Thermoplastic Filament

Disorders of the spine are among the most common indications for neurosurgical and orthopedic surgical interventions. Spinal fixation in the form of pedicle screw placement is a common form of instrumentation method in the lower cervical, thoracic, and lumbar spine. A vital principle to understand for the safe and accurate placement of pedicle screws is the palpable difference between the cortical and cancellous bone, both of which have different material properties and compositions. Probing and palpation of the hard cortical bone, also known as the “ventral lamina”, covering the neural elements of the spinal canal during screw placement provides manual feedback to the surgeon, indicating an impending breach if continued directional force is applied. Generally, this practice is learned at the expense of patients in live operating room scenarios. Currently, there is a paucity of human vertebra simulation designs that have been validated based on the in vivo ultrastructure and physical properties of human cortical and cancellous bone. In this study, Clifton et al. examined the feasibility of combining three-dimensionally printed thermoplastic polymers with polymeric foam to replicate both the vertebral corticocancellous interface and surface anatomy for procedural education [1)].

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Clifton W, Pichelmann M, Vlasak A, Damon A, ReFaey K, Nottmeier E. Investigation and Feasibility of Combined 3D Printed Thermoplastic Filament and Polymeric Foam to Simulate the Cortiocancellous Interface of Human Vertebrae. Sci Rep. 2020 Feb 19;10(1):2912. doi: 10.1038/s41598-020-59993-2. PubMed PMID: 32076086; PubMed Central PMCID: PMC7031368.