

# Emergence of a geometrical and mechanical equilibrium in tissue-engineered heart valves?

**Citation for published version (APA):**

van Kelle, A. J., Janssen - van den Broek, W. J. T., Lopata, R. G. P., Loerakker, S., & Bouten, C. V. C. (2018). *Emergence of a geometrical and mechanical equilibrium in tissue-engineered heart valves?*. Abstract from Annual Heart Valve Society meeting 2018, New York, New York, United States. <http://heartvalvesociety.org/meeting/abstracts/2018/B09.cgi>

**Document status and date:**

Published: 12/04/2018

**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](http://www.tue.nl/taverne)

**Take down policy**

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

[openaccess@tue.nl](mailto:openaccess@tue.nl)

providing details and we will investigate your claim.



[Back to 2018 Moderated Posters](#)

### Emergence Of A Geometrical And Mechanical Equilibrium In Tissue-Engineered Heart Valves?

**Mathieu A.J. van Kelle, M.Sc**, Pim J.A. Oomen, M.Sc, Marloers W.J.T. Janssen-van den Broek, B.Sc, Richard G.P. Lopata, Ph.D, Sandra Loerakker, Ph.D, Carlijn V.C. Bouten, Ph.D.  
Eindhoven University of Technology, Eindhoven, Netherlands.

#### OBJECTIVE:

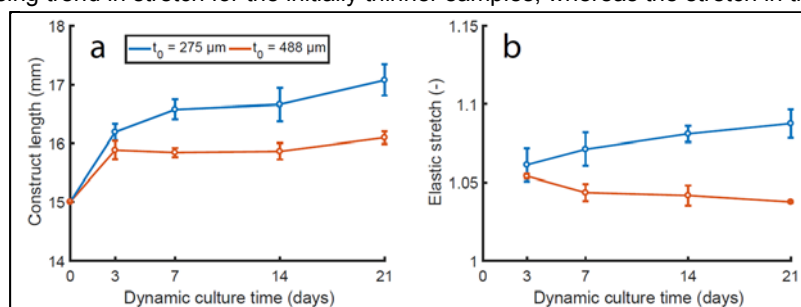
To ensure long-term functionality of tissue-engineered heart valves, it is paramount that they are capable of functional adaptation similar to native heart valves. It is well accepted that this adaptation process partly occurs to maintain a mechanical homeostasis. In this study, we demonstrate that a mechanical and geometrical stable state can also be established in tissue-engineered heart valves, although reaching this state is highly dependent on functional scaffold design, in this particular case initial scaffold thickness.

#### METHODS:

Myofibroblast-seeded circular supramolecular electrospun scaffolds were cultured inside a bioreactor system<sup>1</sup> for 21 days, while being subjected to a dynamic pressure of 4 kPa at 1 Hz. To assess the importance of scaffold design, two different initial scaffold thicknesses were used ( $275 \pm 25$  and  $488 \pm 50 \mu\text{m}$ ). Temporal changes in tissue geometry (length and thickness) and mechanical state (elastic stretch) were quantified (day 0, 3, 7, 14, 21) during dynamic culture, by means of nondestructive ultrasound imaging<sup>1,2</sup>.

#### RESULTS:

Construct length increased during dynamic culture (Fig1a). This eventual length was dependent on the initial scaffold thickness. In addition, the two scaffold thicknesses resulted in strikingly distinct elastic stretches with time of culture (Fig1b), with an increasing trend in stretch for the initially thinner samples, whereas the stretch in the thicker



**Fig. 1:** Unloaded construct length (a) depends on the initial scaffold length  $t_0$ , whereas there is an increasing (thinner samples) or stabilizing (thicker samples) trend in elastic stretches (b).

samples appeared to stabilize.

#### CONCLUSIONS:

These results indicate that initial scaffold thickness influences the construct length after dynamic culture, and leads to an increasing trend or stabilization of the elastic stretch for respectively the thinner and thicker samples. This demonstrates that reaching geometrical and mechanical stability in tissue-engineered heart valves is highly dependent on functional scaffold design.

We acknowledge the European Union's Seventh Framework Programme (604514), and the Netherlands CardioVascular Research Initiative (CVON2012-01).

#### References

- [1] Van Kelle et al., *Tissue Eng Part C Methods* 2017
- [2] Oomen et al., *J Mech Behav Biomed Mater* 2017

[Back to 2018 Moderated Posters](#)

© 2018 THE HEART VALVE SOCIETY  
ALL RIGHTS RESERVED  
PRIVACY POLICY