Bridging the gap between biological and synthetic scaffolds using Quantum Molecular Resonance (QMR) technology to develop next-generation scaffolds for tissue engineering

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ABSTRACT

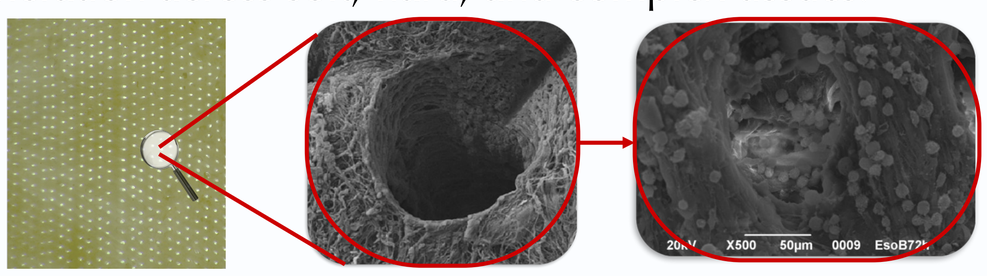
Tissue and organ regeneration requires scaffolds that combine biological signaling with controllable microarchitecture.

Biological scaffolds
- ✓ Natural biochemical cues
- ✗ Poor control over porosity and reproducibility

Synthetic scaffolds
- ✓ Tunable and reproducible architecture
- ✗ Limited biological signaling

Unmet need: preserve organ memory while enabling controllable microarchitecture.

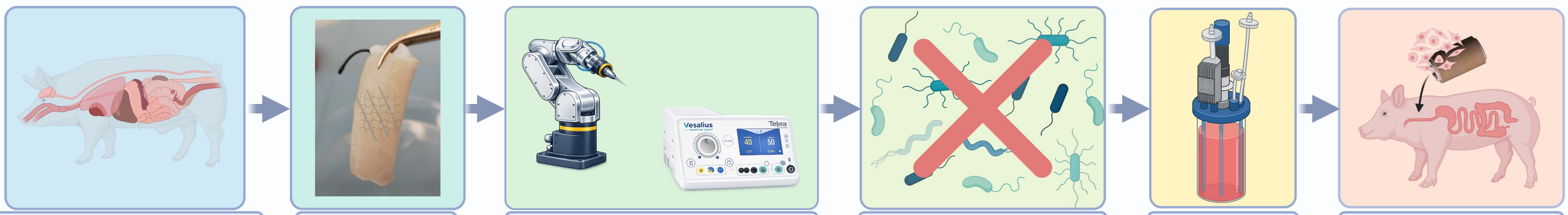
Our approach: Quantum Molecular Resonance (QMR)-driven micro-perforation creates customizable microchannels in decellularized tissues, increasing porosity without thermal damage to enhance cell infiltration and regeneration across soft, hard, and complex tissues.



EVIDENCE

- **Soft tissue**: porcine **esophagus**
  - full organ regeneration *in-vivo* (n=22)
- **Hard tissue**: porcine **palate**
  - promising *in-vivo* outcomes (n=6)
- **Clinical-grade dermal matrix**
  - assessing faster healing & integration
- **Thick tissue**: porcine **urinary bladder**
  - promising *in-vitro* results

