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Original article

Balance and falls risk in women with lower limb osteoarthritis or rheumatoid arthritis

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ABSTRACT

Background/purpose: Lower limb arthritis is a risk factor for falls, although few studies have used comprehensive balance assessment to determine the degree to which this contributes to falls risk. This study evaluated the falls risk and balance impairment of women with lower limb osteoarthritis (OA) or rheumatoid arthritis (RA).

Methods: A cross-sectional comparative study was conducted of women living in the general community. Seventeen women with lower limb OA [mean age: 66.9 years, standard deviation (SD) = 9.8 years], 17 with lower limb RA (mean age: 66.3 years, SD = 9.4 years), and 17 age-matched healthy (no lower limb arthritis) women (mean age: 66.3 years, SD = 10.1 years) were recruited.

All participants underwent a comprehensive balance and mobility assessment, including clinical balance measures (Step Test, Functional Reach), self-generated (Neurocom Balance Master long plate), and externally generated (Chattecx Balance System) force platform measures. Falls risk was assessed using the Falls Risk for Older People – Community version (FROP-Com).

Results: Sixty-five percent of the OA and 65% of the RA women reported one or more falls in the preceding 12 months, and both groups had significantly higher falls risk (FROP-Com) than the matched sample ($p < 0.001$). Both OA and RA participants had significantly impaired balance and mobility, lower activity level, and lower falls efficacy after adjustment for multiple comparisons, compared to the matched sample. Although women with RA performed worse on the majority of measures than the OA women, the difference was only significant for the Maximum Excursion measure of the Limits of Stability test.

Conclusions: Women with lower limb OA or RA have mild to moderate falls risk and balance impairments in comparison to age-matched older women. Further research is needed to evaluate whether exercise programs targeting balance performance, and other interventions to address their multiple falls risk factors, can improve balance and reduce falls in these clinical groups.

1. Introduction

Arthritis is a group of disorders characterized by inflammation of the joints. It is the most common musculoskeletal condition causing severe, long-term pain and physical disability,[1] with increased prevalence with increasing age.[2] As a major public health problem, arthritis is placing a high economic and personal burden on the community. Direct health expenditure in Australia was

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AUD$1.22 billion for osteoarthritis (OA) and AUD$175.1 million for rheumatoid arthritis (RA) in 2004–2005.[2]

OA and RA are the most common forms of arthritis. OA is a degenerative condition of the articular cartilage that mainly involves weight-bearing joints such as the lower spine, hip, knee, and ankle. Age is the strongest predictor of the development and progression of radiographic OA.[1] RA is a chronic systemic autoimmune disease with persistent inflammation that causes destruction of multiple joints. RA predominantly affects the peripheral joints and patients may have other systemic features such as weight loss, malaise, and vasculitis. The prevalence rate of RA is higher among women.[3]

Previous studies have reported that lower limb arthritis and musculoskeletal pain are risk factors for falls.[4–8] At least 50% of people with OA or RA report falls in a 12-month period.[9–11] Several of the common symptoms associated with lower limb arthritis, such as muscle weakness, increased level of pain, functional status, and impaired balance, are risk factors for falling in their own right.[5]

Impaired balance control has been suggested to be one of the more important risk factors of falls in arthritis patients.[6,7,12] Reduced proprioceptive acuity of the involved joints and increased postural sway in standing have been identified in patients with lower limb OA.[13,14] The presence of lower limb RA has been shown to be associated with decreased static postural stability and dynamic balance.[11,15,16]

Although balance has been found to be reduced in both OA and RA samples,[15,17] results from these studies are limited because a narrow range of balance measures have been investigated. Postural balance is complex in nature, and relies on intricate central processing of peripheral sensory information and precise motor responses. Therefore, a suite of balance assessments that incorporate the main domains of static and dynamic balance performance will provide a sound basis for determining areas of deficits, which might be targeted in interventions to reduce falls risk, such as exercise programs. In addition, only one study has compared physical performance measures (including balance) between people with OA and RA,[18] which identified significantly reduced endurance in the OA group, but no difference in balance performance. No study has investigated differences in falls risk or falls efficacy (self-efficacy or confidence in avoiding falls)[19] between these groups.

Therefore, the primary aim of this study was to investigate differences in balance performance, fall risks, and fall efficacy, using a comprehensive suite of laboratory and clinical measures, between women with lower limb OA and those with RA, and healthy age-matched control participants. Secondary aims included identifying frequency of falls in the preceding 12 months, common circumstances of falls for women with OA and RA, and the association between joint pain and falls risk.

