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The Clinical Effect of Platelet-Rich Plasma Injections On Symptomatic Meniscal Tears of The Knee

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ABSTRACT

This study aims to assess the clinical efficacy of intra-articular platelet-rich plasma injections in symptomatic meniscus tears of the knee.

Forty one patients (12 males, 29 females; mean age 38.2±8.37 years; range 21 to 50 years) with meniscal tear included in the study. Lateral patellofemoral approach was used for intra-articular platelet-rich plasma injections. The platelet-rich plasma applications were performed three times one week apart. Patients were evaluated usingVisual Analogue Scale (VAS) and Lequesne Index. Baseline scores were obtained pre-first injection and compared to satisfaction scores one- and four-weeks post-last injections.

Compared with pre-treatment, at post-treatment weeks 1 and 4, both VAS and Lequesne Index scores significantly decreased ($p<0.001$). Also, compared with post-treatment week 1, at post-treatment week 4, both VAS and Lequesne Index scores significantly decreased ($p<0.001$).

Our study results suggest that platelet-rich plasma injections improve pain and disability in patients with meniscus tears of the knee.

Keywords: Knee, meniscus, meniscal tear, intra-articular, platelet-rich plasma

Introduction

The meniscus is a specialized structure withstanding intra-articular injurious stresses such as shear, tension, and compression (1). Also it has critical functions in weight-bearing, shock absorption, cartilage lubrication, and joint stability (1,2). These significant joint-protective properties decrease as a result of meniscus tears and meniscectomies causing meniscal deficiency which associated with premature and progressive osteoarthritis (2). Therefore, modern treatment of meniscal tears is based on the concept of meniscal preservation and expressed as a current slogan "Save the meniscus!" (3,4). This current preservative consept in the management of knee meniscus tears may increase the popularity of non-surgical therapies (4).

Platelet-rich plasma (PRP) is one of blood-derived products produced by centrifuging autologous blood and is also used for managing many medical problems as an active non-surgical therapy (5). It seems more beneficial than other current non-surgical therapies for specific knee pathologies and can be applied indirectly as an injection, or directly as a matrix scaffold (6). Owing to increased platelet concentration, the potential beneficial effects of platelet-derived products like growth factors are expectedin the diseased area that PRP applied (5,6). Thus, PRP is becoming more popular and promising treatment option for a broad spectrum of medical disorders, especially in some musculoskeletal diseases (5,7). However, the studies investigating efficacy of PRP demonstrate its highly variable effectaccording to specific clinical indication (5).

Current evidence indicates that PRP is ineffective in various musculoskeletal diseases including Achilles tendinopathy or repair, muscle injuries, acute fracture or nonunion and surgical augmentation in rotator cuff repair (5). On the other hand, PRP has shown positive effects on some knee disorders such as gonarthrosis, patellar tendinopathy, and meniscal tears (5,6). Considering PRP appears more effective than other current non-surgical treatment options for specific knee disorders (6), and given the modern

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preservative consept in meniscal damages (3,4), future clinical studies may focus on the use of PRP in meniscal tears.

To date, the majority of studies investigatingclinical benefits of PRP in patients with meniscal tears have used intraoperative directly application (6). There is a limited spesific data on the efficacy of PRP injections (indirect application) in symptomatic meniscus tears of the knee. Therefore, the aim of this study was to assess whether indirect application of PRP with intra-articular injections is clinically effective to relive symptoms of knee meniscus tears.

Materials and Methods

This study used a pre- and post-treatment comparative research design. The Van Yuzuncu Yil University Ethics Committee gave its approval (Decision No: 10; Date: 8 October 2013) and the participants' informed consent was obtained.

Magnetic resonance imaging (MRI) was used to diagnose meniscus tears and to establish the grade of tears (8). Only patients with grade 2 or grade 3 meniscus tears according to MRI findings enrolled in the study to provide the ingroup homogeneity, and other grades of meniscus tears were excluded for this reason.

