Massage Therapy for Osteoarthritis of the Knee

A Randomized Controlled Trial

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Background: Massage therapy is an attractive treatment option for osteoarthritis (OA), but its efficacy is uncertain. We conducted a randomized, controlled trial of massage therapy for OA of the knee.

Methods: Sixty-eight adults with radiographically confirmed OA of the knee were assigned either to treatment (twice-weekly sessions of standard Swedish massage in weeks 1-4 and once-weekly sessions in weeks 5-8) or to control (delayed intervention). Primary outcomes were changes in the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain and functional scores and the visual analog scale of pain assessment. The sample provided 80% statistical power to detect a 20-point difference between groups in the change from baseline on the WOMAC and visual analog scale, with a 2-tailed $\alpha$ of .05.

Results: The group receiving massage therapy demonstrated significant improvements in the mean (SD) WOMAC global scores (−17.44 [23.61] mm; $P < .001$), pain (−18.36 [23.28]; $P < .001$), stiffness (−16.63 [28.82] mm; $P < .001$), and physical function domains (−17.27 [24.36] mm; $P < .001$) and in the visual analog scale of pain assessment (−19.38 [28.16] mm; $P < .001$), range of motion in degrees (3.57 [13.61]; $P = .03$), and time to walk 50 ft (15 m) in seconds (−1.77 [2.73]; $P < .01$). Findings were unchanged in multivariable models controlling for demographic factors.

Conclusions: Massage therapy seems to be efficacious in the treatment of OA of the knee. Further study of cost effectiveness and duration of treatment effect is clearly warranted.

Trial Registration: clinicaltrials.gov Identifier: NCT00322244

Arch Intern Med. 2006;166:2533-2538

Osteoarthritis (OA) afflicts as many as 21 million Americans. It is a dynamic process involving an imbalance in tissue homeostasis with cartilage, synovial fluid, subchondral bone, and other joint tissues and structures and becomes more prevalent with advancing age. By 2020, more than 50 million Americans will have OA, which is the most frequently reported chronic condition in the elderly population. The Centers for Disease Control and Prevention highlights OA as a chronic condition that causes more physical limitation than lung and heart disease and diabetes mellitus. The total cost of OA was estimated at $60 billion in 2004. Osteoarthritis of the hip or knee is particularly disabling because it limits ambulation, but the affliction also strikes the hands, the spine, and the feet with the same destructive joint process. The end point of the OA disease process is total loss of joint cartilage in the affected area and the need for joint replacement.

Conventional treatments for OA include pain medication (nonsteroidal anti-inflammatory drugs and cyclooxygenase-2 inhibitors), exercises, hot and cold therapy, corticosteroid injections, and, eventually, surgery to repair the joint. Despite conventional treatment, OA is often progressive and frequently leads to chronic pain and disability. The potential toxic effects of drugs used commonly to treat OA have been especially newsworthy of late.

Massage therapy may diminish symptoms and improve the course of OA by increasing local circulation to the affected joint, improving the tone of supportive musculature, enhancing joint flexibility, and relieving pain. Massage therapy has been evaluated and found to be effective for various painful musculoskeletal con-
cates no pain; 100 mm, worst pain ever). Written confirma-
tion of OA of the knee was provided by the patient’s physi-
cian. Patients with bilateral knee involvement had the more
severely affected knee designated as the study knee.

Exclusion criteria were the presence of rheumatoid arthri-
tis; fibromyalgia; recurrent or active pseudogout, cancer, or other
serious medical conditions; signs or history of kidney or liver
failure; asthma requiring use of corticosteroids; use of oral
corticosteroids within the past 4 weeks, intra-articular knee de-
pocorticosteroids within the previous 3 months, or intra-
articular hyaluronate within the previous 6 months; arthroscopy
of the knee within the previous year; significant injury to the
knee within the previous 6 months; or a rash or open wound
over the knee.

