



Review

Balance performance in older adults with hip osteoarthritis: A systematic review

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ABSTRACT

Background: The hip is one of the most common joints affected by osteoarthritis (OA) and it has been identified as a key risk factors for falls. Physical impairments associated with OA, such as joint pain, muscle weakness, joint stiffness and sensory dysfunction, can all negatively affect balance and increase risk of falling.

Question: Is balance performance altered in older adults with hip osteoarthritis? To determine whether static, dynamic, reactive or functional balance performance is altered in older people with hip osteoarthritis.

Methods: Quantitative measures of postural control, including clinical and lab-based assessment of static, dynamic, reactive and/or functional balance performance, compared with a healthy control group or to the asymptomatic limb.

Results: A total of 5407 articles were identified and 14 papers were included (10 with standardised mean different (SMD) data, four without SMD data). Based on data from single studies, there were medium/large effects for increased medio-lateral displacement when standing with eyes open, increased anterior-posterior and total sway path length when standing with eyes closed, greater overall instability when standing on an unstable surface, and increased displacement toward the stance leg in a lateral step in hip OA compared with controls.

Conclusion: Balance impairments were identified in some measures, limiting the conclusions as to whether balance deficits are a problem in hip OA. Inconsistent findings suggest that balance may not be a primary contributor to increased falls risk in older adults with hip OA. Other factors, such as musculoskeletal deficits, may contribute to higher falls rate in this population.

1. Introduction

By 2050, older adults (aged 60 years or over) are estimated to account for 21% of the worldwide population [1]. Trends in population ageing are expected to be associated with increased healthcare costs and prevalence of age-related diseases, such as osteoarthritis (OA). OA commonly affects weight-bearing joints of the lower limb [2,3], with hip OA reported to affect up to 15% of adults aged 55 years and over [3].

Falls are another serious health concern associated with ageing, which can lead to injury, hospitalisation, loss of independence, and even fatality [4,5]. Lower limb OA (which can affect the ankles, knees or hips) is one key risk factor for falls in older people [6]. Symptoms and physical impairments associated with lower limb OA, including joint pain and stiffness, muscle weakness, and altered sensory function, can be detrimental to balance performance and increase the likelihood

of falling [7–9]. Further, alterations in joint structure, such as cartilage degeneration and osteophyte formation, may alter weight-bearing and movement patterns [10], which in turn may negatively affect balance.

While a number of studies have investigated balance in hip OA, there has not yet been a synthesis of the literature. Many aspects of balance, including static, dynamic and functional balance, have been studied in this population. Therefore, it is timely to systematically review and synthesise data to enhance current understanding of balance impairments in older adults with hip OA. The aim of this systematic review is to determine whether balance performance is altered in older people with unilateral and/or bilateral hip OA. It is important to understand what specific aspects of balance are impaired in hip OA and how balance impairments may vary with disease progression and severity. Such information will be used to inform the advancement of more effective and tailored balance training strategies and falls prevention programs for older individuals with hip OA.

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2. Method

2.1. Search strategy

The systematic review protocol was developed in consultation with guidelines provided by the Preferred Reporting of Systematic Reviews and Meta-Analyses (PRISMA) statement [11]. Two authors independently (AP, MS) searched five electronic databases (Pubmed, Cinahl, Web of Science, Cochrane and Embase) from inception to 30th January 2017, without language restriction, to identify articles related to balance performance in older adults with hip OA. Three sets of entry strings were combined with “AND”. The first set included synonyms of osteoarthritis; the second set of terms related to the anatomical region of interest (i.e. the hip); and the third set of terms were keywords related to balance tests and outcome measures (i.e. centre of pressure, Timed Up and Go). Terms within each entry string were combined using OR. (The full list of search terms can be found in [Box 1](#)) All studies identified by the search strategy were exported into Endnote and duplicates were removed. Reference lists of the included articles were searched, but did not reveal any additional studies for inclusion. The protocol of this systematic review is registered in PROSPERO (registration number 42016035958).

