Craniosynostosis

ISCFS2019/ABS-572

COMPUTATIONAL MODELLING OF CALVARIAL GROWTH IN SAGITTAL SYNOSTOSIS

Oyvind Malde [1], Chien L. Lim [1], Arsalan Marghoub [1], Michael L. Cunningham [2], Richard A. Hopper [2], **Mehran Moazen** [1]

[1]Mechanical Engineering, University College London, London, United Kingdom, [2]Craniofacial Center, Seattle Children's Hospital, Seattle, United States

Preferred presentation method: ORAL

Introduction & Objectives: Early fusion of the sagittal suture is the most common form of craniosynostosis. A number of techniques have been developed for the management of this condition while the "optimum" approach is yet to be known. Computational models have great potential in optimisation of the calvarial reconstruction. The aim of this study was to develop a patient-specific computational model of the calvarial growth to predict the morphology of the calvaria following the surgery based on the pre-operative computed-tomography (CT) images of the same patient.

Material & Methods: CT images of a sagittal sysnotosis patient were obtained pre and post-operatively and in a follow up visit at the ages of 6,9 and 24 months respectively. A 3D finite element model of the skull based on the pre-operative images was developed. The model included the brain, bones and sutures. The treatment approach i.e. here full calvarial remodelling, was virtually performed on the model. Input parameters to the model were estimated based on our previous studies. Several sensitivity analyses to the input parameters were performed and outputs were compared in terms of overall shape to follow up calvarial morphology.

Results: As expected, sensitivity analyses highlighted that model predictions were sensitive to the choice of input parameters. The most important parameters were the way that the bone-brain interface was modelled and modelling bone formation during the development. It was also demonstrated that the calvarial morphology at the 24 month of age could be predicted based on the model at the 6month of the age.

Conclusion: The model developed in this study is the first patient-specific validated model of the calvarial growth. The close match between the predicted shape of the calvarial and the follow up CT build confidence in the modelling approach. However, further studies are required to compare the biomechanics of different reconstruction approaches.

Would you like to insert pictures?: No

Disclosure of Interest: None Declared