

**Document Version**

Final published version

**Licence**

Dutch Copyright Act (Article 25fa)

**Citation (APA)**

Harlianto, N. I., Hirvasniemi, J., Poot, D. H. J., Klein, S., Bierma-Zeinstra, S. M. A., Schiphof, D., & Oei, E. H. G. (2026). Reply to the letter to the editor concerning: T<sub>2</sub> mapping of the articular cartilage as a biomarker for knee osteoarthritis: An analysis of the population-based Rotterdam Study. *Osteoarthritis and Cartilage*, 34(2), e3-e4.  
<https://doi.org/10.1016/j.joca.2025.12.006>

**Important note**

To cite this publication, please use the final published version (if applicable).  
Please check the document version above.

**Copyright**

In case the licence states "Dutch Copyright Act (Article 25fa)", this publication was made available Green Open Access via the TU Delft Institutional Repository pursuant to Dutch Copyright Act (Article 25fa, the Taverne amendment). This provision does not affect copyright ownership.  
Unless copyright is transferred by contract or statute, it remains with the copyright holder.

**Sharing and reuse**

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

**Takedown policy**

Please contact us and provide details if you believe this document breaches copyrights.  
We will remove access to the work immediately and investigate your claim.

Letter to the Editor

## Reply to the letter to the editor concerning: T<sub>2</sub> mapping of the articular cartilage as a biomarker for knee osteoarthritis: An analysis of the population-based Rotterdam Study



Dear Editor,

We would like to thank Que et al. [1] for their interest in our work, their suggestions for future research, and comments on our recent article [2]. While we agree with most of their observations, the suggestions they made were either outside the scope of our current study or not possible to carry out with our dataset. We provide our response to their observations below.

First, they rightly pointed out that our study did not take into account the measures of metabolic syndrome or chronic low-grade inflammation. It has been previously shown that metabolic risk factors are associated with elevated cartilage T<sub>2</sub> values [3], and therefore the observed positive correlation between T<sub>2</sub> values and BMI may reflect a combined mechanical and metabolic contribution. Inclusion of metabolic and inflammatory biomarkers, some of which are available in the Rotterdam Study, in future analyses could help to identify mechanical, metabolic, and inflammatory subtypes of osteoarthritis. This might enable more personalized interventions targeting specific disease mechanisms [4].

Second, the limitations of T<sub>2</sub> mapping are indeed well known [5]. While we agree that combination of T<sub>2</sub> mapping with other compositional MRI sequences is an advantage, other techniques also have their own limitations [5,6]. The delayed gadolinium-enhanced MRI of cartilage (dGEMRIC) is not feasible in large-scale population studies, due to the need for contrast agent injection as well as the delay between the injection and imaging. Sodium MRI requires special hardware and has a low signal-to-noise ratio (SNR) due to the low abundance of sodium in vivo. Of the compositional MRI sequences, in addition to T<sub>2</sub> mapping, T<sub>1rho</sub> is increasingly accepted [7]. While T<sub>1rho</sub> is more sensitive to proteoglycan content than T<sub>2</sub> mapping, and may therefore offer complementary information to T<sub>2</sub> mapping, which is related to collagen content and network integrity, one of its limitations is that it is challenging to acquire within specific absorption rate (SAR) constraints [5–7]. In our study, we were limited to T<sub>2</sub> mapping because this was the only quantitative MRI technique for assessment of cartilage composition acquired in the Rotterdam Study.

Third, Que et al. rightly noted that our study did not include cartilage-repair-specific biomarkers. Combining T<sub>2</sub> mapping with information on collagen matrix breakdown and repair processes in future analyses might help to clarify underlying disease mechanisms, and could be useful for more personalized treatment strategies.

In summary, combining cartilage T<sub>2</sub> mapping with multimodal data, such as biomarker measurements, could help to clarify underlying disease mechanisms and identification of subtypes of osteoarthritis, and could enable more personalized interventions targeting specific disease mechanisms. We consider our study to represent a necessary step for extracting cartilage T<sub>2</sub> values and reporting their associations with MRI-based knee osteoarthritis and patient characteristics in the population-based Rotterdam Study. Building on the findings of this study, more in-depth analyses can be performed in future work.

