

Functional outcome of microfracture in medial compartment osteoarthritis knee augmented with platelet-rich plasma

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Received: 24-10-2021 / Revised: 13-11-2021 / Accepted: 20-12-2021

Abstract

Background: Osteoarthritis (OA) is primarily thought to be a disease of the elderly, as more than one-third of the population over the age of 65 has OA in at least one joint. Microfracture (MFx) of the subchondral bone is a commonly utilized surgical method to address cartilage abnormalities. The effects of MFx with platelet-rich plasma (PRP) augmentation have been studied in animal models and human participants, particularly in the knee and ankle joints. **Aims and objectives:** To analyze the impact of PRP augmentation in MFx of patients with OA in elderly patients. **Materials and Methods:** Thirty-One patients with knee OA were studied in the Department of Orthopaedics, Index Medical College, Hospital and Research Centre, Indore. All the procedures were carried out in the same way. PRP was injected directly into the synovial cavity using the K-wire method. Postoperative evaluations were performed on the 6th, 12th, and 24th weeks after surgery. The surveys WOMAC and Lysholm were used. **Results:** K-wire microfracturation showed postoperative WOMAC improvement compared to preop score in the PRP group ($p < 0.001$). Clinical improvement was noted in the first six weeks, after which the effect lasted ($p < 0.001$). In addition, the Lysholm score also showed a significant difference at the end of the follow-up compared to the preoperative score ($p < 0.001$). **Conclusion:** In individuals over the age of 50, MFx improves motor function and lowers discomfort. The addition of PRP to the procedure is safe, and it can help speed up and prolong the therapeutic effect of the treatment. The technique has excellent results for the first six weeks, after which the improvement lasts.

Keywords: microfracture, WOMAC score, platelet-rich plasma

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Introduction

Osteoarthritis (OA) is a multifaceted condition characterized by degenerative changes in the articular cartilage, subchondral bone, and synovial membrane, resulting in clinical joint failure. The significant component of every synovial joint, hyaline cartilage, has a relatively restricted ability for healing due to its function and structure[1].

The joint is predisposed to quick OA changes once the cartilage is destroyed, which leads to irreversible joint failure. Obesity, sports, hereditary variables, work, previous injuries, and socioeconomic conditions can all impact OA changes in the joint in younger people[2].

Various conservative therapy options are used in the treatment process, including weight loss, daily activity modification, pharmaceutical or surgical treatment. Although each of these procedures is used to extend the life of native joints, they cannot cure cartilage deficiency. In end-stage disease, total knee replacement is the gold standard; however, every total joint replacement technique has its limitations in terms of prosthesis survival time[3]. Because total knee replacement has a 10-year survival rate in 81–92 percent of the cases but the younger the patient is at the time of surgery, the higher the risk of revision surgery[4].

R. Steadman's microfracture (MFx) of the subchondral bone is one of the most extensively utilized surgical methods for correcting cartilage abnormalities.

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The treatment in question is simple and affordable, and it relies on the body's natural ability to mend itself by forming a clot in the cartilage defect[5]. The technique has evolved, and today strategies such as eliminating a calcified subchondral bone, establishing straight, even cartilage edges, and doing MFx as near together as possible are deemed vital. As a result, a rough surface forms, which a blood clot might adhere to[5].

Nonetheless, because of its simplicity, low cost, and quick recovery, K-wire MFx remains one of the most common operations performed by orthopedic surgeons in cartilage abnormalities; nonetheless, techniques of enhancing MFx to widen its indications are constantly sought. Based on animal models, it is claimed that platelet-rich plasma (PRP) augmentation can improve MFx results. Platelet combinations have been utilized in medicine to enhance skin healing since the early 1980s. Since the first reports of its use in maxillofacial surgery, PRP has sparked a lot of curiosity[6].

To the best of our knowledge, there are just a few articles concentrating on PRP use in MFx procedure in vivo on humans at the time of this study's preparation. This study aimed to see if using PRP along with MFx operation could help improve the surgical outcome.

Materials and methods

The present prospective study was performed on 31 subjects with medial compartment OA in the Department of Orthopaedics, Index Medical College, Hospital and Research Centre, Indore. Patients with persistent discomfort in knee joints with Kellgren-Lawrence 1–2 osteoarthritic alterations[7] were included in the study. Prior conservative therapy had failed to improve pain or function in any patients.

Patients with previous fractures of the knee joint, greater than 15 degrees of varus or valgus deformity of the knee joint, lack of full range of motion of the knee joint, clinically diagnosed instability of knee ligaments, previous qualification for unilateral or total knee replacement, diabetes, hematologic disorders, rheumatic diseases, and active oncological process were excluded.

