
Expanded Mesenchymal Stem Cell Therapy for Symptomatic Knee Osteoarthritis

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ABSTRACT

Our objective in this study is to determine if the cellular biological treatment can replace surgery by controlling the symptoms, stopping, or slowing the progression of osteoarthritis (OA), and repairing defects. Bone marrow oedema and subchondral bone cysts are frequent findings in the various stages of knee OA. Typically seen on MRI imaging, once the degenerative process starts, it progresses to severe OA, then a high chance of metal knee replacement. There is no proven therapy yet to alter the outcome of OA. Herein we report a case of a fifty-four-year-old salesperson who enjoys active sports. He presented with symptomatic right knee OA. His knee MRI scan revealed patellofemoral subchondral bone marrow oedema and multiple subchondral cysts. Medial meniscus tear, medial, and patellofemoral cartilage loss. He had a large baker cyst and synovitis. He did not respond to an ultrasound-guided steroid injection. Still, he responded dramatically to a single dose of autologous fat-derived expanded mesenchymal stem cells (MSCs) combined with platelet-rich plasma (PRP). He became symptoms-free three months post the therapy, and that persisted. A repeat MRI nine months after the treatment showed a tiny baker cyst and significant reduction of synovitis due to an anti-inflammatory effect of MSCs. Thirty-three months post-therapy follow-up MRI revealed full resolution of both bone marrow oedema and multiple subchondral patellofemoral bone cysts. This case showed encouraging results, which might change the way we practice medicine in OA management as a step before considering surgery.

Keywords: Baker cyst; Bone marrow oedema; Mesenchymal stem cell; osteoarthritis; OA; PRP; subchondral cysts.

1. INTRODUCTION

Subchondral bone marrow oedema (BME) lesions associated with osteoarthritis (OA) are symptoms of a variety of non-specific histologic abnormalities, including bone marrow necrosis, fibrosis, and trabeculae anomalies [1]. Additionally, subchondral cysts (SBCs) appear as well-defined areas of fluid signal on MRI imaging, and they are known to be associated with OA [2]. BME is a compelling risk factor for structural worsening in knee OA, and its relation to progression is partly explained by its association with limb alignment [3]. OA in young individuals occurs with a history of trauma or excessive forces on the knee joint [4,5].

Through this case, we demonstrate the resolutions of both patellofemoral BME and SBCs using autologous expanded MSCs combined with scaffolding PRP.

2. CASE REPORT

A fifty-four-year-old salesperson. He is usually fit and healthy, a regular gym attendee, and does martial arts. He presented to the orthopaedic surgeon with right knee pain, stiffness, swelling, and a limited range of motion 0-100 degrees. Initial MRI in July 2018 showed large knee joint effusion and moderate baker cyst, medial meniscus tear, patellofemoral oedema, and subchondral cysts. His

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diagnosis was OA triggered by excessive sports. He had an ultrasound-guided steroid injection in August 2018. His case worsened clinically with more knee swelling; a repeat MRI scan in October 2018 showed progression of the meniscus tear, ongoing patellofemoral BME and SBCs, and enlarging baker cyst (Fig. 1a and b). The orthopaedic surgeon recommended surgical intervention with arthroscopic meniscectomy, debridement, and future knee replacement.

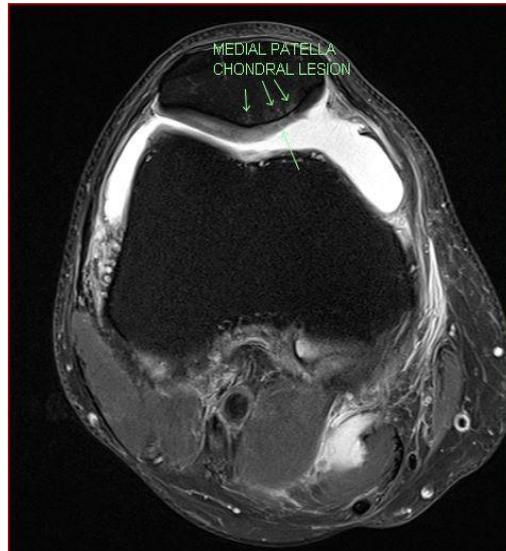


Fig. 1a. pre-treatment Fat-Suppressed T2 MRI demonstrating evidence of patellofemoral subchondral bone marrow oedema and cysts



Fig. 1b. large baker cyst

The patient elected for experimental autologous expanded MSCs therapy. He had abdominal fat harvesting to get the MSCs for purification and expansion in our specialized laboratory for six weeks per standard protocol. In December 2019, we implanted the MSCs with a dose of 80×10^6 combined with PRP into the right knee. We prepared the PRP using ACD-A tubes and centrifuged over eight minutes; We injected a total volume of 8 MLS in a mixture of MSCs (2MLS) and PRP (6MLS) through the medial knee joint under ultrasound guidance.

A follow-up appointment three months following the therapy; he reported pain-free, no stiffness or swelling, and normal knee range of movement 0-135 degrees. Nine months post-therapy, he remained stable, and his MRI showed no progression of a meniscus tear. However, BME and SBCs are still evident with a significant reduction of synovitis and resolution of the baker cyst (Fig. 2a and b).

He continued to be stable with MRI thirty-three months post-MSCs therapy showed complete resolution of both patellofemoral subchondral oedema and subchondral cysts (Fig. 3) with a stable medial meniscus tear and no progression of chondral loss.