2.2. Selection criteria

Titles and abstracts of all identified records were screened for eligibility by two independent raters (AP, EG). When inclusion was unable to be determined from the title and abstract, the full text of the article was retrieved and screened. All types of study design were eligible for inclusion, if they met the following criteria: 1) the study investigated quantitative measures of postural control, including clinical and laboratory-based assessment of static, dynamic, reactive and/or functional (i.e. Timed Up and Go) balance performance; 2) the study populations included individuals with a clinical diagnosis of unilateral or bilateral hip OA; 3) the study compares measures of postural control in individuals with hip OA to a healthy control group (for individuals with unilateral or bilateral hip OA) or to the asymptomatic limb (for individuals with unilateral hip OA only). Any study that assessed balance following an intervention (such as exercise or surgery) or whilst an intervention was in situ (such as bracing or orthoses) was only included if pre-intervention data comparing individuals with hip OA to a control group or the asymptomatic limb were reported.

Studies were excluded if participants were paediatrics, young adults or if participants had a musculoskeletal impairment due to systemic disease (e.g. rheumatoid arthritis), a lower limb amputation (with or without a prosthesis), neurological or sensory impairments known to affect balance (e.g. Parkinson's disease). Studies that investigated spatiotemporal gait parameters were excluded. Animal or cadaveric studies were also excluded.

Box 1 Search Strategy

Group 1: Keywords - Arthritis terms

(chondropathy OR arthritis OR osteoarthritis OR “joint degeneration” OR osteoarthrosis OR osteo-arthritis OR osteo-arthritis OR arthrosis OR arthrogenic)

Group 2: Keywords - Hip terms

(hip OR acetabul* OR “femoral head” OR “head of femur” OR “proximal femur”)

Group 3: Keywords - Balance terms

(BBS OR “postural control” OR “postural sway” OR “postural adjustment” OR “force plate” OR “force platform” OR COP OR “centre of pressure” OR “center of pressure” OR “centre of mass” OR “centre of gravity” OR “center of mass” OR “center of gravity” OR stability OR equilibrium OR balance OR SEBT OR “reactive step” OR TUG OR “timed up and go” OR “four square step” OR “Swaymeter” OR “Sway meter” OR CTSIB OR “Step Test” OR “choice stepping reaction” OR reach OR “retropulsion Test” OR “pull test” OR perturbation)

2.3. Methodological quality assessment

Eligible papers were assessed for quality using the Epidemiological Appraisal Instrument (EAI) [12]. This instrument contains 43 items, is designed to assess the quality of cohort studies and has demonstrated validity and reliability [12]. Each item was scored as “yes” (score = 1); “partial” (score = 0.5); “no” (score = 0); “unable to determine” (score = 0) or “not applicable” (item removed from scoring). The overall score was expressed as an average (ranging from 0 to 1), calculated by summing scores for all items and dividing by the number of items that were scored as “yes”, “no” or “unable to determine”, such that EAI items deemed “not applicable” to the studies included in this review (such as those relating to interventions (n = 9)) did not contribute to scoring. Quality rating was undertaken independently by two authors (AP, EG), and any disagreements were resolved by consultation with a third author (MS or AH).

2.4. Data extraction

Data extraction was completed by two authors (AP, EG) and any queries were discussed by all investigators. Data pertaining to sample size, population demographics, study methodology and balance outcome measures were extracted. Means and standard deviations (SD) of data on balance measures were sourced from the original papers. When means (SD) were not provided numerically in the paper (e.g. displayed in figures or tables), the authors were contacted via email (up to three times) to request the data.

2.5. Data analysis

The SMD was calculated as the difference between the means of the hip OA group and control group, or the means of the affected and unaffected limbs, divided by the pooled SD. Analyses were undertaken using Review Manager Software Package RevMan V5.3 (Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration). Between group (hip OA versus controls) or between limb (affected versus unaffected limb) differences were considered to be significant where the 95% confidence intervals (CI) did not contain zero. Effect sizes were interpreted as: < 0.2 trivial, 0.2 - 0.6 small, 0.61–1.2 medium, and > 1.2 large. [13]. Due to differences in methodology, sample characteristics and balance outcome measures, pooling of data for meta-analysis was not possible. For papers in which mean and SD data was not reported or received (and SMD not able to be calculated), data are reported descriptively.

3. Results

3.1. Selection of studies

The search strategy retrieved 5407 articles. [Fig. 1](#) outlines a

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