Participant recruitment involved informational letters to pa-
tients with OA at the Arthritis and Rheumatic Diseases Center at
Saint Barnabas Ambulatory Care Center and institutional review
board–approved fliers distributed at the Saint Barnabas Ambula-
tory Care Center and nearby senior living facilities and to prac-
ticing primary care physicians in the area. Volunteers were
screened for eligibility over the telephone.

RANDOMIZATION AND SAMPLE SIZE

A research coordinator randomly assigned enrolled partici-
pants to receive either 8 weeks of massage therapy interven-
tion (hereafter, the intervention group) or 8 weeks of usual care
on a wait-list (hereafter, the control group) followed by the in-
tervention using a computer-generated, blocked (blocks of 6)
protocol for the study intervention, which included pétrissage
(compression or manipulation of soft tissue between the fin-
gers and thumb), effleurage (gliding of hands over the skin or soft
tissues), and tapotement (percussion-based massage where
hands strike soft tissue in a repetitive, rhythmic fashion) tech-
niques used at the therapists’ discretion. Massage sessions
were 1-hour long. Usual care included pain medications, ex-
ercises, or hot and cold therapy.

Initial (weeks 1-4) treatments were given with greater fre-
quence (twice weekly) to build a loading dose of massage treat-
ments, followed by once-weekly massage sessions for weeks 5
through 8. Participants remained supine or prone for the full
hour of treatment, turning over at roughly the halfway point.
To minimize practitioner variability of treatment, a standard
protocol incorporating specific strokes (effleurage, pétrissage,
and tapotement) was used; however, a particular sequence of
strokes was not specified. Study personnel met with the mas-
sage therapists at regular intervals to assure compliance with
the protocol. The control group continued to receive conven-
tional medical care during the initial intervention period, then
crossed over to receive massage (weeks 9-16) after an initial
8-week delay. Study personnel prompted subjects for all sched-
uled appointments to minimize attrition.

OUTCOME MEASUREMENTS

All measurements were collected at baseline and after comple-
tion of intervention (at weeks 8 and 16) in both groups. Demo-
graphic data and medical history were documented by the re-
search coordinator. Participants were instructed to keep a daily
medication usage diary.

The WOMAC is a self-administered 3-dimensional ques-
tionnaire that assesses pain, stiffness, and physical functional
disability in patients with knee and hip OA using a series of 24
questions. A negative change in WOMAC scores from base-
line indicates improvement of symptoms and limitation whereas
a positive change indicates deterioration of symptoms and limi-
tation. All 24 WOMAC items are rated on a numerical rating
scale (in millimeters) ranging from 0 (no symptoms/no limi-
tation) to 100 (maximal symptoms/maximal limitation). The
WOMAC scores were standardized by calculating the mean of
the corresponding unweighted item scores in each dimen-
sion. Additional outcome measures assessed at each visit in-
cluded the VAS for pain assessment, which is a 100-mm-long
visual scale on which the participant draws a line to designate
their level of pain at interview; time in seconds to walk a 50-ft
(15-m) straight path; range of motion in degrees using a stan-
dard goniometric assessment as performed by a trained re-
search assistant at the center; and adverse events (complaint, sys-
tem, and severity) were recorded by the research coordinator
during her routine weekly telephone call to each participant.

STATISTICAL ANALYSIS

Descriptive statistics for each relevant variable at baseline were
determined to justify parametric methods. Continuous data are

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presented as mean (SD) in the text and tables. The paired t test was used to examine the change in scores from baseline to follow-up examination. Changes in WOMAC and VAS scores, time to walk 50 ft (15 m), and the clinical assessment for range of motion between the treatment groups were measured using repeated measures analysis of variance. The 95% confidence intervals were determined for changes from baseline. The combined effect of independent variables (demographics, body mass index, baseline WOMAC and VAS scores, and investigators’ baseline assessment for range of motion) and treatment assignment on WOMAC and VAS scores, time to walk 50 ft (15 m), and the clinical assessment for range of motion was assessed with multivariable models using analysis of variance. The WOMAC findings were validated with the VAS findings and the clinical assessment for range of motion using correlation coefficients. Analysis followed an intention to treat design (ie, the last value carried forward). Data were analyzed using SAS statistical software (version 8.2; SAS Institute, Cary, NC). Significance for the 2-tailed t test was set at $P<.05$.

