengineering Laboratory, Universidade and Institut National de Recherche en Informatique et en Automatique (INRIA) and University of Montpellier, Montpellier, France

Mr Guilherme de Paula Rúbio. Graduate Program in Mechanical Engineering, Bioengineering Laboratory, Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil.

Dr Lucas Oliveira Fonseca. Institut National de Recherche en Informatique et en Automatique (INRIA) and University of Montpellier, Montpellier, France

Dr Charles Fattal. CRRF La Châtaigneraie, 95180 Menucourt, France

Professor Adriana Maria Valladão Novais Van Petten. Department of Occupational Therapy, Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil

Professor Claysson Bruno Santos Vimieiro. Graduate Program in Mechanical Engineering, Bioengineering Laboratory, Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil and Graduate Program in Mechanical Engineering, Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil.

Professor Christine Azevedo Coste. Institut National de Recherche en Informatique et en Automatique (INRIA) and University of Montpellier, Montpellier, France

Type and method of review

Intervention, Systematic review

Anticipated or actual start date

04 January 2021

Anticipated completion date

04 January 2022

Funding sources/sponsors

Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Capes): código financeiro 001

Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)

Marie Skłodowska-Curie Actions

Grant number(s)

State the funder, grant or award number and the date of award

Marie Skłodowska-Curie Actions: H2020-MSCA-IF-2019-899040
CNPq:203345/2019-3

Conflicts of interest

Language

English

Country

Brazil, France

Stage of review

Review Ongoing

Subject index terms status

Subject indexing assigned by CRD

Subject index terms

MeSH headings have not been applied to this record

Date of registration in PROSPERO

21 January 2021

Date of first submission

21 December 2020

Stage of review at time of this submission

| Stage | Started | Completed |
|---|---------|-----------|
| Preliminary searches | Yes | No |
| Piloting of the study selection process | No | No |
| Formal screening of search results against eligibility criteria | No | No |
| Data extraction | No | No |
| Risk of bias (quality) assessment | No | No |
| Data analysis | No | No |

The record owner confirms that the information they have supplied for this submission is accurate and complete and they understand that deliberate provision of inaccurate information or omission of data may be construed as scientific misconduct.

The record owner confirms that they will update the status of the review when it is completed and will add publication details in due course.

Versions

21 January 2021
21 January 2021
21 January 2021
02 February 2021

PROSPERO

This information has been provided by the named contact for this review. CRD has accepted this information in good faith and registered the review in PROSPERO. The registrant confirms that the information supplied for this submission is accurate and complete. CRD bears no responsibility or liability for the content of this registration record, any associated files or external websites.