TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Authors' Response

Citation for published version (APA):
Odgaard, A., Kabel, J., Rietbergen, van, B., Dalstra, M., & Huiskes, H. W. J. (1997). Authors' Response. *Journal of Biomechanics*, *30*(11-12), 1193. https://doi.org/10.1016/S0021-9290(97)85610-2

DOI:
10.1016/S0021-9290(97)85610-2

Document status and date:
Published: 01/01/1997

Document Version:
Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

• A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.tue.nl/taverne

Take down policy
If you believe that this document breaches copyright please contact us at:

openaccess@tue.nl

providing details and we will investigate your claim.

Download date: 12. Sep. 2024

ELSEVIER

J. Biomechanics, Vol. 30, Nos. 11/12, p. 1193, 1997
© 1997 Elsevier Science Ltd. All rights reserved
Printed in Great Britain
0021-9290/97 $17.00 + .00

AUTHORS' RESPONSE

Anders Odgaard,* Jesper Kabel,* Bert van Rietbergen,† Michel Dalstra* and Rik Huiskes†

*Orthopaedic Research Laboratory, Department of Orthopaedic Surgery, Aarhus University Hospital, Denmark; and †Biomechanics Section, Institute of Orthopaedics, University of Nijmegen, The Netherlands

We would like to thank Professor Cowin for his interest in and comments related to our paper.

We fully agree with Cowin in his additional comments to the conclusions of the study, (1) that negligence of higher-order fabric measures seem justified, and (2) that the anisotropy of the trabecular tissue has only marginal effects—if any—on the macroscopic elastic behaviour of cancellous bone. These are indeed important conclusions. We note, by the way, that the proof for the second point, the validity of the effective isotropic tissue modulus, was strengthened further in recent work from Kabel *et al.* (1996), comparing experimental results for 29 whole specimens to those of micro-mechanical FEA models.

One caveat in the present study may, however, be the high degree of homogeneity and order in the material studied. The conclusions may not be directly extendible to human cancellous bone because of its generally less ordered structure, and we feel that further verification is needed.

The conclusions reached relates to the elastic properties of cancellous bone. No conclusion concerning anisotropy of strength can be reached. The only link is a number of empirical observations that strength and elastic modulus are related. Although no evidence exists, we feel that tissue anisotropy and non-fabric architectural measures may have some influence on strength anisotropy. This is, however, a highly under-represented field in research on cancellous bone mechanics.

REFERENCE

Kabel, J., van Rietbergen, B., Dalstra, M., Odgaard, A. and Huiskes, R. (1996) A comparison of large scale finite element modeling and traditional compressive testing experiments. *Transactions of the 10th ESB*, Leuven Belgium, p. 271. (Submitted to *Journal of Biomechanics*)