

not believe that adding “partial tear” to the diagnosis of a complete tear is of diagnostic value.

There is criticism directed also at the interpretation of Fig 6. The findings show a complete fluid-filled gap indicating rotator cuff tear. The very thin band of lower signal tissue at the apex of the tear could represent scar or synovial tissue covering the bursal side of the tear. We do agree that complete cuff tendon dissection may have shown a tear missed at arthroscopy.

Dr. Skib has confidence in his MRI accuracy despite no mention of any clinical/surgical correlation with his interpretations. A strength of our study is that we correlated each MRI with the surgical findings. How, without correlation, can Dr. Skib know that his interpretations are accurate? Certainly the expertise of the radiologist is an important factor in accurately interpreting an MRI exam. One of our points in this article was that we compared the accuracy of community radiologists to a radiologist with special interest in musculoskeletal imaging and we concluded that the more experienced radiologist was more accurate.

Obviously, there remains lack of agreement on interpretation of these images. This illustrates the likelihood that we have not yet reached consensus on the radiographic definition of tears, and the range of variation of normal and degenerative nontorn rotator cuff images.

The bottom line is that the MRI interpretation of rotator cuff signal must be viewed with caution, and also with an increasing knowledge of the strengths and limitations of one's local radiographic capabilities. If there is doubt, an arthrogram or MRI saline contrast study may be useful, or if clinically warranted, proceed directly to an arthroscopic examination.

Sincerely,
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To the Editor:

I read with interest the article by Grelsamer et al.¹ and applaud their efforts to address various important issues pertaining to magnetic resonance imaging (MRI) of the knee and patellofemoral joint. Since our group developed the kinematic MRI technique for the assessment of patellar alignment and tracking in 1988² and, along with other investigators,³⁻⁹ continue to apply kinematic MRI to examine various normal and abnormal aspects of the patellofemoral joint,¹⁰⁻¹⁸ I feel compelled to offer my comments on their article.

First, while I agree that the normal position of the patella with the joint in a slightly flexed position (e.g., 5°) is centered over the underlying femoral trochlear groove, I recommend extreme caution regarding making statements pertaining to the position of the patella on routine MRI studies of the knee unless several factors related to positioning are carefully controlled and documented. In consideration that the study by

Grelsamer et al. was performed at six different MR centers, was the position of the knee consistent and accounted for?

In general, routine MR images of the knee are not useful for determining the position of the patella because inconsistent positions of the knee (i.e., with respect to lower limb rotation, flexion of the joint, etc.) and the presence of firmly-placed positioning sponges can easily create a “pseudo-subluxation” of the patella. My comment on this issue is based on more than 10 years of experience and review of over 1,000 routine MRI examinations of the knee and over 1,000 kinematic MRI studies of the patellofemoral joint (unpublished observations).

During routine MRI, the knee may be placed in a slight, externally rotated position (e.g., to facilitate viewing the anterior cruciate ligament on sagittal plane images) and/or it may be at extension or with a slight amount of flexion. Each of these different positions can alter the biomechanics of the patellofemoral joint and effect the position of the patella. In an effort to maintain the knee in a fixed position within the extremity coil during MRI, the MRI technologist typically places foam rubber sponges on the top and sides of the knee, producing forces that could move the patella in an abnormal fashion (i.e., while the knee is in a relaxed condition). More importantly, assessment of the patellofemoral joint while it is in a relaxed or “passive” condition does not provide the best means of identifying an abnormal position of the patella.

The current state-of-the-art technique of performing kinematic MRI of the patellofemoral joint is with the use of the “active-movement against resistance” method.^{6,7,9,14,17,19} The application of resistance to stress the patellofemoral joint during the kinematic MR procedure has been shown to elicit patellar malalignment and tracking abnormalities that may not be observed during unloaded examinations.^{6,14,19} Accordingly, this kinematic MRI technique has been shown to be the most accurate noninvasive diagnostic imaging method of evaluating patellar alignment and tracking.^{6,7,9,14-18}

My second comment pertains to defining the position of the patella relative to the femoral trochlear groove. It has been the overwhelming experience of our group that qualitative, descriptive criteria are the most useful and appropriate means of describing patellar alignment and tracking,^{2,10-18} instead of attempting to apply some form of measurement technique that was previously developed for nonkinematic MRI-based examinations. Of note is that there is no agreement on the usefulness of any particular quantification technique for determining patellar malalignment. Furthermore, abnormal patellofemoral joints often have associated anatomic irregularities (e.g., dysplastic patellae, dysplastic bony anatomy, patella alta, patella infera) and these conditions prevent an accurate assessment of patellar alignment using quantification schemes because there are no consistent or relative landmarks for proper measurement of patellofemoral indices (e.g., there is no way to evaluate the position of the patella relative to the femoral trochlear groove when substantial patella alta is present). Most importantly, the quantitative assessment of patellofemoral incongruency has never been used by the vast majority of

orthopaedic surgeons to guide surgical or rehabilitation procedures designed to treat patellofemoral joint abnormalities.

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Author's Reply

It is an honor to have had Dr. Shellock read our study, and some of the issues he brings up are indeed important. We went to great pains to address them in our article and we will be glad to discuss them again.

Was the specific position of the knee controlled in each of the six centers where the studies were carried out? Absolutely not. This is one of the strengths of the report, not a weakness. Had all studies been performed in one center using one specific technique, the obvious

criticism would have been that our results are simply a reflection of that one particular technique. Since the results of our study were the same regardless of the center and technique used, our conclusion (lateral displacement of the patella on routine MR imaging is not normal) is not likely to simply be due to a positional artifact. It would appear that during routine MR imaging of *normal* knees the specific position does not matter (within reason). Abnormal knees may be more sensitive to slight changes, but that is another matter. What does matter is the clinical screening for 'normal' and 'abnormal'. As noted in the article, our screening was more elaborate than that used in other studies, and this is also a controversial matter (discussed at length in our article and in our recent book¹).

Dr. Shellock states that MR sponges 'could move the patella in an abnormal fashion'. Perhaps they could. But they didn't. In *normal* knees the sponges don't seem to have this effect since, as discussed in our article, essentially all normal patellae were centered over the underlying femur. *Abnormal* patellae behave differently and may be more sensitive to sponges (consider that abnormal patellae are particularly sensitive to leg rotation during the taking of Merchant views).

Dr. Shellock discusses at length the notion that supine, static MR images are not the best way to assess the extensor mechanism and that other techniques (namely his) are better. I think his approaches are indeed interesting (we discuss his ultrafast technique in our book), but why does this matter here? This study examined MRIs as they are routinely performed today. Whether or not the future has something better in store (it always does) is not relevant to this study.

"Quantitative assessment of patellofemoral incongruency has never been used by the vast majority of orthopaedic surgeons." True. In clinical practice, no specific measurements are needed. In a clinical study, on the other hand one must make an attempt to be objective. As imperfect as measurements are, they are necessary to compare patients and to communicate—besides which they are essentially mandated by all editors and reviewers. There is nothing wrong with the use of measurements as long as their limitations are appreciated. Ironically, investigators listed in Dr. Shellock's references such as Kujala et al. have made a career of developing such measurements.

"There is no agreement on the usefulness of any particular quantification technique." That is for sure! How much agreement is there on anything pertaining to the patella? Why then should we not suggest our own quantification system?

In short, our article seems to have triggered a number of thoughts from Dr. Shellock, and we are in agreement with most of these—but they do not necessarily apply to our study.

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Reference

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