



Contents lists available at [ScienceDirect](#)

Journal of Biomechanics

journal homepage: www.elsevier.com/locate/jbiomech
www.JBiomech.com



Corrigendum

Corrigendum to “How accurately can subject-specific finite element models predict strains and strength of human femora? Investigation using full-field measurements” [J. Biomech. 49 (2016) 802–806]



Lorenzo Grassi ^{a,*}, Sami P. Väänänen ^b, Matti Ristinmaa ^c, Jukka S. Jurvelin ^{b,d}, Hanna Isaksson ^a

^a Department of Biomedical Engineering, Lund University, Sweden

^b Department of Applied Physics, University of Eastern Finland, Finland

^c Division of Solid Mechanics, Lund University, Sweden

^d Diagnostic Imaging Center, Kuopio University Hospital, Finland

The authors regret to report that an issue in the proposed code resulted in errors in [Figs. 3 and 4](#) and [Table 2](#). The authors apologize for any inconvenience caused.

The error has been corrected in this corrigendum. To maintain comparable results, two minor changes in the methods were also implemented, namely:

- The principal strains to determine the *yield* and *fracture* state were averaged over a 3 mm radius area on the femoral surface, similar to what was proposed in [Schileo et al. \(2014\)](#).
- The minimum Young's modulus allowed for cortical bone elements was set to 5 GPa, analogously to what was proposed in [Grassi et al. \(2017\)](#).

The new code, with correction and the two additional features above, produced results that were similar to the previously presented data. Thus, the overall findings and conclusions from the original article are still valid.

For new results, please see corrected [Figs. 3 and 4](#) and [Table 2](#).

DOI of original article: <https://doi.org/10.1016/j.jbiomech.2016.02.032>

* Corresponding author at: Department of Biomedical Engineering, Lund University BMC D13, 221 84 Lund, Sweden.

E-mail address: lorenzo.grassi@bme.lth.se (L. Grassi).