A total of 41 patients with meniscal tear included in this study if they fullfilled the following criteria: were 18-50 years old, diagnose of meniscus tear within the last three months, grade 2 or grade 3 meniscus tears, gave written informed consent. Exclusion criteria were included: bleeding disorders history, injections to the knee within the last three months, active use of anticoagulants, grade 1 or grade 4 meniscus tears, thrombocytopenia, infection, pregnancy or breastfeeding.

Lateral patellofemoral approach was used for intra-articular PRP injections. The PRP applications were performed three times one weekapart. Patients were evaluated using Visual Analogue Scale (VAS) and Laquesne Index, in terms of pain severity and functional status (9). Baseline scores were obtained pre-first injectionand compared to satisfaction scores one- and four-weeks post-last injections.

Despite its growing and widespread use, there is still no standardized PRP preparation protocols for the treatment of musculoskeletal diseases. However, recently, it has been suggested that PRP should be contained more than 1 million platelets per Ml (10). In order to evaluate the platelet concentration in PRP that we obtained, a microscopic examination was performed. The platelet count in our PRP was 1.2-1.5 million platelets per mL.

The choice of anticoagulant for PRP is based on the maintenance of the physical and functional properties of the platelets. Therefore, use of anticoagulants with citrate is recommended instead of EDTA which could disrupt platelet integrity (11). Accordingly, we chose an citrated anticoagulant.

The double-centrifugation technique that we used-for the preparation of PRPwas as follows: Totally 10 mL cubital autologous blood was put into four 2.7 mL citrated tubes (BD Vacutainer® Plus Citrate Tube, USA), each containing 2.5 mL, and they were centrifuged at 1500 rpm for 10 minutes. After this first centrifuge, plasma (upper layer) and buffy coat (leucocytes and platelets) were withdrawn by an injector from the tubes and wre transferred to two 2.7 mL citrated tubes. These two tubes were centrifuged for 10 minutes at 3000 rpm. After this second centrifuge, platelet poor plasma (upper layer) was withdrawn and discarded. Remaining lower layer (platelet rich plasma, PRP) excluding erythrocytes was taken into an injector and injected into the knee joint.

Statistical Analysis: All statistics were calculated by SPSS, version 13.0 software program (SPSS Inc., Chicago, IL, USA). The Kolmogorov-Smirnov normality test was used to checkif a continuous variableis normally distributed. Considering non-normal distribution of the continuous data, the Friedman test was performed for the comparisons of evaluation periods. The continuous data were presented as mean±standard deviation (min.-max.). $P<0.05$ was considered as statistically significant.

Results

Out of 41 patients 12 were males and 29 were females. The patients' mean age was 38.2±8.37 years and range was 21 to 50 years. Figure 1 presents the results demonstrating the comparison of pre- and post-treatment periods. Compared with pre-treatment, at post-treatment weeks 1 and 4, both VAS and Lequesne Index scores significantly decreased ($p<0.001$). In addition to this, compared with post-treatment week 1, at post-treatment week 4, both VAS and Lequesne Index scores significantly decreased ($p<0.001$). Thus, it was observed that during the four-week post-treatment follow-up, improvement continued (Table 1).

Table 1. Clinical Scores of Patients Before and After Prp Treatment Periods

	Pre-treatment	Post-treatment (first week)	Post-treatment (fourth week)	P values
VAS	8.22±1.56 (4-10)	3.59±1.86 (0-8)*	1.98±1.90 (0-7)*§	<0.001
LI	10.32±2.73 (2-15)	4.10±2.93 (0-10)*	2.22±2.20 (0-8)*§	<0.001

PRP: Platelet-rich plasma; VAS: Visual analogue scale; LI: Lequesne Index; *****Shows group which is different compared to pre-treatment; § Shows group which is different compared to first week; The data were presented as mean±standard deviation (min.-max.); Treatment include PRP injections performing three times one week apart.

