NeuroRehabilitation 53 (2023) 599–602
DOI:10.3233/NRE-236007
IOS Press

Cochrane Corner

rehabilitation.cochrane.org

Is trunk training effective at improving ability in activities of daily living and function of people who have had a stroke? A Cochrane Review summary with commentary

Alex Todhunter-Brown*
School of Health and Life Science, Glasgow Caledonian University, Glasgow, Scotland, UK
E-mail: apo3@gcu.ac.uk

Abstract.
BACKGROUND: Effective trunk control is an essential component of sitting and standing balance, and is a key requirement for movement of the head and limbs, and for carrying out functional tasks. A stroke can result in impaired trunk control, affected by stroke-related deficits in balance, muscle function, coordination and position sense. Recovery of trunk control is recognised as a key goal of stroke rehabilitation.
OBJECTIVE: To evaluate the effectiveness of trunk training interventions in people with stroke.
METHODS: A summary of the Cochrane Review by Thijs et al. (2023), with comments from a rehabilitation perspective.
RESULTS: 68 studies (2585 participants) were included in the Cochrane review. Trunk training was not found to have any benefit on measures of ADL, when compared to other dose-matched therapies, but did improve trunk function and other outcomes. Trunk training was more beneficial than non-dose-matched therapies for measures of ADL, trunk function, and other outcomes. The certainty of these findings is very low.
CONCLUSION: Evidence supports the use of trunk training as part of stroke rehabilitation. However certainty in these findings is very low due to volume, quality and heterogeneity of the evidence.

Keywords: Stroke rehabilitation, trunk control, trunk training, balance, activities of daily living, systematic review

The aim of this commentary is to discuss from a rehabilitation perspective the Cochrane Review "Trunk training following stroke" (Thijs 2023) by Thijs et al. (2023)[a], published on the Cochrane Library. This Cochrane Corner is produced in agreement with NeuroRehabilitation by Cochrane Rehabilitation with views* of the review summary author in the "implications for practice" section.

[a]This summary is based on a Cochrane Review published in the Cochrane Database of Systematic Reviews 2023, Issue 3. Art. No.: CD013712. DOI: 10.1002/14651858.CD013712.pub2 (see www.cochranelibrary.com for information). Cochrane Reviews are regularly updated as new evidence emerges and in response to feedback, and Cochrane Database of Systematic Reviews should be consulted for the most recent version of the review.

*The views expressed in the summary with commentary are those of the Cochrane Corner author, who is different from the original Cochrane Review authors, and do not represent the Cochrane Library or Wiley.

ISSN 1053-8135/$35.00

1. Background

Stroke is the leading cause of disability worldwide (Feigin, 2022). The most common stroke-related impairment is a loss or limitation of motor function or muscle control (Clery, 2020; Wade, 1992). This includes trunk function or control, which is impaired by stroke-related decreases in coordination, muscle control, strength and position sense.

Effective trunk control is an essential component of sitting and standing balance, and is a key requirement for movement of the head and limbs, and for carrying out functional tasks. A stroke commonly results in impaired trunk control. Recovery of trunk control is recognised as a key goal of stroke rehabilitation.

Trunk training aims to improve neuromuscular control, coordination and strength of the trunk muscles, with the goal of supporting improved function and movement. A range of different trunk training interventions are available; these generally involve trunk exercises, possibly with use of technologies such as unstable or moving surfaces (e.g., physio ball or mechanical devices) or muscular stimulation (electrostimulation).

2. Trunk training following stroke

(Thijs L, Voets E, Denissen S, Mehrholz J, Elsner B, Lemmens R, Verheyden GSAF, 2023).

3. Objective

This Cochrane review aimed to assess the effectiveness of trunk training interventions for people with stroke.

4. What was studied and methods

This is a new Cochrane review, first published in 2023, and conducted using standard methods for Cochrane reviews. The review authors conducted a literature search across 9 databases (including Cochrane Central, MEDLINE, Embase, and CINAHL) to find randomized controlled trials (RCTs) published up to October 2021. Studies included were RCTs which compared trunk training with a dose-matched or non-dose-matched alternative rehabilitation, in adults (≥18 years old) with stroke (ischaemic or haemorrhagic). Outcome measures of interest included ADL, trunk function, arm-hand function, standing balance, leg function, walking ability, and quality of life.

5. Results

Sixty-eight randomised controlled trials, including 2585 stroke survivors, exploring the effectiveness of trunk training were identified; results of 63 of these were included in meta-analyses. Eighteen trials investigated core-stability training, 7 trials investigated electrical stimulation of trunk muscles, 15 trials explored trunk training aimed at improving selective movement of the trunk, 6 investigated sitting-reaching therapy, 2 trials compared use of tilted and horizontal platforms, 17 investigated use of an unstable surface, 4 trials explored weight-shift training, and 3 trials investigated other approaches. The median number of participants in each intervention group was 15. Time post-stroke varied from two weeks to more than 6 months, but the majority of studies (29/65) included only participants who were more than 6 months post-stroke. Intervention dose varied substantially and the control intervention was diverse. In 44 trials the intervention and control groups received the same amount of therapy ("dose-matched therapy"), while in 20 trials there was "non-dose-matched therapy". Results for outcomes of activities of daily living (ADL) and trunk function are summarised below:

- **Dose-matched therapy**
  - *ADL*: No benefits of trunk training were found (9 studies, $n = 229$, SMD 0.10, 95% CI -0.17-0.37).
  - *Trunk function*: Trunk training was found to be beneficial (36 studies, $n = 1217$, SMD 1.03, 95% CI 0.91-1.16).
  - *Other outcomes*: No benefits of trunk training were found on arm-hand activity, but trunk training was found to be beneficial for standing balance, walking ability and quality of life.