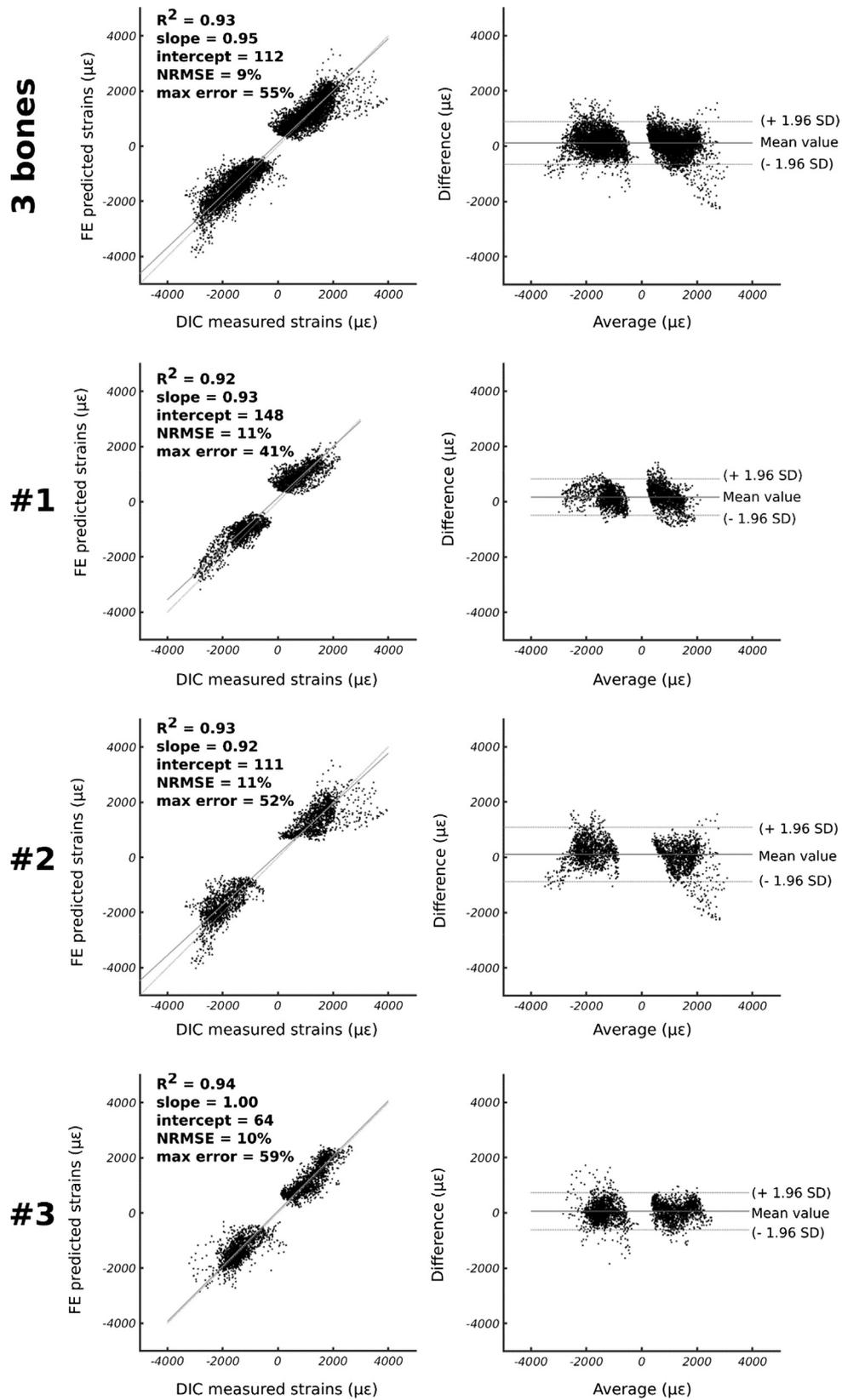


Fig. 3. Prediction accuracy for the principal strains for the three bones pooled (top) and for each bone separately (row 2–4). The applied force was 4 times the subjects' body weight. The robust linear regression analyses are shown on the left, and the Bland-Altman plots on the right. The dotted lines represent the 95% confidence interval.

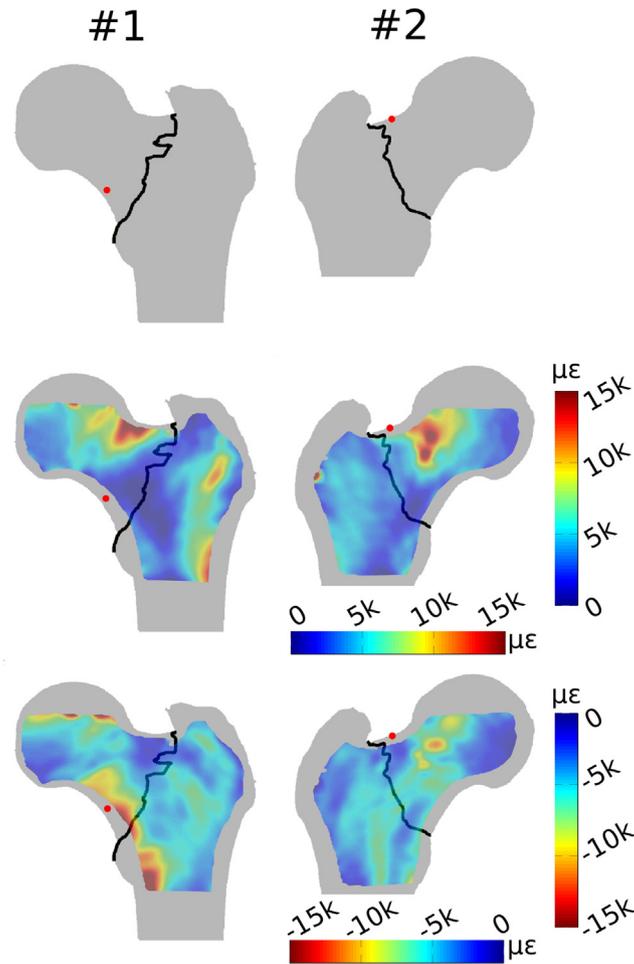


Fig. 4. Top: graphical comparison of the experimentally obtained fracture rim (black) with the fracture onset location predicted by the FE models (red). Middle: the experimentally measured major principal strains at 0.3 ms before a crack was detected in the DIC images are superimposed to the fracture rim and the predicted fracture onset. Bottom: the experimentally measured minor principal strains at 0.3 ms before a crack was detected in the DIC images are superimposed to the fracture rim and the predicted fracture onset. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).

Table 2

Bone strength of the two specimens used in this study as measured during the experiments (Grassi et al., 2014), and predicted using FE models.

	Bone #1	Bone #2
Experimental strength [N]	13,383	7856
Predicted strength [N]	13,144	7663
Difference [%]	−1.8%	−2.5%

Acknowledgements

The authors would like to thank Mr. Joeri Kok for his role in identifying the issue in the code.

References

- Grassi, L., Väänänen, S.P., Amin Yavari, S., Jurvelin, J.S., Weinans, H., Ristinmaa, M., Zadpoor, A.A., Isaksson, H., 2014. Full-field strain measurement during mechanical testing of the human femur at physiologically relevant strain rates. *J. Biomech. Eng.* 136, <https://doi.org/10.1115/1.4028415> 111010.
- Grassi, L., Väänänen, S.P., Ristinmaa, M., Jurvelin, J.S., Isaksson, H., 2017. Prediction of femoral strength using 3D finite element models reconstructed from DXA images: validation against experiments. *Biomech. Model. Mechanobiol.* 16, 1–12. <https://doi.org/10.1007/s10237-016-0866-2>.
- Schileo, E., Balistreri, L., Grassi, L., Cristofolini, L., Taddei, F., 2014. To what extent can linear finite element Models of Human femora predict failure under stance and fall loading configurations? *J. Biomech.* 47, 3531–3538. <https://doi.org/10.1016/j.jbiomech.2014.08.024>.