2. Methods

2.1. Participants

People with arthritis were recruited from public hospitals and private rheumatology clinics. Participants (including age-matched controls) were also recruited through advertisements in a newsletter and a volunteer database. Ethical approval for the study was obtained through Melbourne Health Human Research Ethics Committee and all participants provided informed written consent.

Participants in the arthritis groups were women with lower limb OA or lower limb RA. They had a disease diagnosis of RA or OA based on the criteria set for each disease by the American College of Rheumatology.[20,21] They were excluded if they (1) did not have lower limb arthritis; (2) were bed bound; (3) had Parkinson's disease, stroke, multiple sclerosis, history of cardiac syncope, or epilepsy; (4) had undergone lower limb surgery within the previous 12 months; or (5) had intra-articular viscosupplementation or a corticosteroid injection within the past 6 months.

Community-dwelling women who walked regularly away from home and did not have a diagnosis of lower limb arthritis were also recruited as healthy age-matched controls from a volunteer database at the National Ageing Research Institute, and by advertising the project through newsletters to organizations for community-based older people. Exclusion criteria were having leg pain, having fallen more than once in the past 12 months, using a walking aid, or having a condition affecting mobility. Healthy participants were age-matched to the OA group and the RA group (±3 years).

In total, 120 women responded to recruitment approaches. Forty-two did not come for assessment (27 did not meet inclusion criteria, and 15 were unable to come to the laboratory for assessment – e.g., lived too far away). Seventy-eight participants underwent assessment – 30 with lower limb OA, 18 with lower limb RA, and 29 healthy (no lower limb arthritis) older women. Following assessment, one participant was excluded because she did not meet the inclusion criteria.

For this study, we aimed to age match women from each of the three samples. For each woman with RA (the smallest sample), we attempted to age match (±3 years) one woman from the OA group and one from the healthy comparison group. In cases in which more than one woman in these groups was suitable for age matching, one woman was randomly selected to be the matched participant. One young woman with RA was not able to be age matched with any of the OA or healthy women. In total, 17 participants were able to be age matched in each of the three groups.

2.2. Assessments

Assessments for this study included a suite of well-validated tools in older populations, and have been described previously,[12] and were conducted by an experienced physiotherapist at the Gait and Balance Laboratory at the National Ageing Research Institute. In brief, these included the following assessments.

Falls risk Falls Risk for Older People – Community Setting (FROP-Com) assessment tool[22] (http://www.mednwh.unimelb.edu.au/nari_research/pdf_docs/FropCom2010/Frop-Com-Sept-2010.pdf)

Balance measures. Both clinical measures [Step Test (worst leg score),[23] Functional Reach test,[24] and the fourth component of the Clinical Test of Sensory Interaction on Balance (CTSIB), which involved standing for 30 seconds with eyes closed on medium density foam;[25]] and force platform measures on the NeuroCom Balance Master (long plate) (NeuroCom International, Clackamas, OR, USA)[26] [Limits of Stability test[27] – measures reported were reaction time – the time between the signal to move and the initiation of movement (seconds), and maximum excursion – the furthest distance travelled by the centre of gravity away from upright stance. Faster reaction times (lower scores) and larger maximum excursion (higher scores) indicated better performance]; and response to external perturbations on the Chattecx Balance System (Chattanooga Group, Hixson, TN, USA) – with the platform tilting rhythmically (8 degrees amplitude, 8.3 seconds/cycle) in an anteroposterior direction with a distractor task (counting backwards by threes from a randomly selected three-digit number). This test condition was selected based on previous research showing that it discriminated best between groups with mild falls risk.[28] The mediolateral amplitude of center of pressure adjusted for height (cm), measured for a 10-second test duration was reported for this task. Lower scores indicated better performance.

Leg muscle strength measures. Sit to stand task on the Neurocom Balance Master [measures of (1) mean weight transfer time – time between the onset of the cue to move and the arrival of the center of gravity over the feet (seconds, lower scores indicated better performance); and (2) mean rising index – the amount of force exerted by the legs during the rising phase expressed as a percentage of body weight were reported. Higher scores indicated better performance].