## RESULTS

### PARTICIPANTS

Of 210 candidates screened, 68 subjects participated (34 subjects per group) (Figure). Approximately 82 (39%) of those screened were ineligible, and 60 (28%) were unable to complete screening or were uninterested. The study groups were comparable at baseline (Table 1); however, the mean (SD) WOMAC pain score was higher ($P=.02$) in the intervention group (52.10 [18.82] mm) vs the control group (40.69 [20.01] mm) at baseline. The stiffness, functionality, global, VAS, and range of motion scores at baseline did not differ between groups.

### EFFICACY RESULTS

The mean (SD) WOMAC global score improved significantly from baseline value ($−21.15 [22.46]$ mm; $P<.001$), as did the score in each domain (pain, stiffness, and physical functional disability) (Table 2). The greatest improvement from baseline in the intervention group was observed in pain ($−23.19 [24.30]$ mm; $P<.001$) followed by stiffness ($−21.60 [26.99]$ mm; $P<.001$) and physical function ($−20.50 [22.50]$ mm; $P<.001$). No significant change was observed in the control group from baseline in any of the domains. Improvements observed in the intervention group differed significantly from the control group (pain: $−23.19 [24.30]$ mm vs $−3.08$ [17.38] mm, $P<.001$; stiffness: $−21.60 [26.99]$ mm vs $−4.29$ [24.18] mm, $P=.007$; physical functional disability: $−20.50 [22.50]$ mm vs $−0.02$ [16.37] mm, $P=.002$; and global score: $−21.15 [22.46]$ mm vs $−4.56$ [15.85] mm, $P<.001$).

A similar pattern was observed in the VAS and the clinical assessment for range of motion. The change observed in VAS was highly correlated to the change in the WOMAC global score ($r=0.84$; $P<.001$). Findings persisted after controlling for demographic and baseline clinical values.

The control group in this trial received the intervention after an initial delay of 8 weeks and thus became a second intervention group during weeks 9 to 16 (Figure). Within-group intervention effects for the entire, pooled study sample are thus available and are shown in Table 2. The mean (SD) WOMAC global scores improved significantly from baseline ($−19.38 [28.16]$ mm; $P<.001$). Significant improvement was observed in all domains (pain: $−18.36$ [23.28] mm, $P<.001$; stiffness: $−16.63$ [28.82] mm, $P<.001$; and physical functional disability: $−17.27$ [24.36] mm, $P<.001$) of the WOMAC score. The VAS and range of motion scores also improved significantly from baseline ($−19.38 [28.16]$ mm, $P<.001$; and 3.57 [13.61], $P=.03$, respectively).

At the 16-week assessment, improvements seen in the intervention group (massage intervention ceased at 8 weeks) largely persisted (Table 3). Comparing the improvements observed in the intervention group at week

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### Table 1. Demographic and Baseline Characteristics by Treatment Group

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Intervention ($n = 34$)</th>
<th>Control ($n = 34$)</th>
<th>$P$ Value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>70.4 (11.3)</td>
<td>66.2 (11.3)</td>
<td>.13</td>
</tr>
<tr>
<td>BMI</td>
<td>28.1 (7.8)</td>
<td>29.0 (6.7)</td>
<td>.59</td>
</tr>
<tr>
<td>Sex, No. (%)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7 (20)</td>
<td>8 (23)</td>
<td>.77†</td>
</tr>
<tr>
<td>Female</td>
<td>27 (79)</td>
<td>26 (76)</td>
<td></td>
</tr>
<tr>
<td>Race, No. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>29 (85)</td>
<td>29 (85)</td>
<td>&gt;.99†</td>
</tr>
<tr>
<td>Other</td>
<td>5 (14)</td>
<td>5 (14)</td>
<td></td>
</tr>
<tr>
<td>WOMAC score, mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>40.6 (20.0)</td>
<td>52.10 (18.8)</td>
<td>.02</td>
</tr>
<tr>
<td>Stiffness</td>
<td>52.3 (21.4)</td>
<td>60.34 (18.8)</td>
<td>.11</td>
</tr>
<tr>
<td>Functionality</td>
<td>49.2 (21.6)</td>
<td>55.1 (18.8)</td>
<td>.23</td>
</tr>
<tr>
<td>Global</td>
<td>47.6 (19.9)</td>
<td>54.9 (17.9)</td>
<td>.12</td>
</tr>
<tr>
<td>VAS pain score, mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range of motion, degree</td>
<td>115.6 (13.4)</td>
<td>109.8 (16.7)</td>
<td>.11</td>
</tr>
<tr>
<td>Time to walk 50 ft (15 m), s</td>
<td>15.6 (8.3)</td>
<td>16.7 (5.6)</td>
<td>.50</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); VAS, visual analog scale; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

