

Clinical and MRI Outcomes After Platelet-Rich Plasma Treatment for Knee Osteoarthritis

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Abstract and Introduction

Abstract

The purpose of this study was to investigate whether platelet-rich plasma therapy for early knee osteoarthritis is associated with good clinical outcomes and a change in magnetic resonance imaging (MRI) structural appearances. The design was a prospective cohort study following patients 1 year after platelet-rich plasma therapy for knee osteoarthritis. Twenty-two patients were treated with platelet-rich plasma for early osteoarthritis, confirmed with a baseline MRI. Inclusion criteria were Kellgren grade 0–II with knee pain in patients aged 30 to 70 years. All the patients received a 6-mL platelet-rich plasma injection using the Cascade system. Fifteen subjects underwent clinical assessments at baseline, 1 week, and 1, 3, 6, and 12 months, and MRIs at 1 year. Pain scores significantly decreased, whereas functional and clinical scores increased at 6 months and 1 year from baseline. Qualitative MRIs demonstrated no change per compartment in at least 73% of cases at 1 year.

Introduction

A number of approaches to managing early osteoarthritis have failed to reliably alleviate pain, restore normal knee function and anatomy, or to slow the progression of osteoarthritis. Biological therapies for focal knee osteoarthritis, such as platelet-rich plasma, have been proposed to improve clinical and structural outcomes by delivering a high concentration of growth factors that mediate healing and remodeling.^[1,2]

This study aimed to investigate whether platelet-rich plasma therapy for early knee osteoarthritis is associated with changes in clinical outcomes and magnetic resonance imaging (MRI) over 1 year.

Case Report

This prospective study evaluated 22 patients who were treated with platelet-rich plasma for early osteoarthritis, defined anatomically by degeneration of articular cartilage and subchondral bone, involving the lateral, medial, and/or patellofemoral compartments of the knee. Inclusion criteria were Kellgren grade 0–II, osteoarthritis confirmed by a baseline MRI (some patients also having other intra-articular pathology), with knee pain in patients aged 30 to 70 years. Four patients were lost during the follow-up period, and 1 patient had an additional viscosupplement during the study and so was excluded, resulting in follow-up data for 17 patients with 18 knees injected with platelet-rich plasma. The medial femoral and tibial compartments and patellofemoral joints were affected in all 15 knees with complete MRI data, with 12 patients showing osteoarthritis changes in the lateral tibial and femoral compartments as well. All the patients received a single 6-mL platelet-rich plasma injection, which was concentrated from 20 mL of whole blood using the MTF Cascade system (MTF Sports Medicine, Edison, NJ). The subjects underwent serial clinical assessments at baseline, 1 week, and 1, 3, 6, and 12 months. Visual analog scale (VAS) scores were measured to assess overall knee pain, function, and activities of daily living (ADL) and Western Ontario and McMaster Universities Arthritis Index (WOMAC) scores measured knee pain, stiffness, and ADL.

Magnetic resonance examinations to assess cartilage morphology (with a 1.5 or 3.0-T clinical scanner using fast spin echo

images in 3 planes), and Outerbridge scores were graded by 2 musculoskeletal radiologists (C.H. and E.B.) who were blinded as to whether the examination was performed before or after platelet-rich plasma treatment. The MRI outcomes were assessed using χ^2 analysis or Fisher exact test and paired t tests.

The average age of patients was 54.7 years with 5 (27.8%) females. The average duration of knee pain before platelet-rich plasma injection was 14 months. Outcomes are delineated in the following . In terms of VAS scores, a significant 56.2% reduction in mean baseline VAS pain scores was seen at 6 months (from 4.06 to 1.78, $P < 0.001$), indicating less pain, and the pain scores remained reduced by 58.9% at 1 year (from 4.06 to 1.67, $P = 0.001$). At 1 year, 88% of the patients demonstrated at least a 25% improvement in pain. A significant 24.3% improvement in mean baseline functional scores was seen at 1 year (from 6.39 to 7.94, $P = 0.003$). A significant 24.7% improvement in mean baseline ADL scores was seen at 1 year (from 7.17 to 8.94, $P = 0.001$; Table). All 6-month and 1-year scores were compared with preinjection baseline values that differed per patient.

