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Bone marrow aspiration concentrate and platelet-rich plasma in the treatment of knee osteoarthritis: A report of three cases

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ABSTRACT

This paper presents the cases of 3 females with knee osteoarthritis. All 3 received a single bone marrow aspiration concentrate (BMAC) injection followed one month later by a platelet-rich plasma (PRP) injection. Compared with the baseline values, pain and functionality scores improved in all the patients. The aim of presenting these cases is to highlight that the combined use of intra-articular BMAC and PRP treatments may have positive effects on pain, functional status and quality of life in patients with knee osteoarthritis.

1. Introduction

Knee osteoarthritis (OA) is a common problem that has a negative effect on the activities of daily living and causes pain despite several conservative and surgical methods [1]. In this context, various rehabilitative approaches and injection techniques i.e., superficial/deep heat applications, electrotherapy, balneotherapy, hyaluronic acid injections, acupuncture, and exercises have been previously described [2–4]. However, regenerative treatment processes of replacing, engineering or regenerating human cells, tissues or organs to restore or establish normal function have come into prominence in recent years. Accordingly, platelet-rich plasma (PRP), bone marrow aspirate concentrate (BMAC) or stromal vascular fraction (SMF) of adipose tissue have often been used for the treatment of knee OA [5–8]. Overall, both PRP injection and BMAC therapy have shown favorable impacts on knee OA [9]. However, to the best of our knowledge, the combination of BMAC and PRP injections in the treatment of knee OA has not been previously reported. Therefore, in this paper, three cases are presented, all with symptomatic knee OA that was treated with single BMAC and PRP injections.

2. Case reports

Case-1: A 61-year old female patient was admitted with bilateral knee pain that had been ongoing for 4 years. The pain was exacerbated with weight-bearing activities and knee flexion. Physical examination revealed crepitation, decreased knee flexion, positive Mc Murray and patellar grind tests, and gait difficulty.

Case-2: A 67-year old female patient presented with bilateral knee pain, which worsened with standing and improved at rest, and gait difficulty. Although the pain had been ongoing for many years, it had increased and become worse in the last year. The patient stated that whereas previously she did not feel pain during rest, now she felt pain at rest and during the night. Physical examination revealed antalgic gait, limited knee movements, crepitation, and decreased patellar mobility.

Case-3: A 47-year old female patient was admitted with the complaints of left knee pain, ongoing for 2 years. Physical examination revealed relatively normal gait, limited range of motion, and bilateral positive Patellar Grind test.

The clinical and demographic features of the cases are summarized in Table 1.

Local anesthesia of 2% lidocaine was applied using an 80 mm 23 G needle before the BMAC intervention in all patients. With the patient in a prone position, bone marrow aspirate was harvested via a puncture 2 cm laterocaudally from the upper posterior iliac crest. A total of 30 cc specimen was obtained for each injection and it was fractionated using a BMC kit™, (nFinders, Seoul, Korea). The first cycle was for 6 min at 3500 rpm, followed by a second cycle for 5 min at 3300 rpm. The infiltrated volume of BMAC was 4 mL. In the preparation of PRP, first 8 mL peripheral blood was withdrawn from the patient's arm into a tube containing 2 mL anticoagulant citrate dextrose (Smh Medical Technologies Co., Ltd). This was centrifuged at 3800 rpm for 8 min, then from the middle layer, 3 mL was aspirated.

The BMAC injection was administered first, followed after 1 month by the PRP injection. Compared with the baseline values, pain and functionality scores improved in all patients (Table 1).

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Table 1
Demographical and clinical features (Right/left).

Age	Gender	Physical Examination	X-ray	MRI	Laboratory Tests	BaselineAssessment	Second month Assessment
61	Female	- Mild limitation in flexion - crepitation (+/+) - Patellar Grind Test (+/+) - Mc murray test (±)	Grade 3 OA	Gonarthrosis and degenerative changes in both knees right knee medial meniscus stage 2 tear	ESH: Normal CRP: Normal CBC: Normal	VAS: 7/6 WOMAC: 64/54	VAS: 2/2 WOMAC: 28/22
67	Female	- Mild limitation in flexion - crepitations (+/+) - Patellar Grind Test (−/−), - Mc murray test (−/−)	Grade 2 OA	Gonarthrosis and degenerative changes in both knees, medial meniscal degeneration in both knees	ESH: Normal CRP: Normal CBC: Normal	VAS: 6/5 WOMAC: 50/42	VAS: 1/1 WOMAC: 20/10
47	Female	- No restriction in ROM - crepitation (+/+) - Patellar Grind Test (+/+) - Mc murray test (−/−)	Grade 2 OA	Gonarthrosis, degenerative changes and medial meniscal degeneration of left knee	ESH: Normal CRP: Normal CBC: Normal	VAS: 7 WOMAC: 48	VAS: 2 WOMAC: 18

3. Discussion

PRP injections have been shown to be effective in reducing pain, facilitating joint movements, and improving quality of life in patients with focal cartilage defects and mild-to-moderate OA [10,11]. BMAC is known to be an effective tissue remodeling and regenerative treatment. The mesenchymal stem cell-derived material is obtained by bone marrow aspiration and is centrifuged in special tubes produced for the treatment. After removal of the red blood cells, granulocytes, and immature myeloid precursors, the progenitor cells are injected directly into the diseased area where they are targeted for regeneration. The most important advantage of the BMAC method compared to PRP is that mesenchymal stem cells can differentiate into muscle, cartilage, bone, etc. [12,13]. The effectiveness of the method in cartilage, tendon, bone lesions has been shown in many studies and has been approved by the Food and Drug Administration [14,15].

There is a limited number of studies in literature in which PRP and BMAC techniques have been combined at the same time. Lee et al. [16] reported that the use of PRP and BMAC techniques in combination after tibia bone extension operation provided better and faster bone cortex healing. Moreover, PRP + BMAC administration showed better improvement compared to PRP only in a rabbit model [17] To the best of our knowledge, the combination of BMAC and PRP injection in OA treatment has not been previously reported in literature. In the current patients, the BMAC and PRP injections were administered in sequence of first BMAC followed by the PRP injections.

Ease of harvesting, co culture expansion, and no risk of allogeneic disease transmission are the main advantages of BMAC application. Nonetheless, potential pain during harvest with local anesthetic alone, variable stem cell quantity and quality depending on age, and the potentially detrimental effects of erythrocytes are the disadvantages [18]. In the 3 patients presented in this paper, no side-effects or tractable pain were detected. Moreover, the second intervention of PRP injection is less invasive and easier than the BMAC injection.

Despite the encouraging and beneficial effects that have been reported from injections of BMAC, there is a lack of consensus in literature regarding the frequency of injection and the amount of benefit. In the current patients, a single dose injection was applied, prepared from 4 mL of concentrate as suggested in the data in literature [19].

In conclusion, the combined use of intra-articular BMAC and PRP treatments may have positive effects on pain, functional status and quality of life in patients with knee OA, especially in patients who do not benefit from classical treatment approaches. Nevertheless, further randomized, controlled studies are required, comparing BMAC only and BMAC plus PRP injection.

Conflicts of interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ctcp.2018.11.005.

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