Biomechanical and immunobiological properties of human fascia lata (HFL) vs mesh: implications for pelvic reconstructive surgery.

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BACKGROUND

- **Sacrocolpopexy (SCP)** is a gold-standard urogyaecological procedure for apical vaginal support, with a **low recurrence rate, higher satisfaction and faster recovery** than other abdominal and vaginal prolapse surgeries [1,2].
- **Titanium-coated polypropylene mesh** (**TiMesh**) is an off-label mesh that has previously been implemented in SCP procedures, with patient consent [3].
- The use of **autologous human fascia lata (HFL)** in pelvic reconstructive procedures such as **(SCP)** has become increasingly desired by patients due to a greater awareness of potential complications of synthetic mesh, and a difficulty for surgeons to acquire suitable synthetic grafts.
- However, from a surgical perspective, the **biomechanical, morphological, cellular, matrix, and immunological properties** of HFL remain largely elusive.

AIMS

- To evaluate the **histological and morphometric properties** of HFL in a **pre-clinical murine abdominal incision model.**
- To compare the pre- and post-implantation **biomechanical** and **tensile characteristics** of HFL with synthetic Timesh.
- To assess differences in **extracellular matrix (ECM) regulation, angiogenesis** and ***in vivo*** **foreign body response** of HFL and synthetic explants.

RESULTS

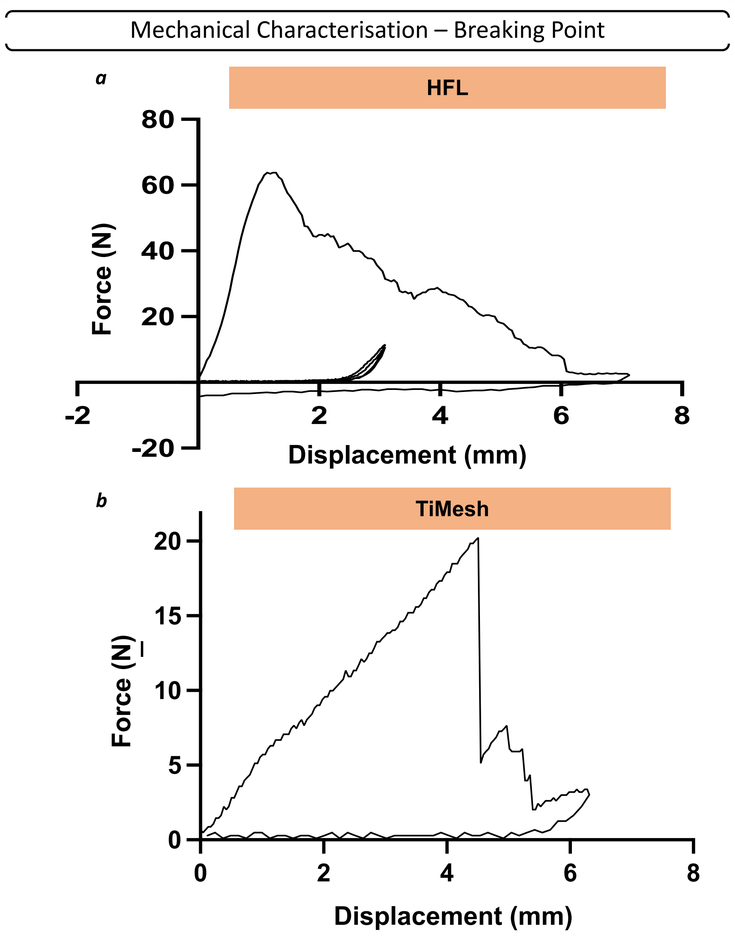


Figure 3: *Breaking point tensiometry of (a) HFL and (b) TiMesh measured as maximum displacement of graft vs absolute force (N).*

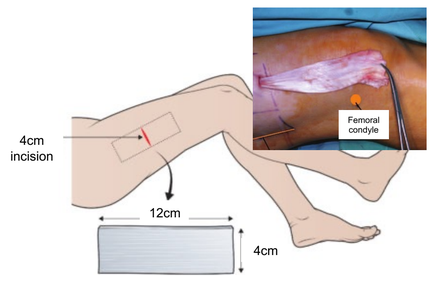
CONCLUSION

- This study highlights that **HFL is an ideal biological graft** that may be used as an alternative to synthetic meshes in Urogynaecology and Urology.
- HFL consists of **fibrous structural proteins such as collagen and elastin,** which confers **higher mechanical adaptability and durability** when compared to TiMesh**.**
- Furthermore, it exhibits **favourable tissue integration** through **upregulation of genes associate with extracellular matrix production and angiogenesis**.
- However, more long-term prospective clinical data is required to confidently demonstrate favorable anatomical and clinical outcomes in autologous fascial SCP.

