

The Effectiveness of Ozone Activated Platelet Rich Plasma Intra Articular Injection in Pain Management of Anterior Cruciate Ligament Tear

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(Submitted: 25 August 2022 – Revised version received: 18 September 2022 – Accepted: 15 October 2022 – Published online: 26 March 2023)

Abstracts

Objectives: The anterior cruciate ligament (ACL) is one of the most common injured knee ligaments and it is one of the most frequent injuries seen in orthopaedic practice.

Methods: This is a retrospective study of 20 patients (14 female and 6 male) with ACL tear managed by intra articular activated PRP injection in the first author private clinic in Kirkuk over 2 years period (August 1, 2017–July 31, 2019). A detailed history was taken according to a questionnaire and a complete physical and radiological (MRI) examination was done. A sample of patient's own blood was used to prepare PRP by a process of two repeated centrifugation. Longevity resources EXT50 Ozone Generator with oxygen tank and CGA870 Oxygen Regulator were used for activation of PRP. The clinical notes were reviewed to ascertain the clinical presentations and response of patients to PRP therapy.

Results: The mean age was 55 ± 10.38 years. The age groups affected with ACL were 50–59 and 60–69 years ($n: 7, 35\%$) for each, while ($n: 5, 25\%$) from age group 40–49 years and ($n: 1, 5\%$) was from age group 20–29. Although 19 patient (95%) have at least one co-morbid condition, all the patient ($n: 20, 100\%$) show good response. 7 patient (35%) received three doses of PRP and 13 patient (65%) received four doses to get good response.

Conclusion: Even though PRP and Ozone are not expensive therapies, they seem to be safe and effective in pain management of ACL tear.

Key Words: ACL tear, pain management, platelets rich plasma, ozone, Iraq

Introduction

One of the most common knee injuries seen in orthopaedic practice is ACL tear. Various predisposing factors participating in ACL tear, including biomechanical and neuromuscular abnormalities, mutations within collagen producing genes, female sex hormones, abnormalities in knee joint laxity and primary structural influences of knee.¹⁻³

ACL tear is a serious knee condition affects mostly physically active people.⁴ Usually it is resulted from non contact injuries whereby the mixture of movements like femoral adduction with internal rotation, flexion of the knee or rotation of tibia with valgus of foot and ankle resulting in partial or complete ACL tears.⁵

ACL injury characterized by instability associated with high risk of secondary osteoarthritis of knee joint.⁶

Management choices include non surgical methods like physiotherapy, bracing and modification of physical activity or surgical ligament reconstruction especially for active people and athletes or people with complex knee injuries.⁷ PRP may be used as a supportive measure intra or post operatively for enhancing ligament injury healing and repair.⁸

PRP is a relatively new autologous treatment and pain management method came out in last few years, now it is quite popular in orthopaedic, rheumatology and sport medicine practices. Even with the controversy around PRP, it gains growing interest because of its effectiveness and cheapness and safety.⁹

PRP owns the therapeutic effectiveness as a result of its role in wound healing and tissue repair processes, this role can be explained by growth factors released a granules in platelets which have regenerative properties. Tissue repair is a complicated mechanism in which many cellular functions occur like chemotaxis, angiogenesis, cell proliferation, extra cellular matrix formation, all of these forming a complex in which three stages distinguished: Inflammation, proliferation and re modulation.⁹ PRP containing growth factors are strongly involved in stages described above, but the mechanism and functions are still not so clear.¹⁰

Ozone therapy widely studied over the last 100 year, ozone effects are certain and safe with almost no side effects.

Ozone therapy leads to increase in RBCs glycolysis activity rate, this will lead to increase amount of O_2 released to tissue, A vasodilator prostacycline production also induced by activation of immune system by ozone. Furthermore, interferone, interleukine-2 and tumor necrosis factor are also will be greatly increased in production with ozone therapy.¹¹

Ozone (O_3) is a form of oxygen in which three atoms bind together instead of the two atoms of O_2 .

Ozone therapy has been used to treat many disease conditions, such as coronary artery disease, chronic severe hepatitis, sudden sensorineural hearing loss, hypersensitive teeth, periodontitis, chronic low back pain (LBP), diabetic wounds as well as trophic and ischemic ulcers.¹²

This study aimed to evaluate efficacy of activated PRP intra articular injection as a pain management method in ACL tear.

Patients and Methods

This is a retrospective study of 20 patients (14 females and 6 males) with ACL tear. The diagnosis was based on clinical and imaging (MRI) features. MRI done before and after finishing the course of therapy and follow up of patients continued for six months after the last injection session. They were managed by PRP injection in the private clinic of 1st. author for family medicine and pain management over 2 years period (August 1, 2017–July 31, 2019).

