Muscle strength in adults with spinal cord injury: A systematic review of manual muscle testing, isokinetic and hand held dynamometry clinimetrics.

Master of Clinical Science
February 2014
Kerry Peek  BSc (Hons), PG Cert.
Student number a1642099
The Joanna Briggs Institute,
School of Translational Health Science,
Faculty of Health Sciences,
The University of Adelaide,
Level 1, 115 Grenfell Street,
SA. 5005.
kerry.peek@adelaide.edu.au
Secondary reviewer:

Prapaphan Pensuk RN, B.N.S., M.N.S
The Joanna Briggs Institute,
School of Translational Health Science,
Faculty of Health Sciences,
The University of Adelaide,
SA. 5005.
prapaphan.pensuk@adelaide.edu.au

Supervisors:

Dr Suzanne Robertson-Malt, BHSc (Hons), PhD
The Joanna Briggs Institute,
School of Translational Health Science,
Faculty of Health Sciences,
The University of Adelaide,
SA. 5005.
suzanne.robertson-malt@adelaide.edu.au

Dr Zachary Munn, PhD, GradDipHlthSci, BMedRad
The Joanna Briggs Institute,
School of Translational Health Science,
Faculty of Health Sciences,
The University of Adelaide,
SA. 5005.
zachary.@adelaide.edu.au

Additional support:

Dr Catalin Tufanaru, MD, MPH
The Joanna Briggs Institute,
School of Translational Health Science,
Faculty of Health Sciences,
The University of Adelaide,
SA. 5005.
catalin.tufanaru@adelaide.edu.au
Table of Contents

Title page: Muscle strength in adults with spinal cord injury:
A systematic review of manual muscle testing,
isokinetic and hand held dynamometry clinimetrics ... 1
Supervisors 2
Contents 3
Abstract 5
Student Declaration Statement 6
Acknowledgements 7
Chapter 1: Introduction 8
   Context of the review 8
   Spinal Cord Injury 8
   Muscle strength 9
   Muscle strength assessment 10
   Methods for conducting muscle strength assessments 11
   Clinimetrics 12
   Statement of review question 16
   Overview of the science of evidence synthesis 17
   Methodological issues, critical appraisal, data extraction and
data synthesis 18
   Definition of terms 20
Chapter 2: Methods 22
   Review objective 22
   Criteria for considering studies for this review 23
      Types of studies 23
      Types of participants 23
      Focus of the review 23
      Outcome measures 23
   Review methods 24
      Search strategy 24
      Assessment of methodological quality 24
      Data extraction 25
      Data synthesis 25
Chapter 3: Results 26
   Description of studies 26
   Review findings/ results 29
   Reliability 33
      Kappa 33
      Intraclass correlation coefficient 34
      Confidence intervals 35
      Manual muscle testing 35
      Isokinetic dynamometry 38
Hand held dynamometry

Validity

Pearson product moment correlation coefficient
Spearman rank correlation coefficient
t-test
p-value

Responsiveness
Interpretability
Key findings
Hand held dynamometry

Chapter 4: Discussion
Methodological quality
Clinimetrics
Reliability
Validity and Responsiveness
Interpretability
Additional Variables
Hand held dynamometry
Assumptions
Limitations
Delimitations

Chapter 5: Conclusions
Implications for practice
Implications for research
General conclusion

References

Appendix I Data Extraction
Appendix II COSMIN tool for methodological quality
Appendix III Search Strategy
Appendix IV Included studies
Appendix V Excluded studies
Abstract

Objectives
The objectives of this systematic review were to synthesise the best available evidence regarding the clinimetrics for manual muscle testing (MMT), isokinetic dynamometry (ID) and hand held dynamometry (HHD) in the assessment of muscle strength in adults with spinal cord injury (SCI) and determine whether there is research evidence to recommend HHD as the standard tool for measuring muscle strength in adults with SCI.

Inclusion Criteria:
Only studies related to adults with SCI and MMT and/or ID and/or HHD were included.

Search Strategy
The search sought to identify any relevant English language published or unpublished studies via a three step search strategy.

Methodological quality
Two independent reviewers assessed the methodological quality of the studies using the quality evaluation tool consensus-based standards for the selection of health status instruments (COSMIN).

Data collection
An original data extraction form was developed to extract quantitative data from the included studies.

Data synthesis
It was not appropriate to conduct a meta-analysis due to the heterogeneity of the included studies. Therefore, the results are presented in narrative text including raw data as presented in the included studies as well as the contextual data.

Results
Eleven studies met the inclusion criteria of this systematic review. The results demonstrated that MMT showed varying inter-tester reliability over 10 muscle groups tested, ID demonstrated good reliability for the shoulder but not the elbow, HHD showed good reliability and validity for the upper limb and trunk, as well as good results for responsiveness and interpretability. Positive correlations were seen between MMT, ID and HHD particularly at the lower MMT grades. However, change in muscle strength scores seen on ID and HHD testing were not always correlated with changes in MMT grade. Significant overlapping of scores was seen between MMT and HHD particularly for grades 4 and 5 with MMT unable to detect subtle changes in muscle strength compared with dynamometry.

Conclusions
In conclusion, when considering the clinimetrics of the 3 methods for assessing muscle strength in adults with SCI there does appear to be support in the literature to recommend the wider application of HHD compared with MMT and ID.
Student Declaration Statement

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint award of this degree.

I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying, subject to the provisions of the Copyright Act 1968.

I also give my permission for the digital version of my thesis to be made available on the web, via the University’s digital research repository, the Library catalogue and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

Signed:

Kerry Peek

Dated:
Acknowledgements

I would like to thank my supervisors, Dr Robertson-Malt and Dr Munn, for their support and advice during my Master’s candidature. A special thank you to Dr Catalin Tufunaru for his invaluable assistance.

My secondary reviewer, Prapaphan Pensuk, for her assistance with methodological quality assessment, reassurance and time.

My family, Brendan, Harry and Charlie, who encouraged me and gave me time and support to get on with it!