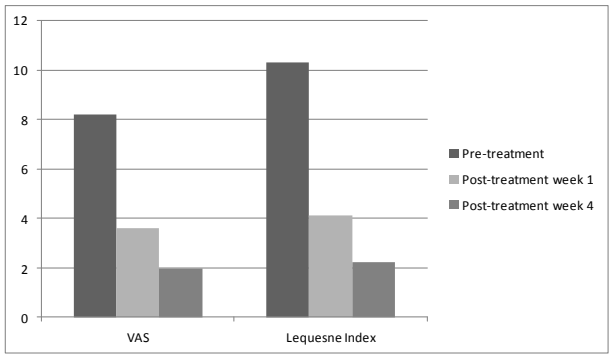

Fig. 1. The results demonstrating the comparision of pre- and post-treatment periods
VAS: Visual analogue scale; All columns were different from each other when compared (<0.001).

Discussion

In this study, we aimed to assess the clinical effect of PRP injections on symptomatic meniscal tears of the knee. For this purpose, we used a pre- and post-treatment comparative research design. The present results suggested that significant improvements were obtained after PRP applications in terms of pain and functional loss due to meniscus tears. Considering a limited specific data on the topic, ourresultsmake an important contribution to the use of PRP injections in the management of symptomatic meniscal tears of the knee.

Results of previous studies on the efficacy of PRP in patients with knee meniscus tears have revealed positive effects (6,12,13). However, these positive effects have been shown in the studies using intraoperative direct application rather than indirectly as an injection application (6). Therefore, there is still limited specific data on the efficacy of intra-articular PRP injections (indirect application) in symptomatic meniscus tearsof the knee. In addition to this, there is a current meniscus protective consept that probably will cause a tendency to use non-surgical treatment methods in the management of meniscal tears of the knee (3,4). Moreover, PRP seems more useful than other non-surgical treatment methods for specific knee disorders (6). Based on these data explained, it can be said that the subject of the present study is worth considering.

Although its mechanism of action is not yet clear, most probably PRP acts by inducing anti-inflammatory properties, stimulating growth factors and anabolic/anti-catabolic pathways (6). It is known that the meniscal injury is a trigger for development of inflammation leading to degenerative processes in the injuried knee (12). Huang et al. (14) have reported that PRP demonstrates positive effects for patients with gonarthrosis by suppressing inflammatory action. Similarly to this, the beneficial effects of PRP on meniscal tears symptoms may be due to induction of anti-inflammatory mechanisms. For these reasons, the use of PRP in the management of meniscal tears of the knee is based on the scientific reasonable grounds. Furthermore, an experimental study has revealed several negative changes related to the synovial fluid, meniscal tissue, and tibial subchondral bone appear in the knees with meniscal tears (15). This experimental results suggest that the negative effects of meniscal injury is not limited to injured meniscus. Therefore, the use of PRP injections indirectly instead of intraoperative direct application targeting only torn meniscus may have a wider healing effect on the knee structures that injuried.

In addition, it is known that there is no correlation between meniscal tears' features and patient's symptoms (16). This may be caused by other knee pathologies associated with meniscal damage such as cruciate ligament damage (17) and knee osteoarthritis (18). Given that PRP is effective in these disorders associated with meniscal damage, the pozitive results of PRP in patients with meniscal tears may also be due to its healing and analgezic effects on the other injuried knee structures treatable with PRP.

On the other hand, the present study has several critical limitations. We did not include a control group with sham application in the study thus a possible placebo effect of injections cannot be ruled out. Besides this, due to the study design including restrictive selection criteria such as age (>18 - <50 years), only grade 2 or 3 meniscus

tears, and diagnosis duration (≤3 months), the study results may not apply toother patients with meniscus tears. Nevertheless, the used selection criteria provide a consistency in terms of homogeneity.

In conclusion, the use of PRP is based strong scientific rationale but its clinical effectiveness has yet to be provenin various specific clinical indications. Specifically, PRP injections improve pain and disability in patients with meniscus tears of the knee, according to our results.