### Author contributions

JH wrote the initial draft of the article. All authors critically revised it for important intellectual content and approved the final version. JH (j.hirvasniemi@erasmusmc.nl) and EO (e.oei@erasmusmc.nl) take responsibility for the integrity of the work as a whole, from inception to finished article.

### Declaration of Competing Interest

The authors report no conflicts of interest.

### References

- [1] Y. Que, Q. Lu, X. Li, Letter to the Editor concerning: T<sub>2</sub> mapping of the articular cartilage as a biomarker for knee osteoarthritis: an analysis of the population-based Rotterdam Study, *Osteoarthr. Cartil.* (2025), <https://doi.org/10.1016/j.joca.2025.10.015>
- [2] N.I. Harlianto, J. Hirvasniemi, D.H.J. Poot, S. Klein, S.M.A. Bierma-Zeinstra, D. Schiphof, et al., T<sub>2</sub> mapping of the articular cartilage as a biomarker for knee osteoarthritis: an analysis of the population-based Rotterdam Study, *Osteoarthr. Cartil.* (2025), <https://doi.org/10.1016/j.joca.2025.09.009>
- [3] P.M. Jungmann, M.S. Kraus, H. Alizai, L. Nardo, T. Baum, M.C. Nevitt, et al., Association of metabolic risk factors with cartilage degradation assessed by T<sub>2</sub> relaxation time at the knee: data from the osteoarthritis initiative, *Arthritis Care Res.* 65 (12) (2013) 1942–1950, <https://doi.org/10.1002/acr.22093>
- [4] W.E. Van Spil, O. Kubassova, M. Boesen, A.C. Bay-Jensen, A. Mobasher, Osteoarthritis phenotypes and novel therapeutic targets, *Biochem Pharm.* 165 (2019) 41–48, <https://doi.org/10.1016/j.bcp.2019.02.037>
- [5] E.H. Oei, J. van Tiel, W.H. Robinson, G.E. Gold, Quantitative radiologic imaging techniques for articular cartilage composition: toward early diagnosis and development of disease-modifying therapeutics for osteoarthritis, *Arthritis Care Res.* 66 (8) (2014) 1129–1141, <https://doi.org/10.1002/acr.22316>
- [6] X. Li, J. Kim, M. Yang, A.H. Ok, Š. Zbýň, T.M. Link, et al., Cartilage compositional MRI – a narrative review of technical development and clinical applications over the past three decades, *Skelet. Radio.* 53 (2024) 1761–1781, <https://doi.org/10.1007/s00256-024-04734-z>

<https://doi.org/10.1016/j.joca.2025.12.006>

1063-4584/© 2025 Osteoarthritis Research Society International. Published by Elsevier Ltd. All rights are reserved, including those for text and data mining, AI training, and similar technologies.

- [7] M. Chalian, X. Li, A. Guermazi, N.A. Obuchowski, J.A. Carrino, E.H. Oei, et al., The QIBA profile for MRI-based compositional imaging of knee cartilage, *Radiology* 301 (2) (2021) 423–432, <https://doi.org/10.1148/radiol.2021204587>

Netanja I. Harlianto <sup>a</sup>, Jukka Hirvasniemi <sup>a b</sup>, Dirk H.J. Poot <sup>a</sup>,  
Stefan Klein <sup>a</sup>, Sita M.A. Bierma-Zeinstra <sup>c</sup>, Dieuwke Schiphof <sup>c</sup>,  
Edwin H.G. Oei <sup>a \*</sup>

<sup>a</sup> Department of Radiology and Nuclear Medicine, Erasmus MC  
University Medical Center Rotterdam, Rotterdam, the Netherlands

<sup>b</sup> Department of Biomechanical Engineering, Delft University of  
Technology, Delft, the Netherlands

<sup>c</sup> Department of General Practice, Erasmus MC University Medical  
Center Rotterdam, Rotterdam, the Netherlands

\*Correspondence to: Department of Radiology and Nuclear  
Medicine, Erasmus MC University Medical Center Rotterdam, P.O.  
Box 2040, Rotterdam, CA 3000, the Netherlands.

E-mail address: [e.oei@erasmusmc.nl](mailto:e.oei@erasmusmc.nl) (E.H.G. Oei).

4 December 2025