# Biomechanics of skull development

***Abstract:*** *The human skull consists of many bones that are joined together along their edges by dense soft tissues called sutures. The sutures are designed to give the bones flexibility for birth and to allow the skull to expand and grow as the brain enlarges. Once the brain and skull have reached their full adult size, the sutures fuse together to create a single bony structure. Premature closure of the sutures (craniosynostosis) is a medical condition that occurs in 1 in 2000 births and may result in functional abnormalities of the brain, breathing, feeding and vision unless there is surgical intervention. However, even after intervention, some children redevelop raised intracranial pressure requiring further surgical procedure.*

*Molecular biologists are working to understand this disorder by investigating the genetic basis of suture formation and fusion in genetically modified animal (mouse) models that display craniosynostosis. These animal models provide an invaluable opportunity to understand the role of biomechanical factors in skulls exhibiting craniosynostosis, which are very difficult to examine and to test in humans. In the meantime, craniofacial surgeons have developed complex surgical procedure to manage the condition and minimise its effects. This surgery is usually carried out when the infant is between three to six months of age.*

*The aim of this research is to understand how the biomechanical forces (especially from the growing brain) interact with the soft tissue structures and individual bone plates to shape the skulls of infants that develop craniosynostosis. The long-term goal of the work is to provide advice to surgeons on when to operate and how best to manage the condition from a biomechanical point of view to ensure the best possible outcome for the child.*

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Mehran Moazen graduated in Mechanical Engineering at the University of Mazandaran, Iran, in 2005 and completed his PhD in Medical Engineering at the University of Hull, UK, in 2008. He then worked as a consultant engineer and post-doctoral research fellow at the University of Hull for Smith & Nephew and Hull York Medical School for about a year. In June 2009, he moved to the University of Leeds, UK, as a post-doctoral research fellow investigating the biomechanics of periprosthetic femoral fracture fixation. In June 2012, he received a prestigious five-year research fellowship from the Royal Academy of Engineering to investigate the biomechanics of craniosynostosis. He joined Department of Mechanical Engineering at UCL in July 2015. His research interests are focused on the biomechanics of bone, to understand the underlying mechanisms of bone growth, adaptation and repair. This involves the use of experimental measurements and computer modelling techniques (e.g. image processing, finite element analysis, multibody dynamic analysis) to create complex musculoskeletal models to predict the forces experienced by the skeletal and the resultant stresses and strains produced in the bone and related medical devices.