References

1. Makris EA, Hadidi P, Athanasiou KA. The knee meniscus: structure-function, pathophysiology, current repair techniques, and prospects for regeneration. Biomaterials 2011; 32: 7411-7431.
2. Rao AJ, Erickson BJ, Cvetanovich GL, Yanke AB, Bach BR Jr, Cole BJ. The meniscus-deficient knee biomechanics, evaluation, and treatment options. Orthop J Sports Med 2015; 3: 2325967115611386.
3. Beaufils P, Becker R, Kopf S, Matthieu O, Pujol N. The knee meniscus: management of traumatic tears and degenerative lesions. EFORT Open Rev 2017; 2: 195-203.
4. Doral MN, Bilge O, Huri G, Turhan E, Verdonk R. Modern treatment of meniscal tears. EFORT Open Rev 2018; 3: 260-268.
5. Le ADK, Enweze L, DeBaun MR, Dragoo JL. Current Clinical Recommendations for Use of Platelet-Rich Plasma. Curr Rev Musculoskelet Med 2018; 11: 624-634.
6. Wasserman A, Matthewson G, MacDonald P. Platelet-Rich Plasma and the Knee-Applications in Orthopedic Surgery. Curr Rev Musculoskelet Med 2018; 11: 607-615.
7. Dawood AS, Salem HA. Current clinical applications of platelet-rich plasma in various gynecological disorders: An appraisal of theory and practice. Clin Exp Reprod Med 2018; 45: 67-74.
8. Stoller DW. Magnetic Resonance Imaging in Orthopaedicsand Sports Medicine. 3rd edition. Philadelphia: Lippincott Williams &Wilkins; 2007. pp. 306-405.
9. Basaran S, Guzel R, Seydaoglu G, Guler-Uysal F. Validity, reliability, and comparison of the WOMAC osteoarthritis index and Lequesne algofunctional index in Turkish patients with hip or knee osteoarthritis. Clin Rheumatol 2010; 29: 749-756.
10. Moatshe G, Morris ER, Cinque ME, et al. Biological treatment of the knee with platelet-rich plasma or bone marrow aspirate concentrates. Acta Orthop 2017; 88: 670-674.
11. Dhurat R, Sukesh M. Principles and Methods of Preparation of Platelet-Rich Plasma: A Review and Author's Perspective. J Cutan Aesthet Surg 2014; 7: 189-197.
12. Kaleka CC, Debieux P, da Costa Astur D, Arliani GG, Cohen M. Updates in biological therapies for knee injuries: menisci. Curr Rev Musculoskelet Med 2014; 7: 247-255.
13. Cengiz IF, Pereira H, Espregueira-Mendes J, Reis RL, Oliveira JM. The Clinical Use of Biologics in the Knee Lesions: Does the Patient Benefit? Curr Rev Musculoskelet Med 2019; 406-414.
14. Huang G, Hua S, Yang T, Ma J, Yu W, Chen X. Platelet-rich plasma shows beneficial effects for patients with knee osteoarthritis by suppressing inflammatory factors. Exp Ther Med 2018; 15: 3096-3102.
15. Steineman BD, LaPrade RF, Santangelo KS, Warner BT, Goodrich LR, Haut Donahue TL. Early Osteoarthritis After Untreated Anterior Meniscal Root Tears: An In Vivo Animal Study. Orthop J Sports Med 2017; 5: 2325967117702452.
16. Englund M, Guermazi A, Gale D, et al. Incidental meniscal findings on knee MRI in middle-aged and elderly persons. N Engl J Med 2008; 359: 1108-1115.
17. Figueroa D, Figueroa F, Calvo R, Vaisman A, Ahumada X, Arellano S. Platelet-rich plasma use in anterior cruciate ligament surgery: systematic review of the literature. Arthroscopy 2015; 31: 981-988.
18. Cook CS, Smith PA. Clinical Update: Why PRP Should Be Your First Choice for Injection Therapy in Treating Osteoarthritis of the Knee. Curr Rev Musculoskelet Med 2018; 11: 583-592.