In this study, the authors used a symptom-based patient-directed questionnaire to assess the outcome after ozone and PRP therapy. The questionnaire was similar to that described by Bhattacharya et al in their study of thoracic outlet compression but slightly modified. The questionnaire asked patients to grade their perception of symptomatic relief using the terms “Excellent” for complete relief of symptoms, “Good” for relief of most major symptoms, “Fair” for relief of some symptoms, but persistence of others and Poor for no improvement.¹³

In order to prepare PRP, under aseptic conditions an autologous blood from the patient’s own vein was drawn by a 50-ml syringe. The withdrawn blood was then placed in sterile tubes, each one filled with 9 ml blood and 1 ml 3.8% sodium citrate as an anticoagulant. Then centrifugation done for tubes for two rounds to produce PRP. Then PRP activated by passing ozone in a concentration of 68.7 gammas and injected into the knee joint space under totally aseptic condition.

Patients received 3–4 doses of PRP intraarticular injections with 4 weeks between doses. All injections were done aseptically using 23-G needles. The numbing skin were first marked, then the skin was injected with 1/2 cc of 2% lidocaine & 3–4 cc of activated PRP injected in the joint.



Fig. 1A Longevity resources EXT50 ozone generator.



Fig. 1B CGA870 oxygen regulator.

Longevity resources EXT50 Ozone Generator (Figure 1A) with oxygen tank and CGA870 Oxygen Regulator (Figure 1B) were used for generation of medical ozone.

Inclusion Criteria

Inclusion criteria for the study included: patients age 18 years and older with ACL injury.

Exclusion Criteria

- Medical history of bleeding tendency.
- Patients on anticoagulants.
- Favism.
- Complete tear of anterior cruciate ligament.

Body mass index (BMI) of the patients was calculated by the equation: Weight in kilogram/ (Height in meter) ² and accordingly, the patients were classified as having a healthy body weight (18.5–24.9), overweight (25–29.9), obesity I (30–34.9), obesity II (35–39.9) and obesity III (≥ 40).¹⁴

All the data were recorded in Microsoft Excel 2010, the data were analyzed by using of computer SPSS 11 program and the www.socscistatistics.com, the differences were considered significant when the probability (P) was less than 0.01 ($p < 0.01$) by using z test for 2 population proportions.

Results

There were 20 patients (14 females and 6 males) with a female: male ratio of 2.3:1. The age ranged between 27 and 69 years with a mean of 55 ± 10.38 . Figure 2 displays patients sex distribution of the studied sample.

Figure 3 shows patients age distribution, most cases affected with ACL were in age group 60–69 ($n: 7, 35\%$) and age group 50–59 ($n: 7, 35\%$) while age group 40–49 ($n: 5, 25\%$) and the least age group affected were 20–29 ($n: 1, 5\%$) in the studied sample.

As shown in Figure 4 most of female patients was house wife ($n: 10, 50\%$) and most of male patients job was free work ($n: 4, 20\%$).

Figure 5 shows patients BMI, most patients were overweight and obese ($n: 16, 80\%$).

Table 1 shows that the top co-morbid condition was obesity as most of the patients ($n: 16, 80\%$) were either overweight or obese. Hypertension ranked second as ten patients (50%) had HT either alone or in combination of other conditions

Figure 6 shows the distribution of patients treated with PRP, ($n: 7, 35\%$) managed with three doses, while ($n: 13, 65\%$) patients managed with four doses.

Table 1. Shows the co-morbidities encountered in the studied patients

Co-morbidity	Sex		Total
	Male	Female	
Overweight or Obesity	5	11	16
Hypertension	2	5	7
Diabetes Mellitus & Hypertension	1	2	3

Figure 7 shows that all patients with ACL tear (n: 20, 100%) managed with PRP had good response.

Discussion

The term PRP is described by platelet concentration 3–8 times above the baseline number, in low levels of plasma.^{13,14} These cells are commonly known for their role in hemostasis, however due to their capacity to release growth factors from their α-granules, they play a key role in mediating the healing of the damaged tissue.^{15,16} These growth factors include vascular endothelial growth factors (VEGF), epidermal growth factors (EGF), platelet-derived growth factors (PDGF), transforming growth factor-beta 1 (TGF-β1), basic fibroblast growth factors (FGF), hepatocyte growth factors (HGF), insulin-like growth factors (IGF-I).^{17,18} Together, the growth factors influence chemotaxis, cell migration, mitosis, angiogenesis and tissue repair.^{17,18} In addition, PRP contains an adhesive substrate for cells, such as fibrin, fibronectin, thrombospondin, osteocalcin

and osteonectin. Considering these properties, PRPs are vital for wound healing and in process of repair of tendons, muscles and cartilage.¹⁹

In this prospective study of 20 patients with ACL injury were treated with PRP activated with ozone show good response in 100%, this results agreed with study by (Laleyprem et al, 2018).²⁰

Injection of PRP activated with ozone in knee osteoarthritis, reduced the pain significantly more than the ozone or PRP injections alone. This might be because of the anti-inflammatory effect of ozone has been supported by the release of anti-inflammatory growth factors from the platelets in PRP in which PRP activated with ozone is used for treatment.²⁰

