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**Research Abstracts**

## Addressing the Fidelity of Materials Used in Surgical Simulator Design: The Muscle Surrogate

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**Introduction:** The required fidelity of synthetic materials in surgical simulators to teach tissue handling and repair requirements should be optimal to enhance psychomotor skills. There is a poor correlation between simulated tissue surrogates in simulators and training outcomes for trainee surgeons with their use. To address this, the mechanical characteristics of several candidate synthetic muscle surrogates were measured, and their subjective fidelity was qualitatively assessed by surgeons.

**Methods:** Silicone was selected after assessing several material options and 16 silicone-based surrogates were evaluated. Three of the closest samples to muscle (Samples 1.1, 1.2, 1.3) and one with inserted longitudinal fibres (1.2F) were mechanically tested in the following: compression and tension, needle puncture force and suture pull-out in comparison with real muscle. The four samples were evaluated by 17 Plastic and Orthopaedic surgeons to determine their views of the fidelity with regard to the handling properties, needle insertion and ease of suture pull-out.

**Results:** The mechanical testing showed the surrogates exhibited varying characteristics that matched some of the properties of muscle, though none recreated all the mechanical characteristics of native muscle. Good biofidelity was generally achieved for compression stiffness and needle puncture force, but it was evident that tensile stiff was too low for all samples. The pull-out forces were variable and too low, except for the sample with longitudinal fibres. In the qualitative assessment, the overall median scores for the four surrogate samples were all between 30 and 32 (possible range 9-45), indicating limited differentiation of the samples tested by the surgeons.

**Conclusions:** The surrogate materials showed a range of mechanical properties bracketing those of real muscle, thus presenting a suitable combination of candidates for use in simulators for muscle repair acquisition. However, despite significant mechanical differences between the samples, all surgeons found the samples to be similar to each other.