*Values are presented as mean (SD) except where noted.
†$P$ values were obtained from 2-tailed $t$ test.
‡$P$ values obtained from $\chi^2$ test.
At 16-wk Follow-up
Pooled Analysis

### Table 2. Change in Outcome Measures from Baseline at 8 and 16 Weeks*

<table>
<thead>
<tr>
<th>Variable</th>
<th>At 8-wk Follow-up</th>
<th>At 16-wk Follow-up</th>
<th>P</th>
<th>Effect Size, d</th>
<th>P</th>
<th>Total for Both Groups</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intervention</td>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group (n = 34)</td>
<td>Group (n = 34)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WOMAC score, mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>−23.19 (24.30)</td>
<td>−3.08 (17.58)</td>
<td>.001</td>
<td>.32</td>
<td>.08</td>
<td>−13.52 (21.49)</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>(−31.67 to 14.71)</td>
<td>(−9.21 to 3.06)</td>
<td></td>
<td>(−21.02 to −6.02)</td>
<td></td>
<td>(−23.99 to −12.72)</td>
<td></td>
</tr>
<tr>
<td>Stiffness</td>
<td>−21.60 (26.99)</td>
<td>−4.29 (24.18)</td>
<td>.001</td>
<td>.31</td>
<td>.04</td>
<td>−11.66 (30.13)</td>
<td>.03</td>
</tr>
<tr>
<td></td>
<td>(−31.02 to 12.19)</td>
<td>(−12.73 to 4.14)</td>
<td></td>
<td>(−22.17 to −1.15)</td>
<td></td>
<td>(−23.61 to −9.65)</td>
<td></td>
</tr>
<tr>
<td>Functionality</td>
<td>−20.50 (22.50)</td>
<td>−5.02 (16.37)</td>
<td>.001</td>
<td>.08</td>
<td>.74</td>
<td>−14.94 (26.02)</td>
<td>.003</td>
</tr>
<tr>
<td></td>
<td>(−28.35 to −12.65)</td>
<td>(−10.73 to 6.09)</td>
<td></td>
<td>(−23.12 to −4.97)</td>
<td></td>
<td>(−17.27 (24.36)</td>
<td></td>
</tr>
<tr>
<td>Global</td>
<td>−21.15 (22.46)</td>
<td>−4.56 (15.85)</td>
<td>.001</td>
<td>.10</td>
<td>.79</td>
<td>−13.73 (24.48)</td>
<td>.002</td>
</tr>
<tr>
<td></td>
<td>(−28.99 to −13.32)</td>
<td>(−10.09 to 9.79)</td>
<td></td>
<td>(−22.27 to −5.19)</td>
<td></td>
<td>(−17.44 (23.61)</td>
<td>.001</td>
</tr>
<tr>
<td>VAS pain score, mm</td>
<td>−22.59 (25.97)</td>
<td>−1.97 (21.07)</td>
<td>.001</td>
<td>.59</td>
<td>.80</td>
<td>−16.18 (30.24)</td>
<td>.004</td>
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<td></td>
<td>(−31.65 to −13.35)</td>
<td>(−9.32 to 5.38)</td>
<td></td>
<td>(−26.73 to −5.62)</td>
<td></td>
<td>(−19.38 (28.16)</td>
<td>.001</td>
</tr>
<tr>
<td>Range of motion, deg</td>
<td>7.15 (11.45)</td>
<td>−1.06 (14.20)</td>
<td>.001</td>
<td>.67</td>
<td>.61</td>
<td>−0.01 (14.78)</td>
<td>.99</td>
</tr>
<tr>
<td></td>
<td>(3.15 to 11.14)</td>
<td>(−6.01 to 3.89)</td>
<td></td>
<td>(−26.73 to −5.62)</td>
<td></td>
<td>(−21.60 (11.36)</td>
<td>.03</td>
</tr>
<tr>
<td>Time to walk 50 ft</td>
<td>−1.77 (2.73)</td>
<td>0.24 (4.81)</td>
<td>.001</td>
<td>.77</td>
<td>.50</td>
<td>0.03 (7.09)</td>
<td>.98</td>
</tr>
<tr>
<td>(15 m), s</td>
<td>(−2.72 to −0.82)</td>
<td>(−1.44 to 1.92)</td>
<td></td>
<td>(−2.44 to 2.50)</td>
<td></td>
<td>(−0.87 (6.41)</td>
<td>.19</td>
</tr>
</tbody>
</table>

