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## Chapter VII

### Summary

Isoelasticity implies the optimum approximation of the physical characteristics of an implant to those of bone. An ideal isoelasticity, however, can never be achieved since bone is anisotropic and the alloplastic materials used in orthopaedic implants shows isotropic properties. In addition, there is no adaptation of the structure to the forces acting on the bone as in case of viable bone. Moreover, the variety of individual forms and strengths of the human bone can never be limited by an artificial implants.

This essay shows that the orthopaedic implants weaken bone by stress shielding but they also predispose to fracture by increasing stiffness of a segment of bone so that there is an abrupt transition between the degree of elasticity of the supported and unsupported segments of bone.

In this essay we discuss the mechanical properties of implantable materials and the bases of design of the implants which shows that the optimal fixation of an implant depends mainly on its material and design features. The elasticity of the material and consequently the deformation of an implant depends on the elastic modulus of the material. Modulus of elasticity measure the rigidity or stiffness of the material. A low modulus of elasticity indicates that the material is pliable and a high modulus indicates that the material is stiff.

Theoretically, a low modulus of elasticity (more elastic) may be advantageous because it would reduce the stress in the component and increase the loading of bone segment and cement resulting in decrease stress shielding but may increase the risk of cement failure. Likewise, a

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high modulus of elasticity (less elastic) may be considered advantageous because it would reduce the stress in cement and decrease the risk of cement failure, but it could be disadvantageous because the bone become unloaded so that, disuse osteoporosis or stress shielding could developed resulting in producing loosening of the component.

In this essay we discuss variable implantable materials especially composites because the composites have potential to made into isoelastic implants. Bone itself can be taught of as a composite material being made up a collagen fibers matrix stiffened by hydroxyapatite crystals.

This essay shows that the concept of isoelasticity means "An even distribution of forces in the bone, and the deformation of both implant and bone in the same direction when placed under load, without relative movements at the contact surface". The isoelasticity is not a mere material property but in addition, design features that allow physiological loading of the bone to achieve favorable bone remodeling and avoid bone atrophy (stress shielding) around the implanted prosthesis. The fixation of the isoelastic prosthesis is cementless, avoiding the drawbacks of using bone cement.

In this essay we discuss examples of isoelastic implants, which are a composite construction that tries to approximate the elasticity and deformation behavior of bone. On reviewing the clinical results of using of these isoelastic prosthesis in joints arthroplasties, they were found better results than those obtained with the other all prosthesis.