Supplementary Material

Comparison of strain measurements by ultrasound speckle tracking and digital video extensometry

We compared the strain measurements using the ultrasound speckle tracking as described in the manuscript, with the data acquired from a digital video extensometer (DVE) that is a built-in optical strain measurement method for the Bose planar biaxial system. Because the recommended sample size for the Bose DVE is 10 mm × 10 mm, we used porcine skin samples that provide a fairly large flat square.

The porcine skin samples were purchased from a local supermarket and kept in phosphate buffered saline (PBS) overnight at 4C prior to experiments. A 1.5 cm square of about 2 mm thick specimen was excised using surgical blades. The specimen was mounted to the biaxial testing system as described in Subsection 2.1. The sample was kept moist throughout the test. Five ink points (4 at the corners to form a square and 1 at the center) were marked on the sample surface for tracking by the digital video extensometer during mechanical testing. The DVE camera (Prosilica GE680, Allied Vision Technologies, Stadtroda, Germany) has a 640 × 480 pixel resolution. To test in a range of strains comparable to that measured in sclera, the sample was preloaded at 25 grams. The sample was first preconditioned with a built-in sine wave frequency sweep (TuneIQ) at a load ranging from 25 to 100 grams and then equilibrated at 25 grams preload for 15 min. Load-controlled biaxial ramps were performed from 25 grams to 100 grams at a loading rate of 0.66 grams/s. Four repeated ramps were performed for the DVE strain

measurements and two repeated ramps were used for the ultrasound speckle tracking measurements.

Figure S1 shows the load vs strain curves obtained from both methods. The strains curves from ultrasound speckle tracking fell within the range of those from DVE; although the latter were markedly noisier. To quantify the influence of the environmental noise during the strain measurements, we acquired two images consecutively on the same skin sample without moving the sample or introducing any deformation. The average spurious strains were approximately 0.01% for the DVE and 0.001% for ultrasound speckle tracking (Tang and Liu, 2012). These results showed that the ultrasound speckle tracking in general agrees with DVE in strain measurements and is less susceptible to environmental noise.

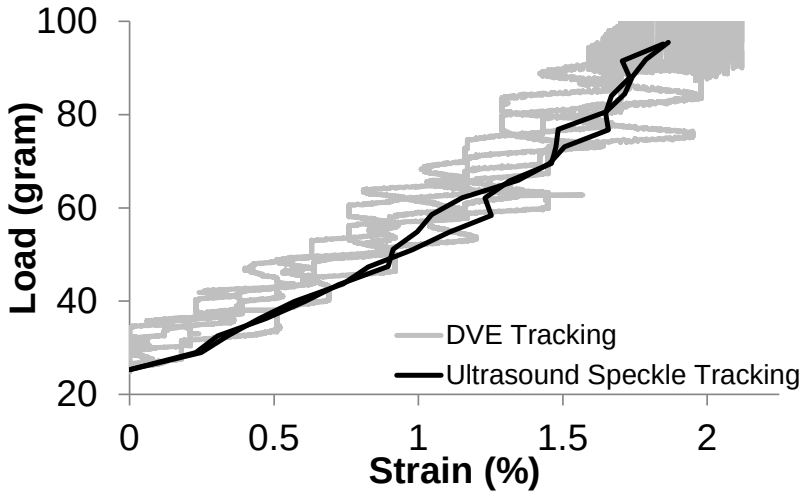

Figure S1: Load versus strain curves during biaxial testing of a porcine skin sample.