### Table 3. Comparison Between Improvements Observed in the Intervention and Control Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Group at 8-wk Follow-up (n = 34)</th>
<th>Intervention Group at 16-wk Follow-up (n = 34)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOMAC score, mm</td>
<td>−3.08 (17.58)</td>
<td>−18.52 (22.51)</td>
<td>.002</td>
</tr>
<tr>
<td></td>
<td>(−9.21 to 3.06)</td>
<td>(−26.37 to −10.66)</td>
<td></td>
</tr>
<tr>
<td>Stiffness</td>
<td>−4.29 (24.18)</td>
<td>−15.51 (22.28)</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>(−12.73 to 4.14)</td>
<td>(−23.29 to −7.74)</td>
<td></td>
</tr>
<tr>
<td>Functionality</td>
<td>−5.02 (16.37)</td>
<td>−17.05 (20.15)</td>
<td>.009</td>
</tr>
<tr>
<td></td>
<td>(−10.73 to 6.69)</td>
<td>(−24.08 to −10.62)</td>
<td></td>
</tr>
<tr>
<td>Global</td>
<td>−4.56 (15.85)</td>
<td>−17.23 (19.98)</td>
<td>.005</td>
</tr>
<tr>
<td></td>
<td>(−10.09 to 0.97)</td>
<td>(−24.16 to −10.2)</td>
<td></td>
</tr>
<tr>
<td>VAS pain score, mm</td>
<td>−1.97 (21.07)</td>
<td>−17.15 (21.27)</td>
<td>.004</td>
</tr>
<tr>
<td></td>
<td>(−9.32 to 5.38)</td>
<td>(−24.57 to −9.73)</td>
<td></td>
</tr>
<tr>
<td>Range of motion, deg</td>
<td>−1.06 (14.20)</td>
<td>3.88 (13.61)</td>
<td>.15</td>
</tr>
<tr>
<td></td>
<td>(−6.01 to 3.89)</td>
<td>(−0.87 to 8.63)</td>
<td></td>
</tr>
<tr>
<td>Time to walk 50 ft</td>
<td>0.24 (4.81)</td>
<td>−2.28 (3.96)</td>
<td>.02</td>
</tr>
<tr>
<td>(15 m), s</td>
<td>(−1.44 to 1.92)</td>
<td>(−3.96 to −0.90)</td>
<td></td>
</tr>
</tbody>
</table>

### Abbreviations:
- CI: confidence interval
- VAS: visual analog scale
- WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index

*Pooled analysis: the intervention group at the 8-week follow-up plus the control group at the 16-week follow-up. Effect size, d = [Δ(intervention at 8 weeks) − Δ(control at 8 weeks)]/pooled SD (ie, intervention plus control at 8 weeks). Data are given as mean (SD) (95% CI). The 95% CI is for the measured change from baseline to follow-up assessment.