Gait measures. Gait velocity, measured at "comfortable walking pace" along the central 6 m of a 10-m walkway; Timed up and Go test;[29] and gait measures on the Neurocom Balance Master [measures of stability during gait (step width, cm), stability during turning (turn sway velocity, reported for worst side turning, with lower scores indicating better performance)].

Additional measures included body mass index, sites of lower limb pain, average pain on movement over the previous week (visual analog scale; VAS),[30] number of falls in the past 12 months (retrospective recall), activity level (Human Activity Profile; HAP),[31] and falls self efficacy (Modified Falls Efficacy Scale; MFES).[32] In addition, the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)[33] was used for OA participants only to assess the three dimensions of pain, joint stiffness, and disability. Lower scores indicated less pain, less stiffness, or less disability.

2.3. Statistical analysis

SPSS version 17 was used for analyses. Descriptive statistics were used to describe performance. For normally distributed variables (skew < 3), one-way analysis of variance (ANOVA) was used to compare the three groups (OA, RA, and control groups), with *post hoc* analysis conducted when significant results were obtained to determine between which pair of groups the significant difference occurred. For non-normally distributed variables, the Kruskal–Wallis test was used to compare group differences. A Bonferroni adjustment was made when several tests were assessing the same subdomain (the relevant adjusted p values are reported in the relevant Tables). Cohen's effect size was calculated to determine the magnitude of differences observed between the OA group and RA group; calculated as the difference between the two mean scores divided by the pooled standard deviation (SD). Effect sizes were classified as small ($\sim$0.25), medium ($\sim$0.5), and large ($\sim$0.8 or greater).[34]

One-way ANOVA was also used to compare lower limb joint pain (VAS, mm) between those with low, moderate, or high falls risk (FROP-Com classification).

3. Results

All variables were normally distributed except for the CTSIB and the Modified Falls Efficacy Scale for the age-matched healthy group. Nonparametric analyses were used for these measures.

The final sample consisted of 17 women with OA (mean age 66.9 years, SD = 9.8 years), 17 with RA (mean age 66.3 years, SD = 9.4 years), and 17 healthy comparison participants (mean age 66.3 years, SD = 10.1 years). Table 1 provides further demographic information about the three groups. Other health problems most commonly experienced by participants were low back pain and osteoporosis. The most common lower limb joint affected in the two arthritis groups was the knee, although 41% of RA participants rated their feet as the most affected joints. Eleven participants (65%) in the OA group and 11 in the RA group fell at least once in the preceding 12 months, compared to only two (12%) of the healthy comparison group.

Table 2 reports circumstances of the most recent fall for the OA (n = 11) and RA (n = 11) groups. For the OA group, falls most commonly involved walking; one-third of falls involved either a step or a kerb; most common injuries were bruises/grazes (although 1 fall caused a fracture); almost two-thirds had a loss of confidence after a fall; but only 25% sought medical attention after the fall. For the RA group, falls most commonly involved walking; one-quarter of falls involved either a step or a kerb; most common injuries were bruises/grazes; one-third had a loss of confidence after a fall; and 42% sought medical attention after the fall.

Participants with OA and RA had significantly higher mean FROP-Com scores (11.7 and 14.7, respectively) than the healthy comparison group (mean FROP-Com = 4.6) (Table 3). According to the criteria described on the FROP-Com, the mean scores for the OA and RA participants indicated mild-to-moderate level of falls risk, while the healthy comparison group had low falls risk.

The most common falls risk factors rated as moderate or severe on the FROP-Com (or rated positive for dichotomous factors) for participants with OA were foot problems (e.g., corns, bunions, or swelling) (58.8%), uncorrected vision loss (47.1%), alcohol intake (41.2%), and unintentional weight loss in past 3–12 months (29.4%) (Table 4). For participants with RA, the most prevalent risk factors rated as moderate or severe were foot problems (94.1%), requiring

Table 1
Sample characteristics for study participants.

