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Using SAXS/WAXS to determine the influence of collagen structure on material properties within acellular dermal matrix materials.

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Collagen tissues such as skin and pericardium are remarkably strong and malleable. These physical characteristics, along with the biocompatibility benefits of being a natural product, make collagen tissues an excellent source material for making surgical patches and implants. Our studies have involved investigating the natural collagen structure within acellular dermal matrix (ADM) materials derived from skin of various species to see how collagen structure can affect material properties and how collagen is able to react to strain. Synchrotron based small angle X-ray scattering was the main investigative technique. We were able to show that collagen fibril alignment in the planar direction results in a stronger ADM material, and when under tension, collagen fibrils realign in the direction of the force before stretching themselves. This behaviour was demonstrated by an initial increase in orientation index upon strain, followed by an increase in D-spacing and decrease in intermolecular spacing and fibril diameter at greater strains.

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