

Technical University of Denmark



Biomechanical study of porcine urinary bladder wall: matter of isotropy or anisotropy

Ajalloueiian, Fatemeh; Sami Jokandan, Maryam; Chronakis, Ioannis S.

Published in:

Book of Abstracts, Sustain 2017

Publication date:

2017

Document Version

Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):

Ajalloueiian, F., Sami Jokandan, M., & Chronakis, I. S. (2017). Biomechanical study of porcine urinary bladder wall: matter of isotropy or anisotropy. In Book of Abstracts, Sustain 2017 [H-1] Technical University of Denmark (DTU).

DTU Library

Technical Information Center of Denmark

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 you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Biomechanical study of porcine urinary bladder wall: matter of isotropy or anisotropy

Fatemeh Ajallouei^{1*}, Maryam Sami Jokandan², Ioannis S Chronakis³

1: Research Group for Nano-Bio Science, Technical University of Denmark, Kemitorvet, 2800 Kgs. Lyngby, Denmark

*Corresponding author email: faaj@food.dtu.dk

Regenerative medicine for reconstructive urogenital surgery has been widely studied during the last two decades[1]. One of the key factors affecting the quality of bladder regeneration is the mechanical properties of the bladder scaffold. Due to extensive similarity of porcine bladder to human bladder[2], and availability of this tissue from local slaughterhouses, we applied porcine bladder. The outcomes from this study can assist researchers with better solutions for design of scaffolds for bladder tissue engineering aiming to provide patients with high quality life in the future.

In most studies, test samples were preserved at -20°C prior to testing. However, we applied fresh samples in all our experiments, as the effect of storage temperature on bladder's mechanical properties is not systematically investigated yet[3]. Bladder is understood to have anisotropic mechanical properties. In order to properly study the anisotropic properties of bladder wall, uniaxial tests were applied under loading conditions similar to physiologic filling of bladder (1–2 mL/min) to evaluate how circumferential and longitudinal cut-outs of lateral region of bladder behave under load. Uniaxial tensile tests under low strain rate of 10 mm/min (0.4%/s) were applied onto rectangular shaped samples. The different strain amplitudes for uniaxial tests are 2.5, 5, 10, 20, 50, 100, 200 and 300%. Samples were under cyclic loading-unloading for 11 rounds, and the data from 11th cycle were applied for further analysis. The first 10 cycles were considered for preconditioning.

Our results demonstrate that bladder behaves isotropic at strain amplitudes below 200%, while at strains above 200% becomes slightly stiffer in longitudinal direction. We conclude that commenting upon isotropy/anisotropy of bladder wall needs to be subjective. It behaves isotropic under physiologic conditions and low strain loads, but anisotropic under high strain amplitudes. We sum up that it is important to consider the study parameters, when referring to mechanical data from reports in literature.

References:

- [1] F. Ajallouei, S. Zeiai, M. Fossum, J.G. Hilborn, *Biomaterials*. 35 (2014) 5741–8.
- [2] S. Korossis, F. Bolland, J. Southgate, E. Ingham, J. Fisher, *Biomaterials*. 30 (2009) 266–275.
- [3] A.N. Natali, A.L. Audenino, W. Artibani, C.G. Fontanella, E.L. Carniel, E.M. Zanetti, *J. Biomech*. 48 (2015) 3088–3096.