Efficacy of progressive resistance training on balance performance in older adults: a systematic review of randomized controlled trials

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CRD summary
This generally well-conducted review found limited and inconsistent evidence for the efficacy of progressive resistance training as a single intervention for improving balance performance in older adults. The review was limited by the poor quality of the available evidence and, therefore, the cautious conclusions drawn by the authors seemed appropriate and were likely to be reliable.

Authors' objectives
To determine the overall efficacy of progressive resistance training as a single intervention on balance performance in older adults

Searching
CINAHL, Cochrane Central register of Controlled Trials, Cochrane Musculoskeletal Injuries Group Specialised Register, Cochrane Database of Systematic Reviews, MEDLINE, SPORTDiscus, EMBASE, Science Direct, Current Contents, Web of Science, PEDro and PubMed were searched from inception to October 2006; search terms were reported. Reference lists of retrieved articles were searched. There was no language restriction, but non-English papers were excluded if translation was unsuccessful.

Study selection
Randomised controlled trials (RCTs) comparing any static, dynamic or functional balance performance to usual care or alternative exercise or education programmes were eligible for inclusion. The eligible participants were adults with a minimum age of 50 years or a mean age of 60 years or over. Studies that included balance training or multimodal training were excluded.

The participants in the eligible studies included each of healthy, community-dwelling, mobility limited and frail cohorts and those with chronic comorbidities. The progressive resistance training interventions were conducted in gym and home-based or home-based settings. A large range of training equipment was used either singly or in combination. Control group activities included no treatment (usual activity), wait-list for an exercise programme on study completion, attention control, alternate exercises, functional exercises and flexibility training. Balance outcomes were categorised as static balance, dynamic balance, functional balance and computerised dynamic posturography.

Two reviewers applied the inclusion criteria independently and resolved any differences by discussion and mutual consent or by a third reviewer.

Assessment of study quality
Two reviewers independently assessed methodological quality using the Physiotherapy Evidence Database (PEDro) scale. Although this scale is an 11-point assessment tool, the reviewers excluded one item, so the quality scores were out of a maximum 10 points. Discrepancies were resolved by discussion or rating by a third reviewer.

Data extraction
Data were collected on study characteristics and outcomes related to balance performance. Standardised effect sizes corrected for small sample bias were calculated for changes in each balance outcome for each study. The authors did not state how many reviewers performed the data extraction.

Methods of synthesis
Because of the clinical heterogeneity in the included trials of interventions, balance outcomes and participants, the outcome data extracted was combined in a narrative synthesis. Differences between the studies were discussed in the text and the study details were tabulated. The results for subgroups were analysed to evaluate the effects of study...
duration, participant type, training intensity and study quality.

**Results of the review**

Twenty-nine RCTs (n=2,174) were included in the review. Twelve of 29 studies (41 per cent) scored more than 6 points on the 10-point quality scale, representing high quality studies. Criteria not met or not reported included: randomisation in 13 studies; allocation concealment in 25 studies; and assessor blinding in 17 studies. In addition, there was substantial attrition in the trials (up to 34 per cent).

Fourteen studies reported that the progressive resistance training group performed from two per cent to 98 per cent better than the control group in a balance outcome.

Static balance tests: six of 29 studies (seven tests, 26 per cent of static balance tests) showed significantly improved balance performance.

From the 29 studies, 26 per cent of balance test, 14 per cent of dynamic tests and 57 per cent of functional balance tests showed significantly improved balance performance.

Results for a range of subgroup analyses were presented. Balance performance improved significantly more in longer-duration studies. There were no significant differences found in the analyses of cohorts, training intensity, quality assessment, assessor blinding or training equipment.

**Authors' conclusions**

Although some studies showed significant improvements in balance performance for groups receiving progressive resistance training, the data did not consistently show that the use of progressive resistance training in isolation improved balance in the elderly.

**CRD commentary**

The review question was clear and supported by detailed inclusion and exclusion criteria with respect to study design, participants and treatments. The search included appropriate electronic databases and was designed to minimise language bias. There was no apparent attempt to locate unpublished material, which meant that relevant studies may have been missed and publication bias cannot be ruled out. Steps were taken to minimise reviewer bias and errors for study selection and quality assessment, but such steps were not reported for data extraction. Validity was assessed using a quality scoring system. The results for each criterion were reported for each study and the overall quality of studies taken into account during the analysis. The quality of the included studies was generally poor and attrition rates were high. The authors' decision not to pool the studies in a meta-analysis was justified given the apparent differences between the studies. This may not only be because of heterogeneity of participants, interventions, balance tests and the methodology of tests but also because of small sample sizes, inadequate doses of progressive resistance training and/or lack of statistical power. This was generally a well-conducted review, but the conclusions were limited by the paucity of good quality evidence. The authors’ conservative conclusions seemed reliable based on the evidence presented.

**Implications of the review for practice and research**

Implications for practice: the authors stated that there was insufficient evidence to recommend the use of progressive resistance training as an isolated intervention strategy for balance enhancement in an elderly cohort.

Implications for research: longer-term robustly designed RCTs were required to examine accompanying adaptations to progressive resistance training and balance improvements that may provide insights into the mechanism by which progressive resistance training may affect balance. In addition, the RCTs should: assess dose-response and duration of training effects of progressive resistance training; use preclinical and frail populations and cohorts with multiple comorbidities; standardise the methodology of static and dynamic balance tests; and investigate the targeting of specific muscle groups by progressive resistance training to elicit specific neural adaptations for balance control.

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