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Twenty-Year Follow-up Study Comparing Operative Versus Nonoperative Treatment of Anterior Cruciate Ligament Ruptures in High-Level Athletes: Response

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Authors' Response:

We thank the *American Journal of Sports Medicine* for giving us the opportunity to comment on the letter to the editor by colleagues Araujo et al. We thank them as well for the time and effort they put into reading and critically reviewing our paper. It is good to read that our research article titled "Twenty-Year Follow-up Study Comparing Operative Versus Nonoperative Treatment of Anterior Cruciate Ligament Ruptures in High-Level Athletes"[8] has been received with great interest, and it is reassuring to know that our extensive work to track all of these patients over a 20-year period has contributed to the understanding of the long-term outcome of anterior cruciate ligament (ACL) injuries. We want to emphasize the importance of long-term follow-up studies, since it is still unclear what the consequences of adopting an operative versus nonoperative treatment are, especially after 2 decades.

1. The necessity to conduct more randomized clinical trials in orthopaedic research cannot be emphasized enough. Our study examined a specific ACL-injured group that was already treated operatively or nonoperatively 20 years ago. We prospectively evaluated these patients after their inclusion in our previous retrospective matched-control study. This limitation steered us to this number, and we therefore did not perform a sample size calculation. With this limitation, the best option was to match both groups of patients. In an ideal situation, where you define the primary outcome, you can better estimate your sample size. This is what we have done since then in the COMPARE study (NTR27446).[1] This is a prospective randomized trial comparing early operative ACL reconstruction with a nonoperative treatment of ACL injury. The study is being concluded as we speak and will be published in the near future. Ideally, it can answer some of the questions that we could not answer now.

We thank you for acknowledging the difficult task of a complete follow-up in such a relatively young and mobile group of high athletes over 2 decades. Less than 5% of the patients were not evaluated with a complete physical

examination because of their reluctance to undergo some of these tests, given their past experiences colored by kinesophobia or pain. This consisted of 2 patients from the nonoperative group. They refused physical examination and functional testing, which resulted in missing data for the Lachman test, pivot-shift test, KT-1000 arthrometer evaluation, and 1-legged hop test. The best solution for these missing data was to impute these numbers by creating 5 new data sets and using the pooled variable for further analyses.

2. We acknowledge that modality and sports activity are of great importance and are underreported in much of the ACL-related research. For our study, we used the validated Tegner score to define sports activity level. As additional information to our data, soccer was the most predominantly performed sport in both groups (66%).

Our patients were selected for nonoperative care in 1992 on the basis of a shared decision between patient and treating physician. The majority of patients had completed a minimum exercise period of 3 months, in which they received exercise therapy and participated in an activity program focused on gradually returning back to (sports) activity. They have proven to be successful nonoperative candidates, as confirmed by the fact that only 1 patient had secondary instability complaints and needed ACL reconstruction in a 20-year follow-up period.

There is still a clear paucity of evidence indicating which determinants are clear predictors of successful operative or nonoperative treatment. Second, reference is made to the studies of Hurd et al[5] and Fitzgerald et al[2]: these studies were published a long time after we started this study, and there is still a lot of discussion and uncertainty about the correct algorithm. Only randomized controlled trials, such as the KANON trial[3,4] and our upcoming COMPARE trial,[1] can be used to create an evidence-based algorithm for operative versus nonoperative treatment.

3. We used the Kellgren and Lawrence score, as this is still the most widely used and accepted classification for radiological osteoarthritis. We were not able to blind the examiners, as it is virtually impossible to obscure the remains of the ACL reconstruction, such as the tibial or femoral tunnel or the changed bone structure at the harvesting site of the bone block at the patella or tibial side. We tried to cover the tunnels and screws of the reconstructed group, but this in some instances also obscured the tibial plateau from being evaluated for osteoarthritis and we abandoned this attempt. We chose to use the scores of the independent observer who scored the radiographs in our previous study.

4. The functional testing for this study was guided primarily by the available testing performed at our 10-year follow-up. Video analysis has been used in the last few years but was not validated at our 10-year follow-up moment, and no consideration was made to add this.

5. We agree that operative techniques are constantly improving, which can be of great influence on the long-term outcome of ACL reconstruction. This debate is ongoing, and there is again pendular movement that transtibial treatment has equal outcomes with no difference versus the anteromedial portal technique.[6] The suggested reference article showing superiority of anteromedial portal and an outside-in single-bundle technique[7] is based on a cohort study without any randomization, with no sample size calculation, and with low sample sizes (<35 patients in each group). We think no clear conclusion can be drawn on the basis of this study.

6. To the best of our knowledge, there is no randomized controlled trial available investigating the time to return to play of nonoperatively treated patients.

No clear criteria are defined for nonoperative patients on when to return to play. Patients in this cohort were ready to return to play at the moment when they were able to manage the sports loads without any pain, instability complaints, or other clinical limiting knee complaints. Once more, this program has stood the test of time, as shown in our 20-year follow-up study.

We agree that a clear, validated, reproducible set of tests would be ideal for any ACL-injured knee; there is, however, a clear paucity of evidence regarding this topic.

Once more, we thank Araujo and his colleagues for the interest and critical view and for enforcing this basic treatment question of whether we should operate or conservatively treat an ACL rupture.

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