ACRM
AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2014;95:2376-81

ORIGINAL ARTICLE

Sex Differences in Patients With Different Stages of Knee Osteoarthritis

David S. Logerstedt, PT, PhD, MPT, Joseph Zeni Jr, PT, PhD, Lynn Snyder-Mackler, PT, ScD

From the Department of Physical Therapy, University of Delaware, Newark, DE.

Abstract

Objective: To quantify the differences in physical impairments and in performance-based measures and patient-reported outcomes in men and women seeking nonoperative management of symptomatic moderate knee osteoarthritis (OA) and those with symptomatic end-stage knee OA scheduled for total knee arthroplasty compared with healthy controls.

Design: Cross-sectional analysis of individuals referred to physical therapy, community participants, and subjects from a 2-year longitudinal study.

Setting: University research department.

Participants: Cross-sectional analysis of participants (N=289) consisting of a moderate OA group (n=83), a severe OA group (n=143), and a healthy control group (n=63).

Interventions: Not applicable.

Main Outcome Measures: Quadriceps strength, timed Up and Go test, stair-climbing test, 6-minute walk test, Knee Outcome Survey—Activities of Daily Living Scale (KOS-ADLS), and Physical Component Summary (PCS) of the Medical Outcomes Study 36-Item Short-Form Health Survey.

Results: Women had worse scores than men for physical impairment and performance-based measures ($P<.001$). In the moderate OA group, women had significantly lower KOS-ADLS ($P=.007$) and PCS ($P=.026$) scores than men, with no differences seen between sexes in the other 2 groups for patient-reported measures.

Conclusions: Differences between women and men with knee OA on physical impairments and performance-based measures are not echoed in the differences seen in patient-reported measures. These measures signal different domains of knee function in patients with knee OA and should be used as part of a comprehensive functional evaluation.

Archives of Physical Medicine and Rehabilitation 2014;95:2376-81

Osteoarthritis (OA) of the knee is characterized by degeneration of the articular cartilage, morphologic changes to the subchondral bone, and damage to the surrounding soft tissue.[1] These structural changes lead to joint pain, quadriceps muscle weakness, reduced range of motion, and joint instability.[2,3] As a result, most individuals with symptomatic knee OA report difficulty with walking, stair climbing, rising from a car, or carrying heavy loads.[4]

One of the challenges when studying patients with knee OA is capturing changes in impairments, activity limitations, and participation restrictions that occur over time but progress at different rates depending on the participant. One method to address this challenge is through a cross-sectional design that permits researchers to study participants at similar stages of OA. Studying patients at different stages of knee OA may provide critical information about how patients perform and function.

Although activity limitations and reduced quality of life are pervasive in this patient population, these deficits are most commonly assessed using patient self-report questionnaires.[5-7] Patient-reported questionnaires are easy and inexpensive to administer in this population; however, these metrics tend to be driven by pain.[8-11] Performance-based assessments are required to obtain a more complete picture of functional limitations in this patient population.[9,12] Therefore, performance-based and patient-

Supported by the National Institutes of Health (grant nos. R01HD041055, K12 HD055931, T32HD7490, P20RR16458) and by the Foundation for Physical Therapy—Promotion of Doctoral Studies I Scholarship.

Disclosures: none.

0003-9993/14/$36 - see front matter © 2014 by the American Congress of Rehabilitation Medicine
http://dx.doi.org/10.1016/j.apmr.2014.07.414

reported outcome measures should be included as part of a comprehensive patient profile to accurately assess multiple domains of physical function and disability in patients with joint pain. A comprehensive physical assessment may enhance clinical decision-making, expedite recovery during rehabilitation, identify the need for additional interventions, or provide an objective assessment on the need for total joint replacement.

The prevalence and incidence of knee OA is influenced by sex differences. The prevalence and severity of knee OA are significantly higher in older women compared with older men.[13,14] Furthermore, the lifetime risk after the age of 25 years of having a total knee arthroplasty (TKA) is higher in women than in men.[15] Function and quality of life are also substantially reduced in women with knee OA compared with men with knee OA. Women who are candidates for TKA are weaker and they walk and climb stairs more slowly than their male counterparts.[16,17] The contribution of sex on different stages of knee OA may inform clinicians about its impact on knee function and on the rehabilitation management of patients with knee OA.

