Jevsevar et al have provided an important service to the clinical physical therapy community with their investigation of knee biomechanics during selected functional activities. The authors have provided quantitative insight into knee function during locomotor activities of daily living (ADLs), which directly affects how treatment programs are designed for patients following knee arthroplasty. It is vitally important that physical therapists evaluate the methods they utilize for treatment and incorporate information available regarding actual ADL physical demands. The biomechanical measurements presented offer quantitative information that can be used by the therapist to complement the myriad of qualitative information frequently used to construct physical therapy programs. Because treatment time is often limited, more realistic treatment goals would be expected to increase the potential of the patient to return to a fully functional level.

In addition to providing clinically relevant information, the authors present findings that may affect how research is conducted in this topic area. In many regards, the authors have been able to provide information not previously available. For example, the results of simultaneous bilateral sagittal motion data collection with the control group supports the use of unilateral data-acquisition systems. For those with limited motion analysis facilities, this is welcome justification for filming or videotaping movement from one side of the subject when the researcher is specifically interested in sagittal motion. Also, the use of three different ADL conditions provides more controlled comparison data than data derived from a variety of different investigations with divergent research protocols.

Other aspects of the article are also helpful to those in research. The authors thoroughly address the reliability of the measurements used, lending credibility to the results. For the most part, extensive detail concerning equipment parameters and test protocol are evident throughout this article. Given this detail, the mechanical aspects of the protocol can be easily replicated by researchers or applied for clinical use by therapists.

There are, however, several conceptual and practical issues that demonstrate some problems or limitations of the work. More detail about certain aspects of the work would be helpful to the reader. For example, the Hospital for Special Surgery (HSS) knee assessment score is referenced but not described within the article. A brief explanation of the scoring system would enable the reader to better understand the 94 score demonstrated by the patients with knee arthroplasty (KA group).

Several methodological concerns are evident in this research. First, the use of sagittal-plane analysis of the knee joint presents some problems. For healthy subjects without pathology, the primary movement occurring at the knee would be expected to be confined to the sagittal plane. The knee motion in the KA group patients, however, would be expected to show some abnormalities, including nonsagittal types of movement such as rotation and varus/valgus. Although the techniques required to measure these movements are complex, they probably demonstrate the largest knee motion variation from normal. Their omission from this study would seem to be a critical limitation.

Second, no information is offered regarding the gender composition of the control and experimental (KA) groups. Although height and weight were not significantly different between the control and KA groups, comparisons between male and female subjects were not reported. The reader must assume the results are not biased by gender. In addition, the lack of significant age-related differences in the control group may be caused by the small sample size (n=5 for the younger group and n=6 for the older group). Age-related differences have been demonstrated in sit-to-stand studies, and differences based on several different factors have been reported for the other two activities. Smidt summarizes the many research findings of age-related differences during walking, and both height and weight have been cited as related to stair climbing. The authors could include a power analysis, which would indicate how many subjects would be required to show significant age-related differences. Consideration of these variables would augment the present work and allow better interpretation of the results.

Third, justification of the velocities chosen for performance of the selected ADL tasks is not provided. The authors state, "Paced cadences were chosen to match normal rates," and they provide numerous references. All subjects ascended and descended the stairs at a pace of 80 steps per minute, walked at a pace of 120 steps per minute, and arose from a chair within 1.2 seconds. It is not clear whether these velocities were similar to the individual subject's pace or based on the literature cited. A KA group subject who is "fully rehabilitated" may still perform ADL tasks at a slower pace than "normal." If the chosen cadences were closer to the normal pace of either the control group or the KA group, velocity would be expected to bias the results. The effort to control velocity is commendable.
Author Response

We are grateful for Dr. Rodgers’ comments. We generally agree with her comments and offer the following clarifications.

The Hospital for Special Surgery (HSS) knee assessment score is widely used in clinical orthopedic practice. Its 100-point scale has 50 points for pain rating, 30 points for function (e.g., “distance walked: unlimited”) generates 6 points), and 20 points for motion and deformity. A score of 90 or greater is considered an “excellent” result. Hence, one of the more interesting results of our study is that subjects considered fully rehabilitated and having a clinically “excellent” result may have movement pathology not detectable without sophisticated laboratory equipment. Such movement pathology may underlie the high incidence of prosthetic loosening and compensatory body segment motions. Such HSS scores, in addition to the approximately 2-minute rests between walking trials, suggest it is unlikely that “fatigue was a factor” influencing the knee arthroplasty (KA) group's results.

We agree that if only two-dimensional (sagittal-plane) motion had been measured, it would indeed inflict a “critical limitation” on our study results. Our system, as indicated in the “Method” section, however, measures all 6 degrees of freedom (three translations and three rotations) of each body segment, making the three planes' motions orthogonal in such a way as to minimize “cross talk” between sagittal-, transverse-, and frontal-plane motions. Many of the references cited in our study reveal three-dimensional knee motions during gait. Our intent was not to de-

References