	OA (n = 17)	RA (n = 17)	Healthy age matched (n = 17)
Age (y), mean (SD)	66.9 (9.8)	66.3 (9.4)	66.3 (10.1)
Female – n (%)	17 (100%)	17 (100%)	17 (100%)
No. of medications median, [IQR]	2 [0–4]	5 [3–7]	0 [0–2]
No. of medical conditions – median, [IQR]	2 [1–3]	3 [2–4]	0 [0–1]
Most common other medical conditions			
Low back pain	9 (52.9%)	14 (82.4%)	3 (17.6%)
Osteoporosis	5 (29.4%)	7 (41.2%)	1 (5.9%)
Dizziness	4 (23.5%)	4 (23.5%)	1 (5.9%)
Hip / knee replacement	1 (5.9%)	2 (11.8%)	0
Use walking aid at home	1 (5.9%)	1 (5.9%)	0
Use walking aid away from home	4 (23.5%)	4 (23.5%)	0
BMI (kg/m^2), mean (SD)	29.1 (7.9)	28.5 (6.2)	27.0 (3.0)
Arthritis details			
Most severely affected lower limb joint – n (%)			
Hip	2 (11.1%)	1 (5.9%)	–
Knee	14 (82.4%)	9 (52.9%)	–
Feet	1 (5.9%)	7 (41.2%)	–
None/control	–	–	29 (100%)
Visual analog scale (worst joint) mm – mean (SD)	36.4 (21.6)	47.1 (28.8)	
Spread of no. of lower limb painful joints – n (%)			
0–1	4 (23.5%)	3 (17.6%)	
2–4	12 (70.6%)	5 (29.4%)	
5–10	1 (5.9%)	5 (29.4%)	
>10	0	4 (23.5%)	
WOMAC (OA participants only) – mean (SD)			
Total pain score	31.0 (16.9)		
Total stiffness score	42.2 (27.0)		
Total difficulty with daily activities score	31.7 (22.7)		
Summary WOMAC score	32.5 (20.8)		
Falls			
No. of falls (in past 12 mo), n (%)			
0	6 (35.3%)	6 (35.3%)	15 (88.2%)
1	4 (23.5%)	4 (23.5%)	2 (11.8%)
2	5 (29.4%)	5 (29.4%)	0
≥3	2 (11.8%)	2 (11.8%)	0

BMI = body mass index; OA = osteoarthritis; RA = rheumatoid arthritis; SD = standard deviation; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index.

Table 2
Circumstances and consequences of most recent fall.

	Osteoarthritis ($n = 11$ fallers)	Rheumatoid arthritis ($n = 11$ fallers)
Location of fall – *n* (%)		
Indoors	1 (8.3%)	1 (8.4%)
Outdoors (home)	3 (25.0%)	3 (25.0%)
Outdoors (street)	5 (41.7%)	4 (33.3%)
Outdoors (other)	2 (16.7%)	4 (33.3%)
Not defined	1 (8.3%)	0
Activity at time of fall – *n* (%)		
Walking	4 (33.3%)	7 (58.4%)
Bending	2 (16.7%)	1 (8.3%)
Rushing	2 (16.7%)	1 (8.3%)
Reaching	1 (8.3%)	1 (8.3%)
Other	3 (25.0%)	2 (16.7%)
Obstacle involved – *n* (%)		
Step/kerb	2 (16.7%)	0
Uneven footpath	2 (16.7%)	3 (25.0%)
Slippery surface	0	1 (8.3%)
Indoor obstacle	1 (8.3%)	0
Other	3 (25.0%)	2 (16.7%)
Nil	4 (33.3%)	6 (50.0%)
Injuries associated with fall – *n* (%)		
Nil	1 (8.3%)	3 (25.0%)
Bruises / grazes	7 (58.4%)	5 (41.7%)
Cuts / stitches	1 (8.3%)	1 (8.3%)
Sprains / strains	2 (16.7%)	3 (25.0%)
Fracture/s	1 (8.3%)	0
Able to get up by self after fall – *n* (%)	7 (58.4%)	7 (58.4%)
Loss of confidence after fall – *n* (%)	7 (58.4%)	4 (33.3%)
Stopped activities after fall – *n* (%)	4 (33.0%)	1 (8.3%)
Medical attention sought after fall – *n* (%)	3 (25.0%)	5 (41.6%)

assistance with Instrumental Activities of Daily Living (52.9%), incontinence (35.3%), and uncorrected vision loss (35.3%). It should be noted that although no arthritis participants were rated as moderate-to-high risk (Table 4) on the item "unsteady on walking and turning", four participants with OA (24%) and 10 participants with RA (59%) were rated as mild risk on this item.

