

A Novel Spinal Implant for Progressive Scoliosis Correction

Idiopathic scoliosis is lateral deviation of the spine, affecting 3.45/1,000 girls and 0.28/1,000 boys worldwide with unknown etiology. The curve develops during puberty and over 80% of patients are women. Mild curve ($< 20^\circ$) will affect the postural balance and therefore increase psychological burden to patients. Apart from cosmetic considerations, scoliosis also causes discomfort, pain and considerable inconvenience. Severe curves ($> 40^\circ$) will eventually cause cardiopulmonary dysfunction, lumbar muscle fatigue, early onset of low back pain and increased mortality if left untreated. The current correction approach for severe curves is that of surgical instrumentation and spinal fusion, and only achieves to 70% correction. Attempting full correction may result in bony fractures or neurological deficit due to spinal cord damage, whereas smaller force will result to under correction. All these problems may attribute to the viscoelastic relaxation of spinal tissues, which the stiffness of the spine decreases over the duration for which the force is applied.

To overcome viscoelasticity, the Department of Orthopaedics & Traumatology of the University of Hong Kong has investigated a novel spinal instrumentation to gradually correct scoliosis by using the 'super-elasticity' found at nickel-titanium (NiTi) shape memory alloy. Super-elasticity is a property in which after the metal is deformed, the recovery force remains constant within a range of deformation. After receiving a patented treatment protocol, the NiTi spinal rod is malleable at room condition, but becomes super-elastic at body temperature. This device is proven to be effectively correct spinal curve in animal. With the concern of nickel allergy, the HKU researchers together with the scientists in the Department of Physics and Materials Science of City University of Hong Kong have developed an advance surface nanotechnology to prevent nickel ion released from the substrate. HKU will start the clinical trial of this novel implant in patients by the end of 2005.