COMPOSITE HYDROGEL: A NEW TOOL FOR REPRODUCING THE MECHANICAL BEHAVIOUR OF SOFT HUMAN TISSUES

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INTRODUCTION

Experimenting with real soft tissue is important to understand its behaviour. However, this is difficult due to ethics, cost of equipment and availability. There is a need for synthetic materials that can mimic real tissues. A composite hydrogel (CH) constituting of PVA and phytagel is able to reproduce the viscoelastic responses of various soft tissues at certain concentrations [1]. Varying the concentration of PVA and phytagel results in a CH with different viscoelastic properties. Here we report an example of brain shift mimicking for robotic surgical experiments.

MATERIALS AND METHODS

In order to tune the behaviour of the CH, unconfined compression tests were performed at 30% strain and 1, 0.01 and 0.0001 s⁻¹ strain rates for both the porcine brain and the composite hydrogels. The stress and viscoelastic properties at 30% strain were calculated.

CH TUNED TO REAL BRAIN

The optimal composition of CH that matches the mechanical behaviour of porcine brain tissue was found to be 5% PVA 0.59% phytagel (wt).

PATIENT SPECIFIC PHANTOM WORKFLOW

Real size geometries can be obtained from MRI scans. The gel can be cast in patient specific silicon mould to reproduce the surgical scenario. The scenario can also be modelled with finite element techniques for surgical pre-operative planning.

REFERENCES