METHODS

Biospecimen Harvest

HFL harvested from women (*n*= 26) undergoing SCP or pubovaginal sling insertion.



Animal Surgery

- C57BL6 mice (n=32)
- Two groups: Timesh vs HFL implant
- Surgery: longitudinal 1.2 cm skin incision to make a pocket into which synthetic or fascial graft was sutured.
- Mice were euthanised after 7 or 90 days (*n*= 8 per group/time-point).

Explant Analysis

Tensiometry
- Uniaxial tensile strength assessment with cyclical loading of HFL and Timesh grafts *in vitro.*

Histology & Morphology Analysis
- Histological and immunohistochemical analysis for explant cellular infiltration, elastin and collagen content.

Fluidigm PCR analysis
- qPCR on extracted cDNA to measure targeted gene expression for ECM regulation, angiogenesis, and foreign body response measured as fold-changes to non-operative controls

RESULTS

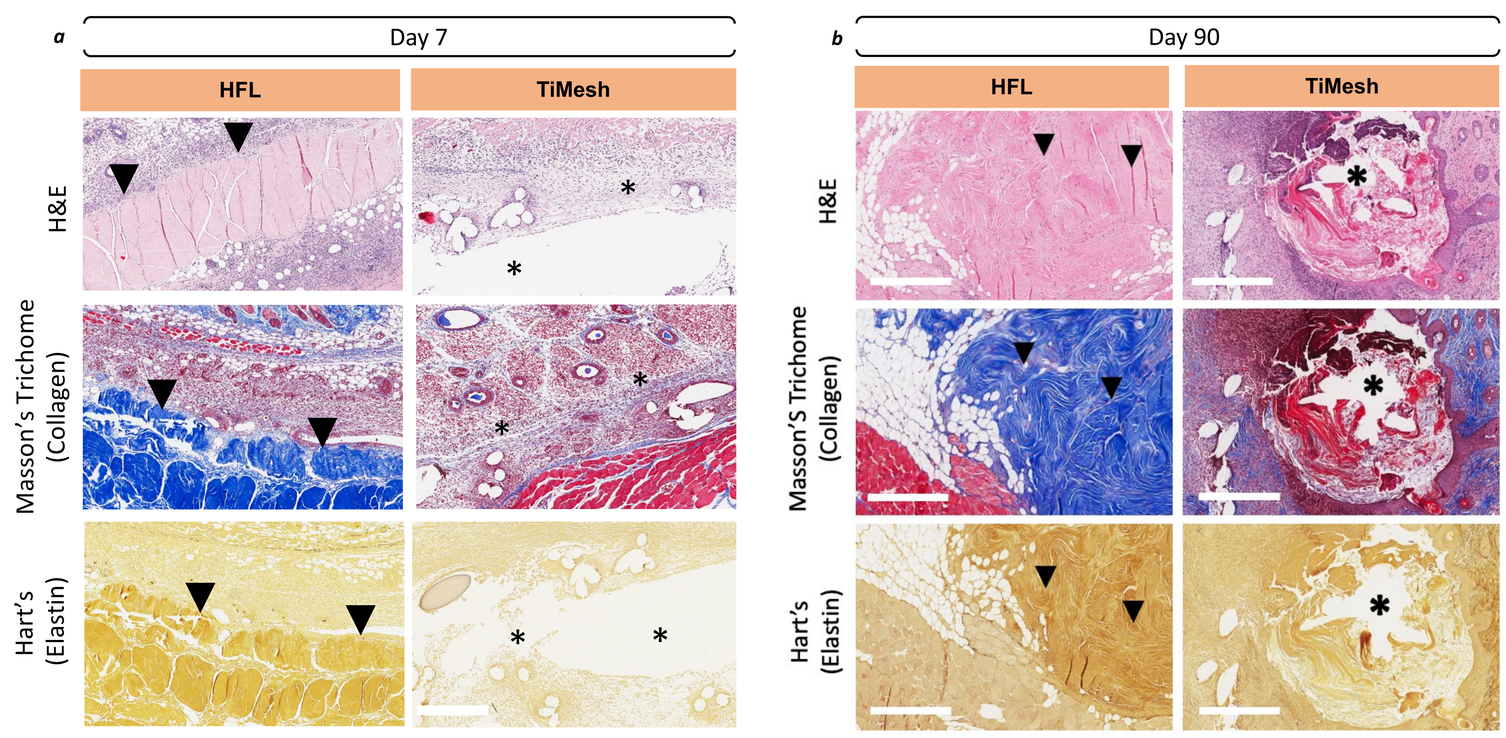


Figure 1: *H&E, Collagen (Masson's trichome) and Elastin stained tissue explants of HFL (black arrowheads) and TiMesh (asterisks) at day 7 (a) and 90 (b), with evidence of a less marked inflammatory response and tissue catabolism in the HFL group compared with TiMesh group. Scalebar = 400μm.*