Table. Mean Score Change for VAS Scores, WOMAC Pain, Stiffness, ADL, and Total Scores From Baseline to 6 and 12 Months

Variable	Baseline		6 Months				12 Months			
	Mean	SD	Mean	SD	% Change From Baseline	<i>P</i>	Mean	SD	% Change From Baseline	<i>P</i>
VAS	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Pain	4.06	1.8	1.78	0.94	56.20	<0.001	1.67	1.33	58.90	0.001
Function	6.39	1.97	7.28	1.96	13.90	0.240	7.94	1.59	24.30	0.003
ADL	7.17	1.95	7.72	2.47	7.70	>0.999	8.94	1.47	24.70	0.001
WOMAC	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Pain	6.67	2.52	3.89	2.25	41.70	0.003	2.94	2.55	55.90	0.001
Stiffness	3.33	1.85	1.89	1.08	43.20	0.022	1.33	1.41	60.10	0.005
ADL	20.56	12.44	10.94	8.73	46.80	0.005	9.11	9.3	55.70	0.005
Total	29.33	15.16	16.09	11.12	45.10	0.003	12.85	12.22	56.20	0.002

The WOMAC pain scores significantly improved, with a reduction of 41.7% ($P = 0.003$) at 6 months and 55.9% ($P = 0.001$) at 1 year. An improvement in pain of 25% or greater was noted in 72% of patients at 1 year. Stiffness scores also significantly improved at 6 months by 43.2% ($P = 0.022$) and by 60.1% at 1 year ($P = 0.005$). Activity of Daily Living scores showed a significant increase at both 6 months of 46.8% ($P = 0.005$) and 55.7% ($P = 0.005$) at 1 year. The overall scores also improved significantly at 6 months by 45.1% ($P = 0.003$) and at 12 months by 56.2% ($P = 0.002$; Table). At 1 year, 66% of the patients demonstrated at least 25% improvement in the overall score. Clinical outcomes were unaffected by the anatomical region of osteoarthritis.

Of the 15 knees that underwent MRI assessment preplatelet- and postplatelet-rich plasma treatment, 12 of the 15 knees (80%) demonstrated no significant worsening of osteoarthritis in their patellofemoral joint. There was no change in the appearance of osteoarthritis 1 year after platelet-rich plasma therapy in 83.3% of all cases when compared with baseline ($N = 12$) with lateral femoral and tibial compartment involvement. Similarly, there was no change in 73.3% of the cases with medial compartment involvement, although these values did not reach statistical significance. The appearance of medial compartment osteoarthritis improved in 1 knee (6.7%) after 1 year. This is in contrast to some longitudinal studies

that suggest an annual decrease of up to 4% to 6% of cartilage volume in knee osteoarthritis compartments.^[3,4]

Discussion

Wang-Saegusa et al^[1] investigated 312 patients with knee osteoarthritis. The patients were given 3 injections of plasma-rich plasma at 2-week intervals. At 6 months, the patients reported a significant improvement in pain, stiffness, function, and the Lequesne Index. In another study of 115 knees with osteoarthritis, the subjects received 3 platelet-rich plasma injections every 21 days.^[2] A significant improvement was measured in all clinical scores at 6 and 12 months.

A number of theories have been proposed to explain the mechanism by which platelet-rich plasma may improve cartilage healing in cases of osteoarthritis. Proliferation of autologous chondrocytes and mesenchymal stem cells were demonstrated after platelet-rich plasma exposure in an ovine model.^[5] Increased hyaluronic acid secretion has also been noted in the presence of platelet-rich rather than platelet-poor preparation.^[6] Human osteoarthritic chondrocytes exposed to platelet-rich plasma demonstrated less interleukin-1 β -induced inhibition of collagen 2 and aggrecan gene expression, and diminished nuclear factor-B activation, which are pathways involved in osteoarthritis pathogenesis.^[7]

This pilot study suggests that platelet-rich plasma may play a role in improving clinical outcomes in patients with early onset osteoarthritis at both 6 months and 1 year. Platelet-rich plasma seemed to result in no change by MRI per knee compartment in at least 73% of cases at 1 year. The limitations of this study included being a limited case series, the absence of a conservatively managed control group, and potential bias in data handling. Further studies are required to fully comprehend the long-term clinical significance of MRI changes seen after platelet-rich plasma therapy for focal early knee osteoarthritis and how this varies to conservatively managed knees.

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Institutional review board approval for the study was received.

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