

Examining the Consequences of Rehabilitation Interventions on Disease Progression and Functional Decline: Is Function Really the Only Thing That Matters?

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While reading the articles by Mikesky et al (1) and van Dijk et al (2) which appear elsewhere in this issue of *Arthritis Care & Research*, I was reminded of the ongoing debate concerning whether measurement of radiographic progression of osteoarthritis (OA) or the progression of symptoms and functional decline is more relevant in reflecting the status of patients with knee OA. Mikesky et al examined the effects of strength training on the incidence and progression of knee OA over a 30-month period. This area of study is important because although there have been a number of studies addressing the relationship between strength and physical function (3–6) and the effects of strength training on pain and function (6–9), to my knowledge there have been no clinical trials examining the effects of strength training on the incidence or progression of radiographic knee OA. However, based on the results of the Mikesky et al study (1), the actual training program did not appear to induce a significant amount of muscle strengthening in the short term, and there was actually a decrease in strength over the long term. Despite concerted efforts by the investigators to encourage adherence to the exercise programs, significant problems with subject adherence occurred during the course of the study, which may explain the limited effects of the program on muscle strength. Nevertheless, it is difficult to make any definitive conclusions about the effects of strength training on the incidence or progression of knee OA based on the results of the study by Mikesky et al, when it is not clear that meaningful increases in strength actually occurred. Further work is still needed to determine whether inducing and maintaining significant gains in muscle strength can

have either a protective or adverse effect on the progression of knee OA.

The article by van Dijk et al (2) is a systematic review of the literature concerning the changes in functional status over time and the identification of predictors of functional change in patients with knee and hip OA. This area of work is also very important because improved understanding of factors that may either contribute to or protect against functional decline can provide insight for developing interventions that might enhance the effectiveness of preventing or minimizing disability. Although van Dijk et al identified a number of factors in the current literature that can either contribute to or protect against functional decline, they correctly point out that the evidence is limited and there is much more room for work in this area.

However, van Dijk et al made one statement that caught my attention: “Previous results from cross-sectional studies suggested there was no or only a weak association between radiologic changes and functioning. In this review, this ambiguous relationship was confirmed by the results of longitudinal studies, emphasizing the need to focus on functional rather than radiologic consequences. Such functional focus is furthermore important, because knowledge of functional consequences is essential for the development of optimal rehabilitation programs in patients with OA.” For me, this statement served as the impetus for the topic of this editorial. Although I am in agreement with a significant focus on function (because this has been a very large element in my own work), I am concerned that it is premature to suggest we completely shift the direction of focus away from radiologic consequences, or progression of disease, and direct our efforts mainly on function when evaluating the consequences of rehabilitation interventions for knee OA.

It is true that both cross-sectional and longitudinal studies have not demonstrated that radiographic severity correlates with measures of pain and function (10–13). For this reason, it has been suggested that efforts may be better placed in developing interventions that reduce the burden of illness related to OA with respect to pain, limitation of

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activities, and participation in life (i.e., exercise, emotional coping strategies, etc.) rather than on expensive, high-tech interventions targeted at correcting structural damage related to the disease (cartilage transplantation, etc.) (14). In my experience, patients are far more interested in treatments that relieve pain and restore their ability to engage in physical and social activities, and are less concerned that their treatments restore normal joint structure, provided that the benefits of reduced pain and improved function are maintained and the treatments do not increase the damage to their knees over the long term. What needs to be considered is that none of the studies examining the relationship between radiographic severity of knee OA, pain, and function examined the effects of an intervention (10–13).

Rehabilitation interventions such as strength training, aerobic exercises, and agility and balance training involve the application of joint loading that may be either of greater frequency or greater magnitude than what is normally encountered in the typical daily activity of the patient. Although radiographic severity may not correlate with symptoms or function in cross-sectional studies or longitudinal studies that describe the natural course of the disease, we cannot assume that the same holds true when additional loads are employed through exercise interventions. We prescribe exercises to improve pain and function and we hope that at the very least, we do not accelerate disease progression and at the very best, the exercise may even have a protective effect on joint structure. However, we are also not certain that some of our interventions, or at least varying levels of our interventions, may have a destructive effect on joint structure. The state of the current science does not tell us whether or not rehabilitation interventions, or the conditions under which they are administered, can influence the rate of structural damage to the knee.

An important part of examining the consequences of rehabilitation is to determine which patients are and are not responsive to the intervention, and what factors may help us differentiate the responders from the nonresponders. Although very little research has been done in this area, there is some evidence to suggest that radiographic severity of knee OA is a predictor of exercise therapy outcomes (15). Fransen et al reported that subjects with greater narrowing of the joint space at baseline did not respond as well to exercise as those who had less severe changes (15). We do not know if the limited response to treatment was due to an acceleration of the disease progression in these subjects, but the results illustrate the importance of considering radiographic severity as a prognostic factor in exercise therapy outcomes.

I propose that if we really want to advance our ability to develop effective exercise interventions for patients with knee OA, we need more research that examines both the structural and functional consequences of administering these interventions. Studies should be designed to examine potential interactions between changes in the rate of radiographic disease progression and functional outcome as a result of exercise therapy. If certain interventions produced substantially high gains in functional outcome at the expense of even small to moderate increases in the

rate of structural deterioration of the joint, then the benefits of reducing the risk of disability may far outweigh the risk of disease progression. In contrast, it would be important to know whether short-term improvements in pain and function with an exercise intervention are mitigated over the long term by an exercise-induced acceleration of disease progression that results in a long-term decline in function and increased pain.

It may also be possible that special circumstances exist where exercise interventions may place an individual at greater risk for progression of disease and disability. For example, Sharma et al demonstrated that in subjects with knee OA who had increased frontal plane passive joint laxity and/or malalignment, those who were stronger at baseline were at greater risk of radiographic OA progression over an 18-month period (16). The effects of strength training were not assessed in this study, but the results underscore the need to determine whether strength training or other exercise interventions, in the presence of special circumstances such as excessive laxity or malalignment, may have differential effects on disease progression and functional outcome.

When examining the consequences of rehabilitation interventions for people with knee OA, I do not believe we are ready to completely shift our focus away from disease progression to focus on pain and function. We have much more to learn about the interactions between the rate of disease progression and the changes in pain and function as a consequence of our interventions. The advancement of more sophisticated imaging technologies may better aid us in understanding these interactions when compared with the information gathered from traditional radiographic assessments. When we have a better understanding of how our exercise interventions affect the rate of disease progression, and how their effects on disease progression in turn may affect functional outcomes, we will be better able to develop more comprehensive treatment guidelines that will improve both the effectiveness and safety of our interventions.

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