The healthy control participants performed significantly better than both the OA and RA participants on all performance measures, with differences being significant with both groups for Step Test, Limits of Stability Maximum Excursion, Chattecx platform tilting dual task, sit to stand (rising index), gait velocity, step and quick turn sway, the Timed Up and Go, and the HAP (AAS) and the MFES (Table 3). Although participants with RA performed worse on the majority of measures than the OA participants, only one of these differences was statistically significant (Limits of Stability Maximum Excursion). Effect sizes for differences between the OA and RA groups for several of the measures were moderate (FROP-Com, Limits of Stability reaction time) or large (Limits of Stability Maximum Excursion). The RA participants were steadier on turning than the OA participants, and had a narrower step width, but these differences were not statistically significant ($p > 0.05$).

A sub-analysis was performed combining the RA and OA participants to determine whether lower limb joint pain on movement in the past week was associated with falls risk. There was no significant difference in VAS for those with mild falls risk (FROP-Com 0-11, VAS 4.0 ± 1.8), moderate falls risk (FROP-Com 12–18, VAS 4.7 ± 3.0), and high falls risk (FROP-Com >19, VAS 3.7 ± 2.4) ($F = 0.397$; $p = 0.676$).

4. Discussion

This study highlights the high frequency of falls, and increased falls risk and balance impairment in older women with OA and RA, compared to an age matched group of healthy women.

Sixty-five percent of both the OA and RA women reported falling at least once in the preceding 12 months, compared to 30–35% in community-dwelling older people.[35] High rates of falls of at least 50% have been reported in other samples of people with OA or RA.[9–11] Given that our study, and these other studies have utilized

Table 3
Comparison of balance and mobility measures between participants with OA, RA, and healthy aged-matched women.

	OA ($n = 17$) [Mean (SD)]	RA ($n = 17$) [Mean (SD)]	Effect size of difference between OA and RA participants	Healthy comparison group ($n = 17$) [Mean (SD)]	*p* value[a]
Falls risk					
-FROP-Com without home assessment	11.7 (5.7)	14.7 (5.2)	0.55	4.6 (2.5)	<0.001*
Human Activity Profile	59.4 (13.7)	54.8 (10.3)	0.38	73.1 (5.2)	<0.000*
Modified Falls Efficacy Scale[b]	9.0 (1.2)	8.4 (1.3)	0.48	9.8 (0.4)	0.001*
Static balance (Bonferoni – $p < 0.05$)					
Clinical Test of Sensory Interaction on Balance; EC Foam (s)	26.4 (8.0)	26.5 (9.2)	0.01	28.8 (4.2)	0.484
Dynamic balance – self perturbation (Bonferroni – $p < 0.0125$)[c]					
Functional Reach Test (cm)	27.0 (6.4)	28.2 (6.8)	0.18	32.9 (4.9)	0.016
Step test – worse leg (no. in 15 s)	15.5 (4.2)	13.8 (4.2)	0.40	18.9 (1.9)	0.001**
Limits of stability–composite MXE (%) – NeuroCom	88.5 (9.3)	78.3 (15.4)	0.83	92.9 (8.4)	0.003***
Limits of stability -composite reaction time (s) – NeuroCom	0.93 (0.27)	1.09 (0.21)	0.67	0.87 (0.20)	0.025
Dynamic balance – external perturbation (Bonferroni – $p < 0.05$)					
Response to perturbation with distraction (cm) - Chattecx	1.35 (0.56)	1.61 (0.56)	0.46	0.99 (0.29)	0.007*
Leg strength (Bonferroni – $p < 0.05$)					
Sit to stand – rising index (% body weight)	15.5 (6.3)	13.2 (4.0)	0.45	18.7 (5.9)	0.021*
Gait measures (Bonferroni – $p < 0.0125$)					
Step width (cm)	17.0 (3.7)	14.6 (4.4)	0.59	14.2 (2.8)	0.083
Clinical gait velocity (m/min)	74.3 (14.5)	68.4 (15.7)	0.39	85.7 (14.9)	0.011**
Step and Quick Turn – sway (for worse direction) (deg/s)	47.1 (19.0)	41.8 (11.7)	0.35	31.7 (9.0)	0.008**
Timed Up and Go (s)	10.4 (2.3)	10.9 (2.3)	0.22	8.3 (1.4)	0.003**

*Significant difference ($p < 0.05$) between the healthy group and both arthritis groups, but no difference between the two arthritis groups.
**Significant difference ($p < 0.0125$) between the healthy group and both arthritis groups, but no difference between the two arthritis groups.
***Significant difference ($p < 0.0125$) between the RA group, and both the healthy group and the OA group.
FROP-Com = Falls Risk for Older People – Community Setting; MXE = maximum excursion; OA = osteoarthritis; RA = rheumatoid arthritis; SD = standard deviation.
[a] Based on one-way analysis of variance. For significant *p* values, post hoc analysis was undertaken to determine between which pairs there was a significant difference.
[b] Skewed data for healthy group, therefore, nonparametric analysis (Kruskal Wallis test) conducted.
[c] A Bonferroni adjustment was made where several tests were assessing the same subdomain – significance values are denoted in brackets.
Shaded rows indicate measures where lower score indicates better performance.