Quality of evidence: Certainty in all these findings was judged to very low (low for walking ability), due to risk of bias of included studies, volume of data and heterogeneity.

- **Non-dose-matched therapy**
  - *ADL*: Trunk training was found to be beneficial (5 studies, $n = 283$, SMD 0.96, 95% CI 0.69-1.24).

- *Trunk function*: Trunk training was found to be beneficial (14 studies, $n = 466$, SMD 1.49, 95% CI 1.26-1.71).
- *Other outcomes*: Trunk training was also found to be beneficial for outcomes of arm-hand activity, standing balance, walking ability and quality of life

Quality of evidence: Certainty in all these findings was judged to very low, due to risk of bias of included studies, volume of data and heterogeneity.

6. Conclusions

Evidence supports the use of trunk training as part of stroke rehabilitation. However certainty in these findings is very low, due to volume, quality and heterogeneity of the evidence.

7. Implications for practice in neurorehabilitation

Trunk control is an essential component for movement and function in sitting and standing. Trunk training and exercises are an integral part of stroke rehabilitation, and are recommended in national guidelines to improve balance (e.g. Herbert 2016, Winstein 2016, Australian Clinical Guidelines for Stroke, *National Clinical Guideline for Stroke for the UK and Ireland*).

The evidence synthesised within this review supports the inclusion of trunk training within stroke rehabilitation for people who are two weeks or more post-stroke. However, the certainty in this finding is very low as the studies are all small, diverse and some have methodological and reporting limitations. High quality, phase III randomised controlled trials are needed to improve certainty in the effectiveness of trunk training.

The lack of any studies including stroke survivors in the acute phase (i.e. less than 2 weeks post-stroke) means that there is no evidence relating to the effectiveness of trunk training during this period.

Studies have explored different types of trunk training interventions. Most studies investigated interventions described as “core-stability trunk training”, “selective-trunk training” and “unstable-trunk training”. The review authors report that information about the details of some of the study interventions was lacking, and often there was insufficient detail to support implementation in clinical practice. Consequently, the evidence in the review cannot directly inform selection and application of any specific trunk training interventions. It is likely that components of the different treatments described in the review overlap. Further, although not explicitly reported in the review, it is likely that many of the interventions involved selection and adaptation of techniques according to assessment of a patient’s individual needs. Thus, while the evidence supports the use of trunk training for people with stroke, there remains insufficient evidence to support use of any specific approach to trunk training. Health professionals implementing trunk training should therefore ensure that techniques are selected according to an expert assessment of a patient’s needs, with modification / adaptation informed by ongoing re-assessment.

Conflict of interest

Alex Todhunter-Brown is an author of several Cochrane Reviews and co-lead of the Cochrane Heart, Stroke & Circulation thematic group. No conflicts of interest are reported.

Acknowledgments

The author thanks Cochrane Rehabilitation and the corresponding author of the original Cochrane Review, Prof. Geert Verheyden, for reviewing the contents of the Cochrane Corner.

References

Thijs, L., Voets, E., Denissen, S., Mehrholz, J., Elsner, B., Lemmens, R., & Verheyden, GSAF. (2023). Trunk training following stroke. *Cochrane Database of Systematic Reviews*, Issue 3. Art. No.: CD013712. DOI: 10.1002/14651858.CD013712.pub2.

Feigin, V. L., Brainin, M., Norrving, B., Martins, S., Sacco, R. L., Hacke, W., Fisher, M., Pandian, J., & Lindsay, P. (2022). World Stroke Organization (WSO): Global Stroke Fact Sheet 2022. *Int J Stroke*, *17*(1), 18-29.

Wade, D. T. (1992). Measurement in Neurological Rehabilitation. 1st edition. Oxford: Oxford University Press.

Clery, A., Bhalla, A., Rudd, A. G., Wolfe, C. D. A., & Wang, Y. (2020). Trends in prevalence of acute stroke impairments: A population-based cohort study using the South London Stroke Register. *Plos Medicine*, *17*(10), e1003366.

National Clinical Guideline for Stroke for the UK and Ireland. London: Intercollegiate Stroke Working Party; 2023 May 4.

Available at: www.strokeguideline.org. Retrieved 1st August 2023.

Clinical Guidelines for Stroke… | *InformMe—Stroke Foundation*. (n.d.). Retrieved 1st August 2023, from https://informme.org.au/guidelines/clinical-guidelines-for-stroke-management

Hebert, D., Lindsay, M. P., McIntyre, A., Kirton, A., Rumney, P. G., Bagg, S., Bayley, M., Dowlatshahi, D., Dukelow, S., Garnhum, M., Glasser, E., Halabi, M.-L., Kang, E., MacKay-Lyons, M., Martino, R., Rochette, A., Rowe, S., Salbach, N., Semenko, B., & Teasell, R. (2016). Canadian stroke best practice recommendations: Stroke rehabilitation practice guidelines, update 2015. *International Journal of Stroke*, *11*(4), 459-484. https://doi.org/10.1177/1747493016643553

Winstein, C. J., Stein, J., Arena, R., Bates, B., Cherney, L. R., Cramer, S. C., Deruyter, F., Eng, J. J., Fisher, B., Harvey, R. L., Lang, C. E., MacKay-Lyons, M., Ottenbacher, K. J., Pugh, S., Reeves, M. J., Richards, L. G., Stiers, W., Zorowitz, R. D., & American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research. (2016). Guidelines for Adult Stroke Rehabilitation and Recovery: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. *Stroke*, *47*(6), e98-e169. https://doi.org/10.1161/STR.0000000000000098