A detailed medical history was taken, and a physical examination was performed in each case.

PRP preparation required 20 mL of peripheral blood taken before the procedure. The procedure was performed using the standard technique[8]; microfractures were performed with K-wires less than 1mm thickness. Observing the blood or fat outflow from the microfracture was used to quantify the depth of the microfractures. The joint was drained of any remaining fluids after the microfractures were formed. PRP was then injected directly over the cartilage lesion. Because the PRP injected into the lesion came in direct contact with exposed collagen fibers, endogenous PRP activation and fibrin network formation began at the lesion site. Following the procedure, no suction drain was used.

Each patient was mobilized within the bed on the first day after the procedure, and the full range of motion without weight-bearing was encouraged. On the second day after the procedure, the patients were discharged from the hospital, and assisted walking with crutches without full weight-bearing was encouraged for 6 weeks. Isometric exercises were introduced from day 1 and carried out for 6 weeks.

After 6 weeks, the participants were allowed to walk with full weight-bearing without the assistance of crutches. Follow-up was performed in an out-patient clinic after 2, 6, 12, and 24 weeks.

The Lysholm Knee Scoring Scale and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) 3.0 in Visual Analogue Scale version was used. Before procedure and 6, 12, and 24 weeks after the procedure, WOMAC questionnaires were completed. The Lysholm questionnaire was completed before the procedure and again after 24 weeks.

Data analysis was performed using IBM SPSS ver. 20 software. Descriptive analysis was performed to obtain the baseline characteristics. Quantitative data were expressed as mean and standard deviation, whereas categorical data were expressed as percentages and numbers. Mean was compared using ANOVA. A p-value of <0.05 is considered significant.

Results

Females [23 (74.2%)] represented the majority in the study. Males accounted for 25.8% (n=8) population. The mean age of the study population was 64.21 ± 4.24 years. The mean BMI and duration of symptoms were 31.4 ± 2.12 kg/m² and 52.4 ± 6.12 .

All participants enrolled in the study presented poor joint function measured in Lysholm score. WOMAC questionnaires showed overall great pain, stiffness, and poor functionality in daily activities.

Table 1: Baseline and clinical characteristic of the study population

Parameters	Unit	PRP augmented group (N= 31)
Age	year (mean \pm SD)	64.21 \pm 4.24
Female Gender	n (%)	23 (74.2)
Male Gender	n (%)	8 (25.8)
BMI	Kg/m ² (mean \pm SD)	31.4 \pm 2.12
Duration of symptoms	Months	52.4 \pm 6.12
Involvement of the dominant extremity	n (%)	10 (32.3)
Opposite extremity involvement	n (%)	12 (38.7)
Before procedure physiotherapy	n (%)	24 (77.4)

Table 2: Comparison of results in PRP

Parameter	WOMAC Total mean (\pm SD)	P-value*
Preoperative	1354.2 (\pm 627.3)	
Postoperative 6 weeks	602.6 (\pm 604.9)	<0.001
Postoperative 12 weeks	626.4 (\pm 686.5)	<0.001
Postoperative 24 weeks	681.8 (\pm 731.3)	<0.001
	WOMAC Stiffness mean (\pm SD)	
Preoperative	110.2 (\pm 61.2)	
Postoperative 6 weeks	41.8 (\pm 49.3)	<0.001
Postoperative 12 weeks	50.3 (\pm 59.2)	<0.001
Postoperative 24 weeks	52.7 (\pm 64.0)	<0.001
	WOMAC Function mean (\pm SD)	
Preoperative	975.4 (\pm 449.2)	
Postoperative 6 weeks	444.6 (\pm 449.2)	<0.001
Postoperative 12 weeks	453.6 (\pm 495.9)	<0.001
Postoperative 24 weeks	497.4 (\pm 530.4)	<0.001
	Lysholm. mean (\pm SD)	
Preoperative	49.25 (\pm 12.86)	
Postoperative 24 weeks	77.06 (\pm 17.01)	0.001

*P-value is calculated between preoperative and postoperative follow up at 6, 12, and 24 weeks