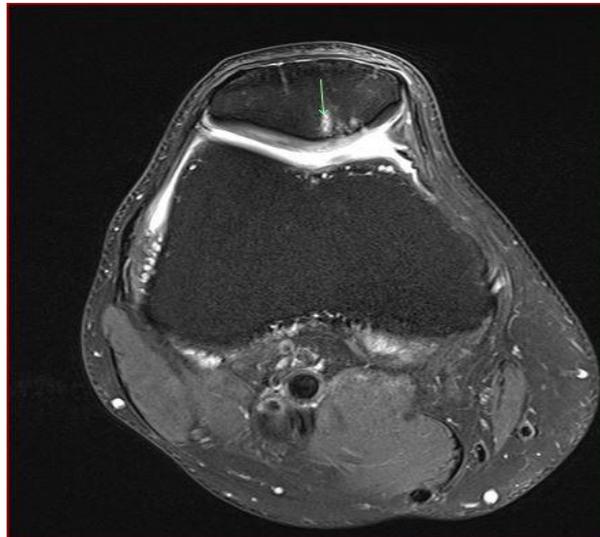


Fig. 2a. Fat-Suppressed T2 MRI, Nine months post-treatment, demonstrating stable subchondral bone marrow oedema and cysts

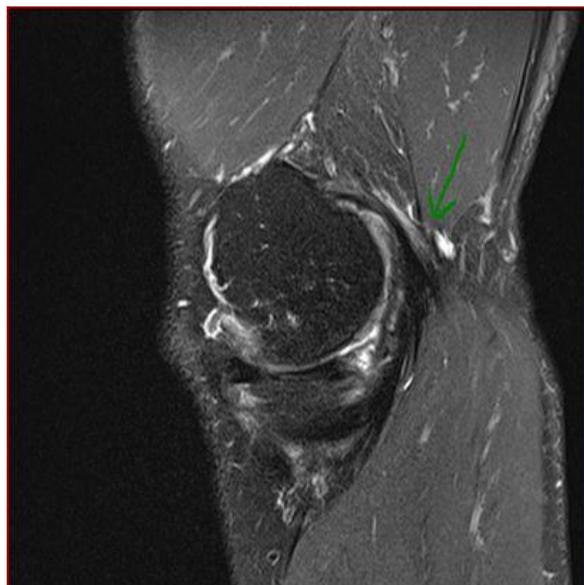


Fig. 2b. Baker cyst nearly resolved

3. DISCUSSION

There is no cure for BME or SBCs, but symptoms control with anti-inflammatory medicine, weight reduction, physiotherapy, and perform lower impact activities, such as swimming or cycling, instead of

higher impact activities such as running and jumping. Additionally, quadriceps strengthening exercises are suitable for slowing the progression of existing lesions and preventing new ones. Yet, no traditional or experimental therapy alters the outcome of OA.

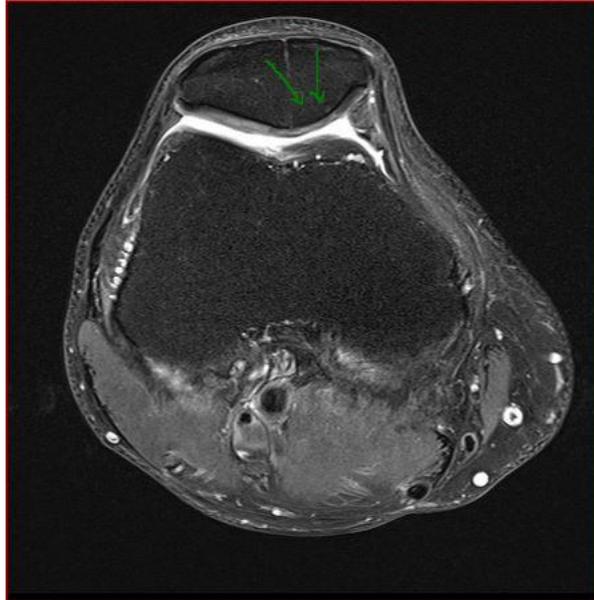


Fig. 3. Fat-Suppressed T2 MRI Thirty-three months post-treatment demonstrating complete resolution subchondral bone marrow oedema and cysts

MSC therapy is promising science as it can provide appropriate cellular signals to encourage tissue regeneration, anti-inflammatory effect, and local immune modulation. MSCs are currently being studied in various research facilities and clinical practices to determine Efficacy and safety [6-8]. In addition, randomized controlled trials suggested the positive outcome of MSCs in OA [9-11]. The theoretical hypothesis of MSCs can regenerate cartilage and eradicate or postpone the need for knee replacement [12].

Our patient had significant clinical and radiological outcomes due to the anabolic and anti-inflammatory effects of combined MSCs with PRP. His symptoms resolved, and his MRI scan showed significant improvement of joint synovitis with baker cyst has reduced in size dramatically. The meniscus tear and chondral thinning remained stable and resolution of both BME and SBCs, suggesting a successful outcome to MSCs therapy.

4. CONCLUSION

We hypothesize the use of expanded mesenchymal stem cells combined with PRP has resulted in the resolution of subchondral patellofemoral bone marrow oedema and subchondral cysts and, in principle, potential repairing OA defects. However, we need to see if those findings are consistent on large randomized controlled trials.

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COMPETING INTERESTS

The author has declared that no competing interests exist.

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Biography of the author(s)



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Research and Academic Experience: He has extensive experience in Expanded Autologous Mesenchymal Stem Cell Therapy for Musculoskeletal and Orthopaedic Conditions.

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The number of Published Papers: He has six research articles.

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