New method makes spinning collagen microfibres quicker, cheaper, and easier

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Scientists in Norfolk, VA have developed a new method of making collagen microfibres, which could have applications in research, medical devices and clinical treatments ranging from ligament damage to skin burns.

While collagen fibre manufacturing methods such as electrospinning and extrusion exist for biomedical applications, they have seen limited clinical success. This is partially due to challenges of scalability, cost, and complexity.

The research team, from Eastern Virginia Medical School, The Frank Reidy Research Center for Bioelectrics at Old Dominion University and Embody LLC developed a new method called pneumatospinning.

Writing in *Biofabrication*, they describe how it uses a high-speed air-based technique to form collagen microfibres from clinical-grade calf skin collagen.

Lead author Dr. Michael Francis said: "Existing methods for making collagen fibre produce low volumes of material, and are very complicated and expensive. Our aim with this research was to explore a cheaper, simpler method that could produce more material faster, ultimately moving towards clinical translation."

The researchers dissolved clinical grade type-1 collagen in acetic acid. They then used a common airbrush to spray the solution (pneumatospinning), polymerizing it into cytocompatible sub-micron fibres. After stabilising the resulting collagen scaffolds, the team examined them using Fourier-transform infrared spectroscopy, circular dichroism, mechanical testing and scanning electron microscopy to show the assembly of native collagen fibre from the molecular to microscales, through mesoscale and into macroscale.

Dr. Francis said: "We found the pneumatospun collagen fibres had significantly higher tensile strength compared to electrospun collagen. Also, stem cells cultured on the pneumatospun collagen showed strong cell attachment and compatibility, providing opportunities for more advanced combination therapies."

"Using dimethyl sulfoxide (DMSO) as a solvent, we were also able to make a blended, microfibrous biomaterial by pneumatospinning it with poly(d,l-lactide) This enables even more possible applications of this collagen microfibre-based manufacturing technology for other therapeutic indications with varying requirements, such as higher tensile strength and tailorable degradation kinetics, as based on clinical need."

"As a robust and rapid method of collagen microfibre synthesis, this method has many applications in medical device manufacturing. That includes those benefiting from anisotropic microstructures, such as ligament, tendon and nerve repair, for topical meshes such as ocular or wound dressings, or even for applying microfibrous collagen-based coatings to other materials, such as polymers and metals to enhance graft integration and compatibility."

More information: Seth Polk et al. Pneumatospinning of collagen microfibers from benign solvents, *Biofabrication* (2018). DOI: 10.1088/1758-5090/aad7d0

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