†For P < .05, difference between the intervention group at the 8-week follow-up and the control group at the 8-week follow-up by repeated measures analysis of variance.

‡P values are for baseline to 8-week and 16-week measurement differences within-group paired t test.

### Subjects
Subjects were instructed to report adverse events to the massage therapist; 1 reported increased discomfort and refused to return for the 8-week assessment.

### SAFETY
This study suggests that massage therapy using the Swedish technique is safe and effective for reducing pain and improving function in patients with symptomatic OA of the knee. To our knowledge, this is the first prospective, randomized trial assessing the efficacy of massage for OA. Massage has previously shown promise for other musculoskeletal conditions such as rheumatoid arthritis and fibromyalgia.25-27 Our results are concordant with these prior findings.

In this study, the magnitude of the treatment effects (ie, effect size) at the 8-week assessment in the WOMAC scale were large, ranging from 0.64 to 0.86 (Table 2). These effects are greater than those observed by Witt et al28 in a large acupuncture trial of similar design.

Using intention-to-treat analysis and carrying forward baseline values likely biased our results toward the null. The treatment effects observed were stronger when limited to only those subjects returning for follow-up. Thus, our findings are a conservative estimate of the magnitude of treatment effect. Losses to follow-up, shown in the Figure, are reflective of the real-world experience with an elderly population with impaired mobility.
We used a wait-list control design because no validated method of performing "placebo massage" has been developed. This did result in increased contact with study personnel for the intervention group during the 8-week intervention. Although Hawthorne effect\textsuperscript{29,30} may have been a factor in our results, both intragroup and intergroup differences were significant at 8 weeks, and the improvements in the intervention group largely persisted at the 16-week follow-up, which was 8 weeks after the subjects finished the weekly massage sessions.

We used Swedish massage because it is one of the more common and readily accessible or practiced techniques in the United States.\textsuperscript{22} There was limited precedent for selecting frequency, duration, or even type of massage. There may prove to be more—and less—effective approaches, and this will need to be elucidated in subsequent studies.

The potential importance of massage as an adjunct to or even an alternative to pharmacotherapy is self-evident. Current pharmacological treatments for OA are associated with high rates of adverse effects, such as cardiovascular, gastrointestinal, renal, and hepatic toxic effects.\textsuperscript{31,33-38} Many patients are already adding or trying massage as a therapy for OA.\textsuperscript{35-38}

There are also nonconventional and nutriceutical treatments for OA. Trials regarding the efficacy of glucosamine with or without chondroitin are inconclusive. However, a recent randomized controlled clinical trial (the Glucosamine/chondroitin Arthritis Intervention Trial\textsuperscript{39}) suggested that the combination is effective for patients with moderate to severe OA pain. Other nutriceutical treatments, including devil’s claw and ginger,\textsuperscript{39} have yet to be proven effective. Recent research has suggested that acupuncture may also be an effective option for patients with OA.\textsuperscript{40} Establishing massage as a therapy for OA would provide an additional option to the current approaches.

Study limitations include a single intervention and homogeneous study sample. Study participants were recruited in northern New Jersey, and most of the subjects in the intervention and control groups were white women; demographic homogeneity may limit generalizability. However, in individuals older than 50 years, knee and hand OA is more prevalent in women than men.\textsuperscript{5} Black and white individuals have similar rates of OA, although higher body weights may contribute to a slightly higher prevalence in black persons.\textsuperscript{5}

The study duration was only 16 weeks; OA is a chronic condition, and therefore longer studies will be needed. Losses to follow-up were noteworthy. However, an intention-to-treat analysis was used, and therefore our findings may be conservative estimates of treatment effect.

Because participants did not keep accurate medication diaries, we cannot reliably know if change in medications in any way affected our results. It seems unlikely that the massage intervention would have caused participants to increase their medication in such a way as to lead to significant improvement in pain and function compared with the control group. Bias toward a null effect is more probable.

In conclusion, this pilot study suggests that massage therapy is efficacious in the treatment of OA of the knee, with beneficial effects persisting for weeks following treat-