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


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

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**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[1] 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±25 and 488±50µm). 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[1,2].

**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 samples appeared to stabilize.

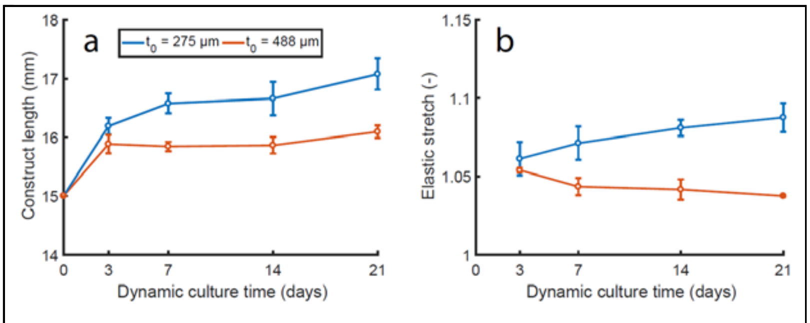


**Fig. 1:** Unloaded construct length (a) dependents on the initial scaffold length $t_0$, whereas there is an increasing (thinner samples) or stabilizing (thicker samples) trend in elastic stretches (b).

**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*

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