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Anatomical reasoning in the design of biomedical implants of orthopedic and trauma surgery; tibia as an example

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Abstract

The basic role of anatomy in refining surgical techniques and improvements of surgical implants especially in orthopedic and trauma surgery is undeniable. However, it may need to be relevantly investigated and analyzed in a meticulous way. Reasoning of the topography, relation, and course of anatomical structures is imperative as a guide for perfect surgical technique. More importantly, understanding the functionality of the anatomical structures and their mechanical effect along their course on the adjacent structures, particularly under traumatic and pathological circumstances are key factors in designing biological implants and biomaterials.

For over two decades the interlocking intramedullary nails are successfully used to treat long bone fractures including tibia. Despite of their popularity and effectiveness in treating numerous varieties of fractures, technical difficulties and complications are sometimes inevitable due to lack of anatomical reasoning. Although the technological advances and continuous efforts to improve the current nails, their design contributes largely to the development of the possible technical difficulties and implant-related complications.

The general design of the current nails are conceptually perfect fit since they are based on the use of intramedullary cavity; a constant anatomical feature of the long bones. However, functionally based complications such as rotations at the fracture site in, for example, the lower one third tibial fractures urged scientists to add proximal and distal locking screws in order to minimize the post-surgical rotation element. Conceptually, the idea is valid since it significantly reduced the chance for rotation. However, mechanical failures still are a possibility. The immediate reason for such complications seems to be lack of adequate anatomical and biomechanical reasoning of the region. Therefore, anatomically based re-evaluation of the design of particularly the distal interlocking screws may be required.

Biography

Yehia Marreez has completed both M.D. and Ph.D. of Anatomy from the Medical Schools of the Universities of Paris V and XII, France. He completed residency program in Orthopedic and Trauma Surgery and fellowship in Hand and Upper Extremity Surgery in the Parisian hospitals. He also performed postdoctoral studies in the Universities of Auckland and Otago Schools of Medicine, New Zealand. He has over 29 years of combined experience as an orthopedic surgeon and clinical anatomy instructor. Currently, he is a Professor of Anatomy and Musculoskeletal Pathology at Touro University Nevada and member of world health organization (WHO) at GIEESC section. He has published more than 35 papers in peer-reviewed journals.