The purpose of this study was to quantify the differences in physical impairments and in performance-based and patient-reported outcomes in men and women seeking nonoperative management of symptomatic moderate knee OA and those with symptomatic end-stage knee OA scheduled for TKA compared with healthy control subjects. We hypothesized that women would have worse scores than men, regardless of whether they were seeking nonoperative management for symptomatic moderate knee OA or TKA to manage the pain and symptoms of end-stage knee OA.

Methods

Participants

This is a cross-sectional analysis of 289 participants. The moderate OA group (n=83) consisted of individuals with unilateral knee OA who were referred to our clinic by their treating physician to obtain a functional assessment and to manage the pain and impairments associated with symptomatic knee OA. The severe OA group (n=143) consisted of individuals with end-stage, unilateral knee OA who were scheduled for unilateral TKA within the next 2 to 4 weeks. These patients had participated in a 2-year longitudinal study[17] investigating clinical and functional outcomes after TKA. Patients in the moderate OA group and the severe OA group had symptomatic knee OA with at least grade 3 on the Kellgren-Lawrence grading scale. All subjects in the moderate OA group were not seeking surgical intervention to manage their knee pain and symptoms, whereas all subjects in the severe OA group were scheduled for TKA within 2 weeks. The control group (n=63) consisted of healthy individuals recruited through community advertisements. All subjects in the control group had no lower extremity joint pain or a history of diagnosed knee abnormalities and were eligible if they were in the same age ranges as the moderate and severe OA groups. Exclusion criteria for the moderate and severe OA groups included any lower extremity musculoskeletal abnormalities other than unilateral knee OA, contralateral knee pain greater than 4/10 on a verbal rating scale, and planned staged TKA on the contralateral knee. Exclusion criteria for all groups included cardiovascular disease, neurologic impairments, or any other physical limitations that affected activities of daily living. Similar numbers of men (n=153) and women (n=136) were assessed. Demographic data for all groups are presented in table 1. All subjects gave informed consent at the time of inclusion. The study was approved by the Human Subjects Institutional Review Board at the University of Delaware.

Table 1 Demographic data for all groups

Characteristics	Control Group (n=63)	Moderate OA Group (n=83)	Severe OA Group (n=143)
Men/women	26/37	51/32	76/67
Age (y)	63.00±8.4	58.06±10.00*	65.09±8.48
BMI (kg/m^2)	26.78±4.26†	31.49±5.81	31.05±5.15

NOTE. Values are n or mean ± SD.
Abbreviation: BMI, body mass index.
* Moderate OA group significantly different than control and severe OA groups ($P<.05$).
† Control group significantly different than moderate and severe OA groups ($P<.05$).

List of abbreviations:

KOS-ADLS	Knee Outcome Survey–Activities of Daily Living Scale
MVIC	maximal voluntary isometric contraction
NMVIC	normalized maximal voluntary isometric contraction
OA	osteoarthritis
PCS	Physical Component Summary
SCT	stair-climbing test
SF-36	Medical Outcomes Study 36-Item Short-Form Health Survey
6MWT	6-minute walk test
TKA	total knee arthroplasty
TUG	timed Up and Go

Measures

Patients were tested using 1 physical impairment measure (maximal quadriceps force), 3 performance-based tests (timed Up and Go [TUG], stair-climbing test [SCT], 6-min walk test [6MWT]), and 2 patient-reported questionnaires (Knee Outcome Survey–Activities of Daily Living Scale [KOS-ADLS], Physical Component Summary [PCS] of the Medical Outcomes Study 36-Item Short-Form Health Survey [SF-36]). These tests and questionnaires are components of the Delaware Osteoarthritis Profile and have been used to measure functional ability before and after TKA.[12,18]

Quadriceps strength testing

Quadriceps strength testing consisted of maximal voluntary isometric contraction (MVIC) on an electromechanical dynamometer.[19,a] Patients performed up to a maximum of 3 MVICs. Verbal encouragement from the therapist and visual feedback from the dynamometer's real-time visual display were used to help facilitate maximal effort. Customized software written code[b] was used to determine the MVIC force in newtons and then normalized to body mass index as normalized maximal voluntary isometric contraction (NMVIC).

Performance-based measures

The TUG test assesses the time it takes for a patient to rise from an armed chair, walk 3m as fast and safely as possible, turn around, walk back 3m to the chair, and return to the seated position.[8,20] Patients were permitted to use the arms of the chair to rise from and sit down in the chair. The time was recorded with a standard stopwatch. The