

Tissue Engineering in Orthopaedic Surgery: Understanding the Clinical Parameters

Stuart Goodman
Stanford University

Tissue engineering holds the promise of regenerating functional structures that are absent due to congenital, developmental or acquired disorders. However, if tissue loss is acquired, the revitalization process must be considered in the broader context of the overall disease process. If tissue regeneration is going to succeed, the mechano-biological environment into which the new tissue is to be placed must be optimized so that the processes of degeneration and failure are not the end result. This concept is extremely important when considering orthopaedic tissue engineering. Furthermore, the expectations of the physician and patient must be aligned with realistic, attainable goals so that disappointment does not occur. In this lecture, the above concepts will be developed in the context of orthopaedic tissue engineering for acquired arthritic and traumatic disorders.

When considering tissue engineering for arthritic disorders, the etiology of the arthritis must be taken into account. Some basic questions immediately arise. Is the arthritis part of a more widespread systemic disorder such as rheumatoid arthritis? What is the pathophysiology of the disease? Is the systemic disorder under satisfactory medical control? What is the natural history of the disease? Is the arthritis confined to one joint or is it polyarticular? Are there biomechanical or other contributory factors that need to be addressed?

What is the status of soft tissues, bone and neurovascular structures near the joint? What are the patient's wishes and aspirations? Are there other alternatives for salvage or replacement of the joint? When some of these issues are examined more closely, it is easy to see why, all things considered, the elderly patient with end-stage arthritis of the hip or knee is probably best served by joint replacement. Furthermore, younger patients with more localized unicompartamental arthritis and biomechanical malalignment should consider realignment procedures in addition to efforts at regeneration.

In the context of orthopaedic trauma management, many of the same principles apply. Both systemic factors (pre-existing disease, polytrauma with a systemic metabolic sequelae etc.) and local factors (overall limb alignment, injury to specific musculoskeletal structures, vascularity, nerve supply, infection etc.) are important to the eventual outcome. As one orthopaedic surgeon constantly states, one must consider the patient, the limb, the fracture and the health care team when caring for patients with orthopaedic trauma. Attempts at regeneration of musculoskeletal tissues in traumatic cases must be individualized and take the patient's physical and psychosocial state into consideration. Financial issues that are relevant to the patient, their family and society are also important.