



Objectively Measured Physical Activity and Symptoms Change in Knee Osteoarthritis

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ABSTRACT

OBJECTIVE: The study objective was to quantify the association between daily physical activity measured by accelerometer and 1-year changes in symptoms among people with knee osteoarthritis.

METHODS: Participants from the Osteoarthritis Initiative had knee radiographs and physical activity assessed using GT1M ActiGraph (Pensacola, FL) uniaxial accelerometers at the 48-month visit. Physical activity was calculated and categorized as tertiles of average daily minutes in light and moderate-to-vigorous activity. Outcomes were 1-year change in symptoms measured by Western Ontario and McMaster Universities scales, including pain, stiffness, and physical function. Adjusted multivariable linear models estimated the relationship between tertiles of light or moderate-to-vigorous physical activity and changes in knee symptoms.

RESULTS: Among 1059 participants (55% were women; mean age, 66 ± 9 years), greater time in light activity was associated with a trend toward declined physical function ($P = .01$). Greater time in daily moderate-to-vigorous activity also was associated with declined physical function ($P = .01$) and increased pain ($P = .08$). None of these average changes in symptoms reached minimally important clinical differences. However, greater daily time in both activities was associated with a higher probability of worsening symptoms among persons with Kellgren–Lawrence grade 4 osteoarthritis.

CONCLUSIONS: Objectively measured daily activity was not associated with 1-year symptom improvements among community-dwelling adults with knee osteoarthritis. In those with advanced disease (Kellgren–Lawrence grade 4), greater daily minutes in physical activity were associated with worsening symptoms. How best to implement exercise regimens in persons with advanced knee osteoarthritis to reduce the deleterious impact on symptoms needs to be explored.

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KEYWORDS: Knee osteoarthritis; Patient-reported outcomes; Physical activity

Knee osteoarthritis is a leading cause of pain and functional limitations among older adults.^{1,2} Although no effective remedy for osteoarthritis exists, the American

College of Rheumatology and the US federal government recommend self-management strategies, such as regular physical activity.^{3,4} The beneficial effects of physical activity among patients with osteoarthritis generally are supported through randomized clinical trials.⁵ These trials vary in duration, intensity, and type of interventions; have selective populations, such as those with milder conditions who received intense encouragement and monitoring; and assess outcomes over short periods of time, all of which reduce generalizability to activities of normal daily living.^{5,6}

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The details related to different levels of intensity, type, and duration for daily physical activity needed to improve symptoms and function among osteoarthritis populations are limited and contradictory.⁷⁻⁹ Nonexperimental studies examining the association between physical activity and symptoms have been cross-sectional or have used self-reported questionnaires to quantify activity.^{8,10-12} Longitudinal studies to quantify the impact of varying levels of intensity with regard to activities of daily living on pain, stiffness, and function in patients with knee osteoarthritis using objectively measured physical activity are needed to understand what intensity of activities should be recommended in what types of patients with osteoarthritis to improve symptoms.

The Osteoarthritis Initiative (OAI) data provide an opportunity to investigate the association between physical activity on 1-year changes in symptoms because they offer a subcohort with objectively measured physical activity and comprehensive examinations of knee symptoms. The current study will quantify the association of objectively measured physical activity of daily living on changes in symptoms in persons with knee osteoarthritis and evaluate the extent to which the observed association is similar across levels of disease severity. We hypothesized (1) that greater daily minutes of physical activity at baseline would be associated with improved symptoms over a 1-year period among patients with knee osteoarthritis and (2) that beneficial effects may not be observed across all levels of disease severity.

MATERIALS AND METHODS

This study used publicly available data from the OAI.¹³ The University of Massachusetts Institutional Review Board considered this study exempt.

Design and Setting Overview

The OAI was a prospective study examining the development and progression of knee osteoarthritis in adults aged 45 to 79 years at enrollment. The OAI enrolled 4796 adults (2004-2006) with symptomatic osteoarthritis in at least 1 knee or at least 1 established risk factor for knee osteoarthritis. Participants had annual follow-up examinations. Accelerometer monitoring data were collected on a subcohort of participants at the 48-month follow-up visit, considered the baseline assessment for this study (n = 2127; 78.4% of eligible) (Figure 1).

CLINICAL SIGNIFICANCE

- Greater time spent in light or moderate-to-vigorous activity was not associated with improved symptoms over 1 year.
- In those with advanced knee osteoarthritis (Kellgren–Lawrence grade 4), greater time spent in daily light and moderate levels of daily activities were associated with higher probabilities of worsening symptoms.
- Recommendations for physical activity in osteoarthritis should take stages of disease into account.

Study Participants

We identified 1225 participants with radiographic knee osteoarthritis at baseline in at least 1 knee (Kellgren–Lawrence grade ≥ 2).¹⁴ To provide a sufficient estimation of physical activity based on the accelerometer, 1105 participants with 4 to 7 valid days (≥ 10 wear hours per day) of physical activity monitoring data were included.¹⁵ After excluding participants with missing outcome data (n = 46), the final sample included 1059 participants.

Patient-reported Osteoarthritis Symptoms

Participants completed the knee-specific Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index (Version LK 3.1) at annual evaluations. The WOMAC measured Pain (5 items), Stiffness (2 items), and Physical Function (17 items).¹⁶ Five Likert responses, ranging from 0 = none to 4 = extreme, were available for

each item. Responses to items of dimensions in Pain, Stiffness, and Physical Function were summed to establish subscale scores, with higher scores indicating worse symptoms of the knee or knee-related function. If participants had radiographic osteoarthritis in both knees, the worst WOMAC measurements were used. The primary outcome was the difference between 60-month follow-up visit scores and 48-month visit scores for each subscale.

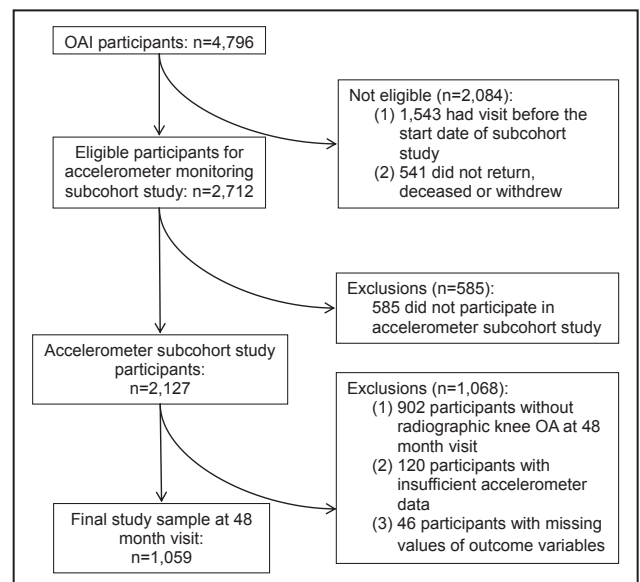


Figure 1 Flow of analytic sample of participants with accelerometer data through study follow-up. OA = osteoarthritis; OAI = Osteoarthritis Initiative.

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