Osteochondral Transplantation in Shoulder Joint

Essay

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ABSTRACT

Osteochondral transplantation from the knee to the shoulder results in a good clinical outcome in terms of pain relief and functional recovery. The ideal osteochondral defect for an osteochondral autologous transplantation in the shoulder is relatively small; however, the results of study suggest that the development of osteoarthritis and the progression of preexisting osteoarthritic changes cannot be altered by the technique. Osteochondral allograft transfer follows a similar protocol of osteochondral autograft transfer, matching a donor plug to a recipient site, but without the limitations on transferable tissue imposed by donor-site morbidity.

The treatment of focal chondral and osteochondral defects of the humeral head remains challenging, especially in younger patients.

Keywords:

Chondral defects,

Osteochondral defects,

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INTRODUCTION

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Hyaline articular cartilage is an avascular and insensate tissue that allows low friction transmission of physiologic loads in diarthrodial joints. Ideally, the functional structure of articular cartilage is maintained in homeostasis over the lifetime of an individual. However, mature hyaline cartilage is relatively hypocellular and incapable of mounting an effective repair response when injured in the skeletally mature adult. Partial-thickness chondral lesions often remain occult due to the insensate nature of articular cartilage and even small, focal full-thickness lesions can remain asymptomatic. While the natural progression of degenerative changes and associated disability is multifactorial, increasing defect size contributes to the development of symptoms and, ultimately, osteoarthritis. Progressive enlargement of articular defects may involve loss of containment in the articular cartilage, leading to increases in load bearing and stress concentration at the defect rim **(Guettler et al., 2004).**

Chondral lesions of the glenohumeral joint pose a significant clinical problem. The natural history of such lesions is unclear; there is no established treatment mentioned in the literature, and nonoperative treatment may not provide sufficient relief from pain **(Snow and Funk, 2008).**

The treatment threshold for surgical intervention is not unequivocal, but patients with symptomatic lesions are generally considered as candidates for cartilage procedures. Of the many different techniques that have been proposed over time, the ones that are in common use today include marrow-stimulating techniques such as micro-fracture, autologous chondrocyte implantation in its different variations, and osteochondral grafting using autologous or allogeneic tissue **(Alford and Cole, 2005).**

Marrow-stimulating techniques are commonly considered as an initial reparative treatment option for relatively small, contained articular cartilage lesions because they are simple to perform, economical and often appropriate and effective. However, these efforts generally result in fibrocartilagenous repair with biomechanical properties and wear characteristics that are inferior to that of hyaline cartilage. Autologous chondrocyte implantation (ACI) has gained popularity over the last decade as a restorative procedure. Criticisms of ACI include the high cost of culturing and expanding chondrocytes, the invasive, two-step nature of the procedure, the steep learning curve associated with the technique, and the inconsistent hyaline quality of the resultant tissue as it matures. Consequent generations of ACI have tried to address some of the issues of donor site morbidity and graft hypertrophy by introducing collagen patches for coverage and by seeding the cultured chondrocytes in artificial scaffolds **(Bartlett et al., 2005).**

The use of osteochondral grafts of autologous or allogeneic origin is well supported on a basic science level and has a long successful clinical history as a means of biologic resurfacing. While either application has unique advantages and challenges, both subscribe to a common paradigm of transplanting mature hyaline cartilage containing viable chondrocytes attached to subchondral bone to restore the architecture and characteristics of native tissue in acquired osteoarticular defects. By transplanting structurally complete osteochondral units with an intact tidemark, the fixation issue is mostly related to that of osseous ingrowth **(Bobic, 1999).**

One obvious disadvantage of autologous graft sources is that the maximum graft surface area is self-limited by donor volume, to small and medium-sized lesions. Also, donor site morbidity can significantly add to the disease burden during intra-articular transfer, or even introduce it if the transfer is inter-articular. However, autologous grafting does hold advantages over other graft sources, such as fresh osteochondral allografting. It is relatively cheap, immediately available, nonantigenic, and osteogenetic, leading to reliable osteointegration. One advantage of osteochondral allografting is that even very large and multiple lesions can be addressed with a solid orthotopic graft that reproduces the anatomy of the native joint both macroscopically and microscopically, without the risk of inducing donor site morbidity. No other current cartilage repair procedure can match the versatility of osteochondral allografts when addressing complex lesions in topographically challenging environments, especially if they present with an osseous

deficiency. Obvious drawbacks to the methodology are the scarcity of organ donor tissue, financial and logistical issues of procurement, and residual risk of infection, albeit small. The surgical techniques for either graft source are straight forward but require precision to restore articular surface congruity while maximizing the potential for bony healing. The mosaicplasty technique incorporates multiple, small autologous grafts, with fibrocartilage to fill in the space between osteochondral grafts, whereas the osteochondral autologous transfer system (OATS) utilizes bigger and fewer dowels **(Duchow et al., 2000).**

Osteochondral allografting employs orthotopic donor tissue to recreate topographically appropriate articular surface anatomy, using either dowel that are analogous to the OATS grafts, especially for contained small- to medium-sized condylar lesions that are accessible, while larger, more complex lesions can be addressed with freehanded shell grafts **(Lane et al., 2004).**

ANATOMY AND BIOMECHANICS OF THE SHOULDER JOINT