MATERIALS & METHODS

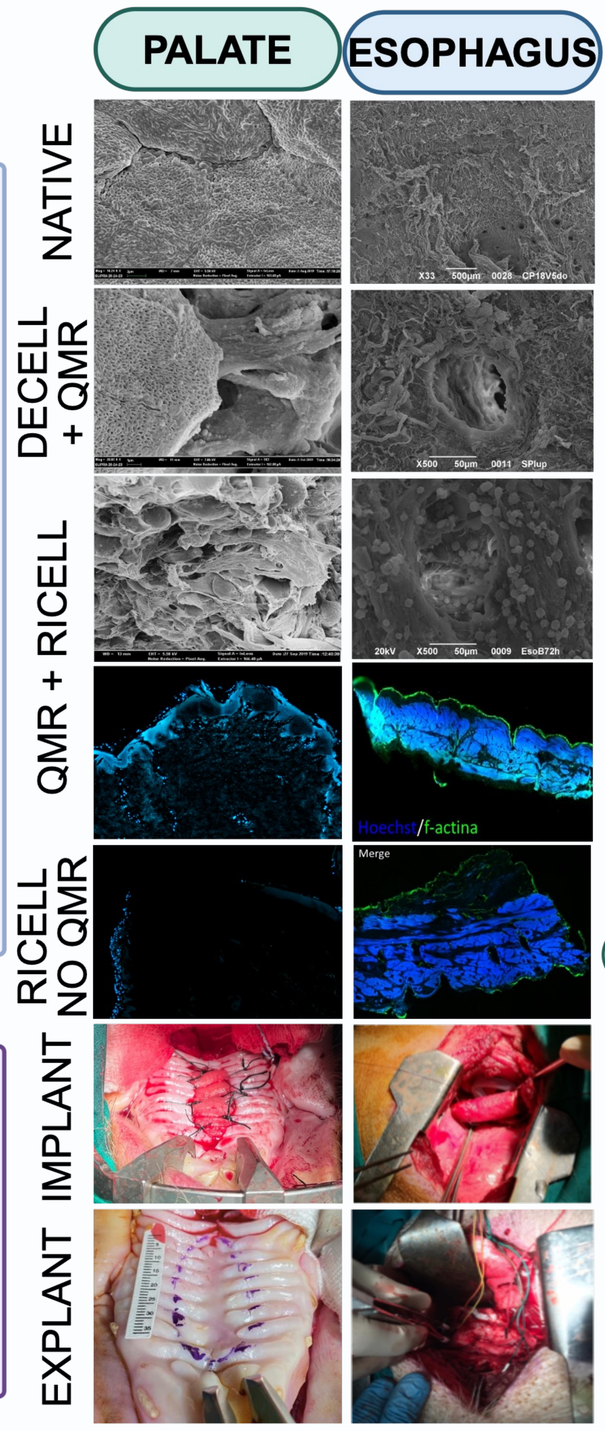


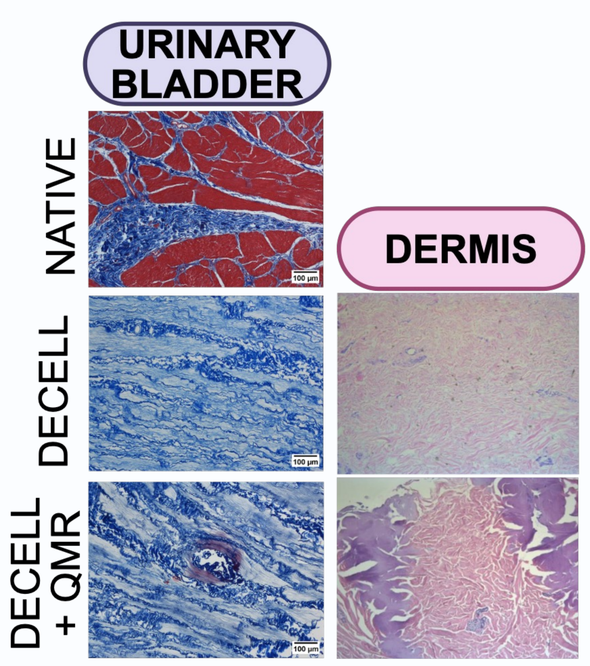
ORGAN PROCUREMENT → DECELL → QMR MICRO-PERFORATION → STERILIZATION → CELL SEEDING → *IN VIVO* TESTS

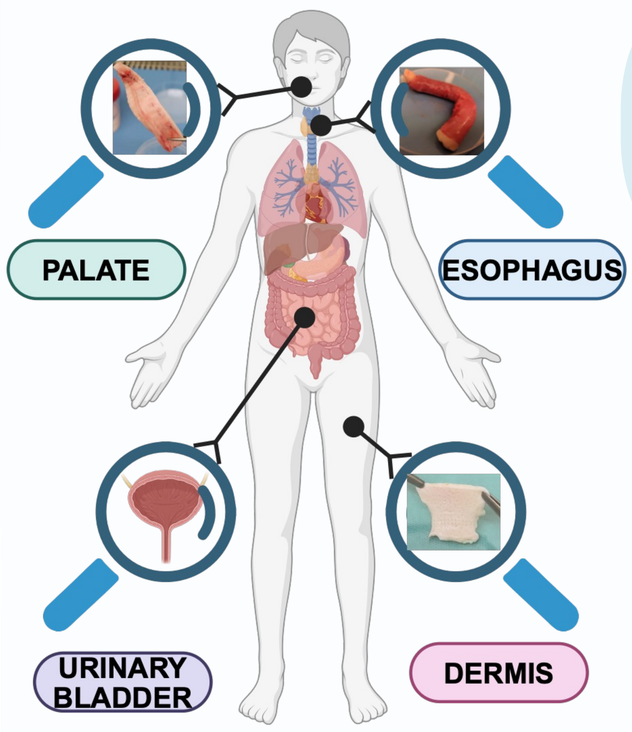
RESULTS



***IN VITRO* TESTS**







***IN VIVO* TESTS**

DISCUSSION

Increased porosity enhances cell infiltration and repopulation, resulting in faster and more homogeneous tissue regeneration.
QMR technology has demonstrated excellent *in vivo* outcomes in porcine models for soft (esophagus [1]) and hard (palate [2]) tissues. The method is now being applied to MODA, a clinically approved dermal matrix [3,4], and extended to complex tissues such as the urinary bladder, showing promising *in vitro* results.

CONCLUSIONS

QMR micro-perforation emerges as a versatile platform to enhance integration and regeneration across multiple tissue types.

REFERENCES

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