Numerical evaluation of the effects of stress shielding on a femur bone with a freeze dried cortical bone plate

Akondi Saisri
Manipal University, India

Damaged bone tissues have a remarkable ability to regenerate itself. A fractured bone when held together using a bone plate/grafts when surgically implanted has proven to regain its original strength. The most common biomaterials used in the manufacturing of bone plates in the industry are titanium and stainless steel based alloys, as the bone plates must be strong enough to give support to the fractured bone as well as bear the load normally placed on the bone while it heals. The plate must also have stiffness similar to that of the bone to which it is attached. Evaluating the stiffness of the bone plate is important because the stress shielding increases with the difference in stiffness. Stress shielding is the phenomenon in which the implant bears most of the load normally placed on the bone. Although this is favorable while the bone is weak, but as the bone heals and regains strength, it does not allow the bone to carry an increasing load, which results in the reduction of bone density and final regained strength. The objective of the study was to suggest Freeze Dried Cortical bone plate with appropriate geometry as a biomaterial which can be used to make bone plates for fracture healing with the method of Finite Element Analysis. It was found that a curved geometry with 120° arc axis with Stainless Steel Bands can be used for optimum distribution of stresses and strains when an axial static load is applied.

Keywords: Freeze Dried Cortical Bone Plate, Biomaterials, Stress Shielding, Fracture Healing, Numerical Models.

Biography

Akondi Saisri is a recent graduate with a B.Tech in Biomedical Engineering from Manipal Academy of Higher Education (Manipal University). She has won numerous awards pertaining to low cost medical devices. She won New Zealand- India Sustainability Award organized by Education New Zealand for her cost effective m-Health application. She is also the Co-Investigator for Novel Vaccination Beads Project which is funded by the Bill and Melinda Gates Foundation Grant. She is also a TEDx speaker.

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