Recent Advances in Egypt for Treatment of Talar Osteochondral Lesions

Amgad M. Haleem, MD, PhD[a,b,*], Mostafa M. AbouSayed, MD[b,c], Mohammed Gomaa, MD[b]

KEYWORDS

• Osteochondral lesions • Talus • Articular cartilage • Repair • Reconstruction • Tissue engineering

KEY POINTS

- Treatment of osteochondral lesions (OCLs) of the talus among other weightbearing joints of the lower extremity remains a most challenging arena in orthopedic surgery.
- The basis of marrow stimulation gave way to novel tissue engineering techniques involving various cell niches, growth factors, and scaffolds.
- This article highlights current state-of-the-art techniques and reviews the literature on recent advances in articular cartilage repair using various novel tissue engineering approaches, including various scaffolds, growth factors, and cell niches; which include chondrocytes and culture expanded bone marrow-derived mesenchymal stem cells.

Video content accompanies this article at http://www.foot.theclinics.com

INTRODUCTION

Osteochondral lesions (OCLs) of the talus encompass several synonyms that define a lesion of any origin that involves the articular surface of the talar dome with the underlying subchondral bone. These include osteochondral defects, osteocartilaginous bodies, osteochondritis dissecans, early avascular necrosis, transchondral fractures, and intra-articular fragmentary fragments. These lesions are commonly associated with ankle injuries. They have been shown to occur in up to 50% of ankle sprains

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[a] Department of Orthopedic Surgery, Oklahoma University College of Medicine Health Sciences Center, Oklahoma City, OK, USA; [b] Department of Orthopedic Surgery, Kasr Al-Ainy Hospital, Cairo University School of Medicine, Saray El-Manial Street, El-Manial, Cairo 12411, Egypt; [c] Department of Orthopedic Surgery, Albany Medical College, 1367 Washington Avenue, Albany, NY 12206, USA

* Corresponding author. Department of Orthopedic Surgery, Oklahoma University College of Medicine Health Sciences Center, 920 Stanton L Young Blvd, WP 1380, Oklahoma City, OK 73104.
E-mail addresses: haleem@kasralainy.edu.eg; amgad-haleem@ouhsc.edu

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and fractures.[1] Although the predominant cause remains traumatic,[2] several atraumatic causes have been described in patients without a history of trauma. Such theories include spontaneous necrosis,[3,4] embolic disease, alcohol abuse, endocrine abnormalities,[5] unstable ankle ligaments,[6] and potential congenital or hereditary factors.[7,8]

Treatment of osteochondral lesions (OCLs) of the talus, among other weightbearing joints of the lower extremity, has evolved from palliative treatment, such as debridement and lavage or abrasion chondroplasty, to what may be called the 3 "R" paradigm: reconstruction, repair, and replacement. Reconstruction involves reattachment of OCLs by biodegradable fixation devices and/or reconstructing the contour of the articular surface by autologous or allogenous osteochondral grafts. Repair includes the formation of reparative tissue by marrow stimulation techniques, namely microfracture (MF). The basis of marrow stimulation gave way to novel tissue engineering techniques involving various cell niches, growth factors, and scaffolds. Replacement involves the final stage of joint salvage by partial or total replacement of the articular surfaces with metal prosthesis. Given the finite lifespan of these prosthesis and their infeasible use in the younger active population with high demands, evolution of tissue engineering modalities for cartilage repair has given way to a wide array of techniques that aim at restoring the complex hyaline nature of articular cartilage.

Currently, cartilage tissue engineering has 3 cornerstones. The first is a cell niche with chondrogenic potential that enables proliferation and differentiation into mature chondrocytes. Second, a scaffold is needed that is chondroconductive and/or chondroinductive. Chondroconductivity is defined as providing a structural framework for cartilage growth, whereas chondroinductivity involves the internal ability of the scaffold to provide chondrogenic factors that stimulate cartilage formation and induction of stem cells and/or chondrocytes down a hyaline cartilage-forming lineage. The third cornerstone involves growth factors that need to be introduced to stimulate the chondrogenic cellular pathway with subsequent production of a hyaline extracellular matrix with predominant type II collagen and aggrecan.

This article highlights the current state-of-the-art techniques in cartilage tissue engineering and regeneration, with special emphasis on clinical applications and a brief literature review. The main focus is on various clinically available scaffolds, growth factors, and cell niches; namely chondrocytes and culture-expanded bone marrow-derived (BM) mesenchymal stem cell (MSCs), with which the authors had a relatively extensive experience in Egypt.

DECISION-MAKING IN MANAGEMENT OF OSTEOCHONDRAL DEFECTS

Given the abundant options of surgical treatment of OCLs of the talar dome, the approach to cartilage tissue regeneration strategies should be tailored to each individual. The most important factors to consider in the management of OCLs are patient-specific and lesion-specific. Patient-specific factors include age, body mass index (BMI), activity levels, functional demands, and ability to comply with rehabilitation. Older patients are not candidates for autologous cell implantation techniques because cell senescence is a concerning factor, even with mesenchymal stem cell populations that were proven to undergo senescence.[9,10] Systemic inflammatory and immunosuppressive disorders negate the use of tissue engineering techniques involving implantation of live or culture-expanded cells. The inflammatory process associated with these diseases hinders chondrogenic differentiation of such implanted cell populations. Lesion-specific factors include defect cause, size, site, containment,[11] condition