Table 4
Proportion of participants rated as moderate-to-high risk (score 2 or 3) on each risk factor for FROP-Com.

	Osteoarthritis ($n = 17$)	Rheumatoid arthritis ($n = 17$)	Healthy age matched ($n = 17$)
Injuries associated with falls in past 12 mo	4 (23.5%)	4 (23.5%)	0
Taking medications associated with increased falls risk	0	1 (5.9%)	0
Inappropriate footwear	4 (23.5%)	3 (17.6%)	2 (11.8%)
Reduced food intake in past 3 mo	1 (5.9%)	1 (5.9%)	1 (5.9%)
Weight loss in past 3–12 mo	5 (29.4%)	4 (23.5%)	4 (23.5%)
Alcohol intake	7 (41.2%)	3 (17.6%)	3 (17.6%)
Under- or overestimation of abilities resulting in risk taking behavior or activity avoidance	0	2 (11.8%)	0
Unsteady on walking and turning (observation)	0	0	0
Low level of physical activity	2 (11.8%)	2 (11.8%)	1 (5.9%)
Dichotomous variables (% rated as yes)			
Uncorrected sensory loss			
Vision	8 (47.1%)	6 (35.3%)	5 (29.4%)
Somatosensory	1 (5.9%)	4 (23.5%)	2 (11.8%)
Foot problems	10 (58.8%)	16 (94.1%)	7 (41.2%)
Inappropriate/unsafe footwear	4 (23.5%)	3 (17.6%)	2 (11.8%)
Incontinent	4 (23.5%)	6 (35.3%)	0
Frequent nocturnal toileting	5 (29.4%)	2 (11.8%)	1 (5.9%)
Assistance required for Instrumental Activities of Daily Living	3 (17.6%)	9 (52.9%)	0

FROP-Com = Falls Risk for Older People – Community Setting.

retrospective recall over a 12-month period to determine falls, and that retrospective recall has been shown to underestimate falls compared to prospective data collection using falls calendars,[36] actual falls rates may be even higher. As such, older people with lower limb arthritis should be assessed for falls risk, and be considered for falls prevention interventions.

On the majority of the measures of falls incidence, falls risk, balance and mobility measures, the increased risk seen was evident in the OA and the RA samples, compared to the aged-matched comparison sample. Few studies have previously compared falls, balance and mobility outcomes between people with OA and RA. One study that did make similar comparisons identified poorer endurance in a sample with OA compared to a group with RA, but did not find any between-group differences in balance performance.[18] The present study utilized a limited set of measures of balance (single leg stance, bilateral stance with eyes closed, walking forward on a line, and an alternate arm and leg flexion task), and reduced the sensitivity to identifying group differences by collapsing data to a 0–2 scale for each measure. A range of tasks were selected for the current study to reflect the multidimensional nature of balance performance, and to provide sensitive measurement of performance, including static stance, stepping, reaching/leaning and turning tasks, and response to external perturbations, which reflect the common circumstances in which falls can occur. In contrast to the results of the study of Ekdahl et al,[18] the current study identified a trend for reduced balance performance in the RA group on most of the balance measures, although this difference was only statistically significant for the Limits of Stability Maximum Excursion measure. Several of the pairwise comparisons between the OA and RA groups approached significance in the post hoc analyses (data not shown), suggesting that the relatively small sample size for each group may have resulted in reduced ability to identify statistically significant findings. Possible factors contributing to this trend for poorer balance performance in the RA group compared to the OA group may be muscle wasting associated with joint inflammation evident in RA patients, or potentially greater levels of joint destruction in the RA group. Other measures such as the Clinical Test of Sensory Interaction on Balance (Eyes closed on foam) did not differ between the OA and RA groups. This test condition primarily assesses integrity of the vestibular system, which may explain why no difference was observed in this test in these clinical groups. Further research is required to reinforce findings from the present study, and to investigate contributory factors to differences identified between people with OA and RA.