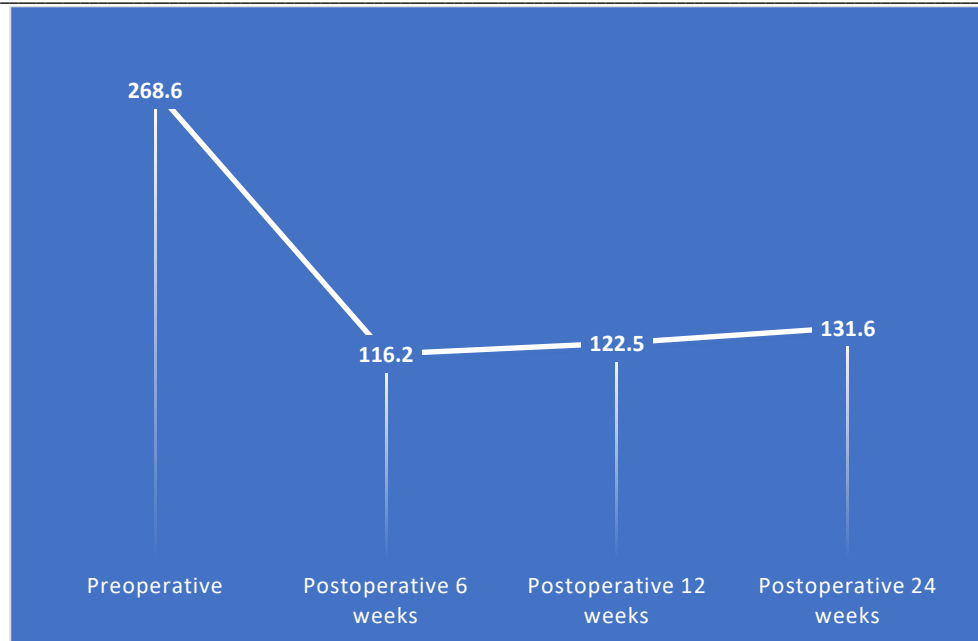


Fig 1: WOMAC Pain mean(±SD)

Discussion

One of the most common causes of disability in the elderly is osteoarthritis. It is well known that osteoarthritic alterations in the joints cause pain, impede joint function, and reduce life quality in those who are affected. Total knee replacement is the gold standard for treating end-stage knee joint osteoarthritis; however, there is significant disagreement among orthopedic societies about treating early osteoarthritic abnormalities in the knee joint.

This work attempted to assess a potentially advantageous way of non-arthroscopic microfracturation of chondral defects in the early stages of osteoarthritis using a minimally invasive approach. The study reported exploring the therapeutic effect of PRP augmentation of microfractures in the elderly population, based on the assumptions that PRP injection enhances the mechanical and histological features of the cartilage covering the defect.

The present study reported a higher incidence of OA among elderly females with BMI >3kg/m² and symptoms lasting for more than 50 months (table 1). In line with this, previous reports also reported that OA was more common in old age symptomatic females[9]. Another study from India showed similar reports where the prevalence of OA was 28.7%, affecting mainly old age females[10]. Similar studies also reported a significant association of obesity (p=0.04) with OA¹⁰, which is in line with present study findings.

Our findings suggest that non-arthroscopic K-wire microfracturation positively impacts pain and daily activities, evidenced by lower WOMAC and higher Lysholm scores. Microfractures were previously thought to provide the best results in younger people with isolated cartilage abnormalities[11]. Our findings reveal that the therapeutic effects of osteoarthritic alterations in elderly people beyond 60 are unaffected by their age. Furthermore, with PRP injection during MFx, good clinical outcomes can be achieved in as early as 6 weeks.

In recent investigations, microfractures were found to be the treatment of choice for early osteoarthritic alterations in the knee and ankle joints. Their findings verified the microfracture technique's effectiveness in lowering pain and enhancing knee function. The study by Duif et al. included 58 patients, most of whom had grade IV or III cartilage lesions. After one year, they showed significant pain alleviation and improved knee function[12]. The treatment of degenerative alterations in the ankle joint has also been researched. It has been demonstrated that the microfracture approach provides good pain alleviation and function improvement results[13].

The most significant gains in knee function and pain reduction were shown in the first 6 weeks with PRP. Our findings align with those of other researchers who claim that microfractures restore knee function quickly; however, PRP augmentation may hasten the therapeutic effect. Most of the authors noticed the most significant improvement in the first few weeks. The progress plateaued[12,13,14] overtime, which is consistent with our findings for the PRP.

According to our findings, PRP administration accelerates and prolongs the therapeutic impact. Over six weeks, PRP demonstrated clinical improvement, which lasted until the follow-up. Present study findings also suggested that PRP may extend the therapeutic effects of treatment. Other trials involving the use of PRP in the augmentation of MFx included a 24-month follow-up period, at the end of which the pain reduction and function improvement findings were equivalent[12,14,15].

Conclusion

In an older group of individuals, non-arthroscopic K-wire MFx improves function and lowers discomfort in the early stages of osteoarthritis. The addition of PRP to the operation is safe, and it may help speed up and prolong the therapeutic impact. The procedure's results are noticeable even in the first six weeks, following which the improvement lasts for a reasonable amount of time.

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Conflict of Interest: Nil Source of support: Nil