Characteristics of highly flexible PDMS membranes for long-term mechanostimulation of biological tissue

Measurement of mechanical properties of soft biological tissue remains a challenging task in mechanobiology. Recently, we presented a bioreactor for simultaneous mechanostimulation and analysis of the mechanical properties of soft biological tissue samples. In this bioreactor, the sample is stretched via deflection of a flexible membrane. It was found that the use of highly compliant membranes increases accuracy of measurements. Here, we describe the production process and characteristics of thin and flexible membranes of polydimethylsiloxane (PDMS) designed to improve the signal-to-noise ratio of our bioreactor. By a spin-coating process, PDMS membranes were built by polymerization of a two component elastomer. The influence of resin components proportion, rotation duration, and speed of the spinning were related to the membrane mechanics. Membranes of 22 mm inner diameter and 33 to 36 μm thickness at homogeneous profiles were produced. Isolated rat diaphragms served as biological tissue samples. Mechanical properties of the membranes remained constant.
during 24 h of mechanostimulation. In contrast, time- and strain-dependent mechanical properties of the diaphragms were found.

Stichworte: silicone membranes, mechanical properties, rat diaphragm

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