The broad range of falls risk factors rated as moderate or high risk in the OA and RA samples highlights the importance for clinicians to ask questions routinely about falls, unsteadiness, and falls risk factors, in order to obtain a comprehensive perspective of the individual's falls risk profile. Responses to these assessment items may be used as a basis for determining an appropriate intervention program. There were some differences in the most common risk factors rated as moderate-to-high risk in the two samples of participants with arthritis, with the biggest difference in frequency of foot problems [94.1% (95% confidence interval 82.9–100.00) in the RA sample, and 58.8% (95% confidence interval 35.4–82.2) in the OA sample]. Foot problems, uncorrected vision impairment, incontinence, and alcohol intake were the most commonly reported risk factors for the arthritis groups. Although these common risk factors provide some guidance as to the most common risk factors to assess for, and to incorporate into multifactorial interventions, they also highlight the importance for clinicians to utilize a validated falls risk assessment tool to facilitate identification of risk factors. The FROP-Com tool used in this study has been used to discriminate falls risk in a variety of samples including older fallers presenting to emergency departments,[22,37] older people with mild-to-moderate Alzheimer's disease,[38] and patients with stroke.[39] The tool takes approximately 20 minutes to administer, and has guidelines for administration, and for suggested intervention options to consider. The results of this study reinforce the utility of the tool in people with OA and RA.

The study results demonstrate the presence of balance impairments in the OA and RA groups across a variety of balance-related tasks, including both static tasks, and dynamic tasks involving reaching, stepping, and turning. Identifying balance impairments across differing tasks provides a basis for selecting targeted exercises to address specific balance impairments. Exercise programs that incorporate balance training alone or in combination with other exercise types (e.g., strength training or cardiovascular training) have been shown to reduce falls in older people,[40] however this approach using land-based exercises has not been specifically investigated in samples of people with OA or RA in randomized controlled trials.[7,41] Although it has been argued that some of the successful randomized trials in older people have included at least some participants with arthritis, there is usually little detail about type or severity of arthritis, and none have undertaken subanalyses

of the outcomes for participants with arthritis. There are some factors that might limit the generalizability of exercise approaches shown to be effective in older people generally to older people with arthritis. The presence or potential to exacerbate pain during balance exercises is one factor that may suggest that extra care is needed as a minimum, or that in some cases, different exercises are required. A recent study by our team has shown that a modified version of the physiotherapist-prescribed, home-based Otago exercise program,[42] which incorporates some additional higher level balance, could be safely implemented in women with OA and RA. Participants showed significant improvements in falls risk, activity level, fear of falling, functional reach, rising index for sit to stand, and step width in walking.[12] This study was limited by a pre–post design, but the positive results suggest further research using a randomized trial design is warranted. Hydrotherapy is another exercise approach that has been recommended to achieve a range of physical health benefits for people with lower limb arthritis. However, a recent randomized trial incorporating balance and resistance-type exercises in water did not reduce falls risk or improve balance or mobility, compared to a group randomized to a time-matched computer training program.[43]

There were several limitations to this study. The sample was a volunteer rather than a representative sample, so care must be made in generalizing these results to the wider population with lower limb arthritis. The limited number of health conditions used as exclusion criteria means that some participants with arthritis may have had other health problems contributing to their balance impairment. In addition, the control group participants did not undergo rigorous screening of their health status, so some may have had subclinical health problems that might have affected their balance performance. The use of 12-month retrospective falls recall may have resulted in under-reporting of falls. There is a higher proportion of women with arthritis in the community,[1] and gender effects have been previously demonstrated on some balance and mobility related tasks,[44] therefore, the study sample was restricted to females. A similar study involving men with arthritis is warranted.

5. Conclusions

The results of this study demonstrated high risk of falls and balance and mobility impairment in older women with OA and RA. There were some differences in falls circumstances, and falls risk factor profile between these two groups, highlighting the importance of falls risk assessment in people with OA or RA. However, on most balance and mobility tasks, both groups of arthritis participants demonstrated similar increased levels of impairment across several balance domains. Given the moderate levels of balance impairment identified, future research should investigate the effectiveness of balance exercise programs, and multifactorial falls prevention programs, addressing identified falls risk factors, for older people with OA or RA.

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