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A Promising New Treatment for Osteoarthritis

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Abstract

At present, there is no definite cure for the underlying causes of osteoarthritis (OA). However, adipose tissue-derived stem cells (ASCs) in the form of stromal vascular fraction can offer an alternative at this time. ASCs are one type of mesenchymal stem cells that have been utilized and have demonstrated an ability to regenerate cartilage in human patients with OA. Here, we highlight the possibility of ASCs regenerating cartilage in human OA patients.

Keywords: Osteoarthritis; Adipose tissue-derived stem cells; Cell therapy; Cartilage regeneration

Introduction

Osteoarthritis (OA) is the most common and debilitating disorder in the elderly, affecting an estimated 10% of men and

18% of women over 60 years of age [1]. The pain and loss of function can be debilitating; in developed countries the resultant socioeconomic burden is large, costing between 1.0% and 2.5% of gross domestic product [2]. Traditionally, OA treatment consists of pain management with joint replacement for end-stage disease [3-5]. This approach does not address the morbidity associated with early disease or the limitations of arthroplasty surgery, which include the possibility of adverse outcomes and the finite lifespan of prostheses [5].

In 2011, Dr. Pak of our group reported the first study that showed the possibility of autologous adipose tissue-derived stem cells (ASCs) [in the form of stromal vascular fraction (SVF)] regenerating cartilage in human OA patients [6].

Recently, our [7] and other [8-9] groups reported safe and efficacious treatments for OA using autologous ASCs in the form of SVF with or without platelet-rich plasma (PRP) (Table 1).

Table 1 Important clinical studies on autologous ASC treatments for osteoarthritis (OA) from 2013 to 2015

Study type	Number of subjects	Intervention treatment	Follow-up (months)	Outcome and comments
Retrospective cohort study [7]	81	Adipose SVF (ASCs) + PRP via percutaneous injections	26.6	ASCs + PRP are safe and potentially effective in treating patients with OA of knee and "hip".
Randomised double-blind dose escalation study (a proof-of-concept clinical trial) [8]	18	Culture-expanded ASCs via arthroscopic injections	6	1.0x10 ⁸ ASCs into the osteoarthritic knee improved function and pain of the knee joint. Radiological, arthroscopic, and histological measures demonstrated regeneration of hyaline-like articular cartilage.
Comparative study [9]	54	Adipose SVF (ASCs) vs adipose SVF (ASCs) + fibrin glue as a scaffold	28.6	Clinical and arthroscopic outcomes of ASCs implantation were encouraging for OA knees in both groups, although there were no significant differences in outcome scores between two groups.
Multi-center case control study [10]	1114	Adipose SVF (ASCs) via percutaneous injection	17.2	ASC is a novel and promising treatment approach for patients with degenerative OA of knee and hip. ASCs implantation is safe and effective.

SVF, stromal vascular fraction; ASC, adipose tissue-derived stem cells; PRP, platelet-rich plasma; OA, osteoarthritis

Currently, there is no cure for painful OA in stages 2 and 3. For these patients, the intra-articular injection of ASCs can be an alternative treatment. As described in the **Table 1**, the joint injection of autologous ASCs was safe and efficacious. Also, obtaining approximately 100 g of adipose tissue and percutaneous joint injections of ASCs with or without PRP are considered to be a minimally invasive procedure and can be readily accepted by patients [6]. These procedures carry a relatively low rate of morbidity and side effects [7-10].

Autologous adipose SVF can be as efficacious as autologous culture-expanded ASCs. Matter of fact, non-culture and non-expanded adipose stem cells in the form of SVF can be considered to be more efficacious than culture-expanded ASCs; adipose SVF contains other cells and tissues that can contribute to excrete for more growth factors and can also work as scaffolding materials.

Furthermore, preliminary results of phase I or II clinical studies (ClinicalTrials.gov identifier NCT01585857 in France, NCT02219113 in Russia, NCT01300598 in Korea, NCT01739504 in USA, etc.) using autologous ASCs are promising since ASC-based therapy was shown to be safe and well-tolerated [11].

Taken together, ASC-based cell therapy can be a promising new treatment for OA. However, the possibility of using other stem cell-based approaches (bone marrow-derived stem cells, embryonic stem cells, induced pluripotent stem cells, etc.) has to be evaluated in the context of controlled long-term studies that would be compared with the outcome of ASC-based cell therapy.

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