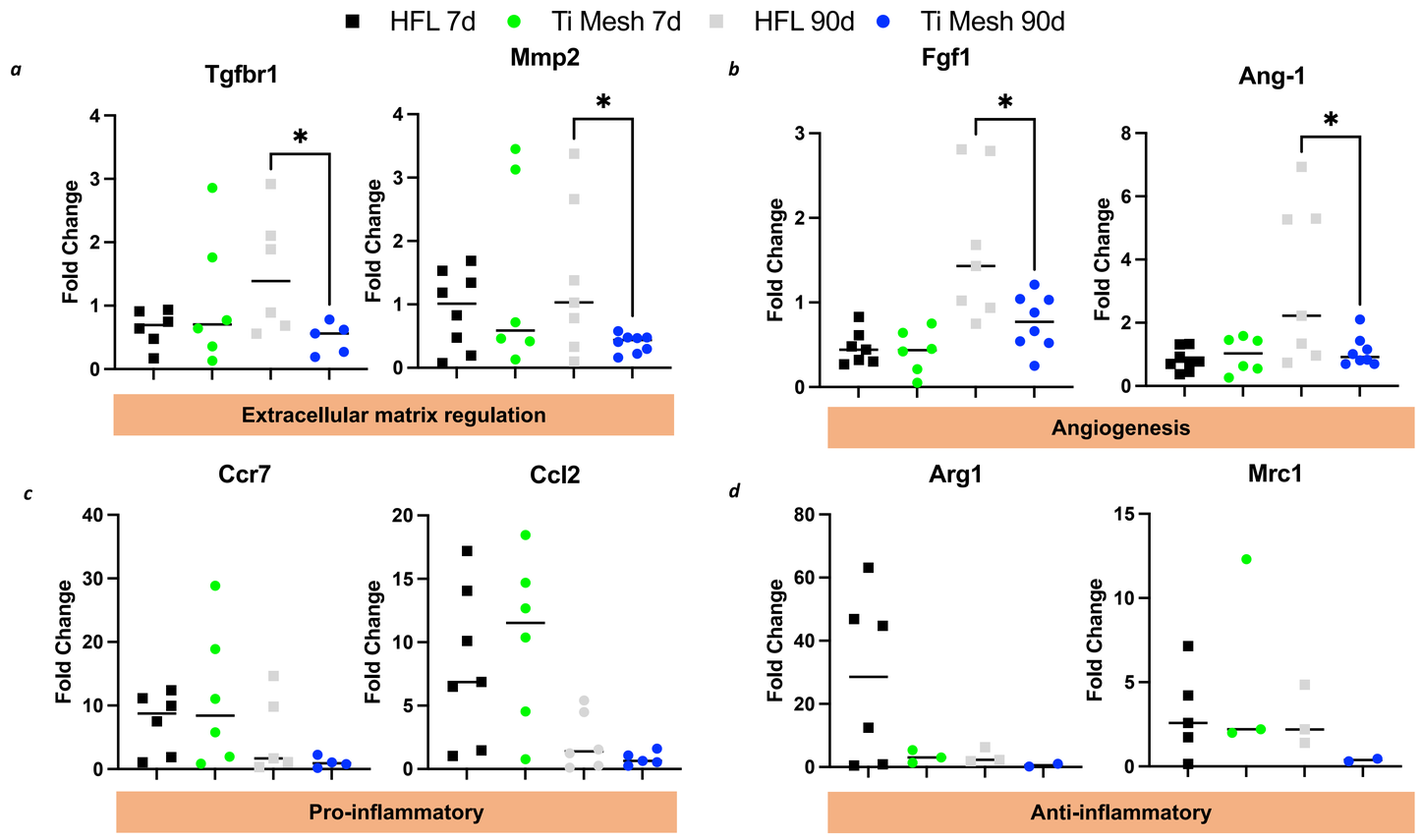


Figure 2: *Quantitative PCR analysis of various genes associated with (a) ECM production (Tgfbr1), ECM regulation (Mmp2), (b) angiogenesis (Fgf1, Ang-1), (c) pro-inflammation (Ccr7, Ccl2) and (d)anti-inflammation (Arg1, Mrc1). Represented as fold change with respect to the non-operative control (* = P <0.05).*

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