



Project Proposal for Ph.D.

Project Details	
Project Title	Biomechanics of spinal implants for patients with early onset scoliosis
Project Summary	Early-onset scoliosis (EOS) defined as scoliosis manifesting before the age of 10 years is a challenging problem to treat – the deformity in most cases is progressive and can become severe over a course of few years. The natural history of the disease can lead to restrictive pulmonary disease, cardiac disease and early mortality. Early definitive fusion with spinal instrumentation performed for early-onset scoliosis in the past were performed with the belief that a short, straight spine was superior to a long, deformed spine. However, with the knowledge that early fusion of the spine in the growing age limits the growth of not just the spine, but the lungs and the thoracic cavity also shifted the focus of management from the spine alone to the spine, chest wall and lungs. The goal of treatment is to achieve a well-aligned spine while allowing the thoracic cavity to develop sufficiently to support pulmonary development and function. The success of distraction-based techniques like growing rods critically depends on the anchorage and stability provided by the foundation sites since the entire forces of the growth of the spine and the periodic distractions are going to be distributed narrowly across these 2-3 motion segments. As a consequence to the significant stress faced by these anchors, the incidence of hardware-related complications such as pull-out of the anchors is as high as 15%-45%. Typically, the implant failure occurs at the proximal anchors sites as the unfavourable bony anatomy – the small size of the pedicles in paediatric spine and the occasionally accompanying pedicle dysmorphism – precludes a solid purchase at the foundation sites. The occurrence of hardware-related complications can lead to an unplanned return to the operating room (UPROR) for the patient – such complications and the resultant surgeries can be devastating for the patient and relatives and compromise the success of growth-friendly surgeries in this patient population. The aim of this study is to investigate the failure modes of various commercially available anchorage and to perform <i>in silico</i> evaluation of novel anchorage designs for patients with EOS.

Ph.D. Supervisors				
Role	Name of Faculty		Academic Unit in IITD/Institute/University	Email ID (Official)
Supervisor 1	Anoop Chawla		Mechanical Engineering, IITD	achawla@mech.iitd.ac.in
Supervisor 2	Kaushik Mukherjee		Mechanical Engineering, IITD	kmukherjee@mech.iitd.ac.in
Supervisor 3	Bhavuk Garg		Department of Orthopedics, JPNATC, AIIMS	drbhavukgarg@gmail.com

Project requirements (Student qualifications, experience required, etc)

*The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)

- Student qualifications:
 - B.E./B.Tech (from CFTI)/M.E./M.Tech in Mechanical Engineering/Biomedical Engineering with valid GATE score
 - Knowledge of CAD & FE packages (like SolidWorks, Ansys) and/or any biomedical image processing module will be desirable
 - Knowledge of Gait and motion analysis and/or musculoskeletal modeling package (OpenSim/AnyBody) will be an additional advantage
- Facilities required:
 - Gait and Motion analysis lab (AIIMS New Delhi)
 - Patient recruitment (AIIMS New Delhi)
 - Clinical data (CT/MRI from AIIMS New Delhi)
 - Computational facility (IIT Delhi)
 - Gait lab (IIT Delhi)

Source of fellowship/funding (CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)
Candidate with his/her own fellowship /institute assistantship

Role of Faculty Members involved:	
Supervisor-1	Computational modelling, FEM, Fracture analysis, Implant Design, Mentoring
Supervisor-2	Gait and motion analysis, Musculoskeletal modelling, Orthopedic Biomechanics, Mentoring
Supervisor-3	Clinician, Orthopedic Surgeon, Patient recruitment, Mentoring