Although there was no other similar study on ACL injury treatment with ozone activated PRP, its concluded by doctor RuhiCakir that combination of ozone with PRP effective in 95–98% of cases, apply to all range of aging groups, & it avoids surgery in high number of case.²¹

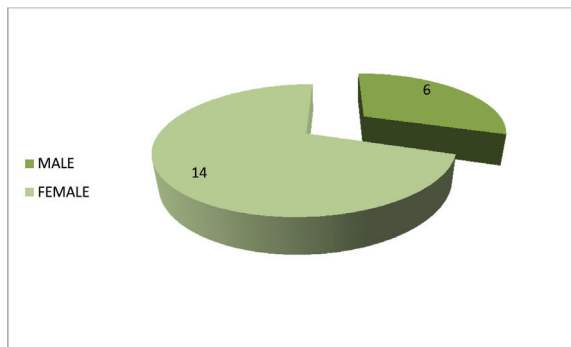


Fig. 2 Patients Sex Distribution.

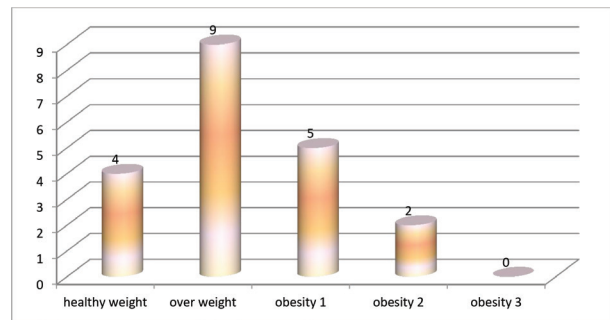


Fig. 5 Patients BMI distribution.

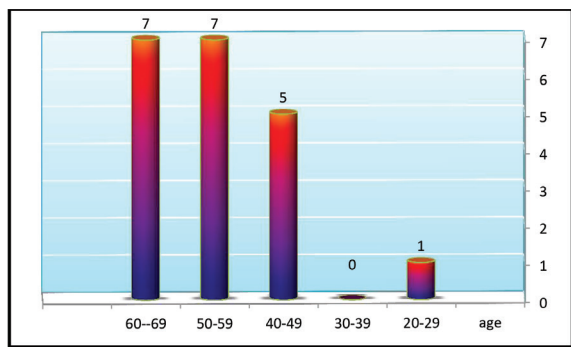


Fig. 3 Patients Age Distribution.

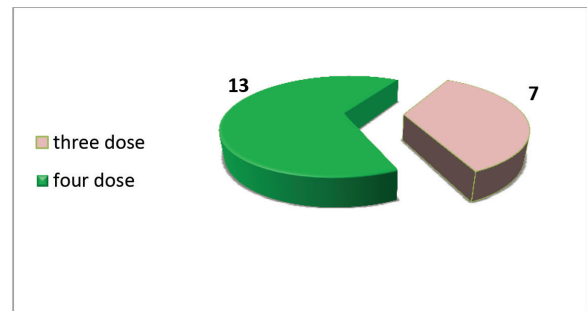


Fig. 6 Distribution of patients treated with three or four sessions of PRP injections.

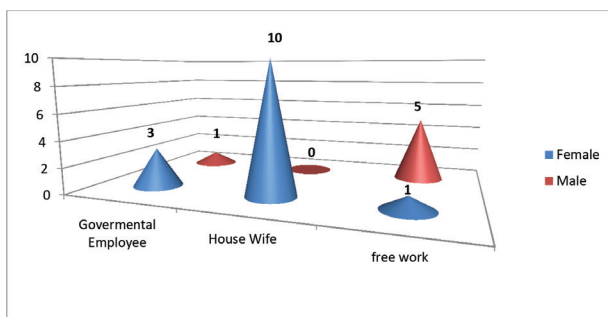


Fig. 4 Patients Job Distribution.

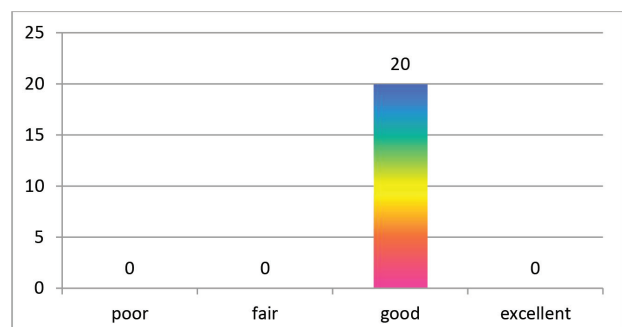


Fig. 7 Patients response to PRP injections.

In this study we follow up patients for 6 months with good result, while a study done by Ghazi hosseini and his colleagues in which they compare the effect of PRP, hyaluronic acid (HA) injection and ozone injection in knee osteoarthritis, they found that ozone injection had rapid effects and better short-term results after 2 months, but its therapeutic effects did not persist after 6 months and at the 6-month follow up PRP and HA were superior to ozone and the only patients treated with PRP improved symptoms persisted for 12 months.²²

In summary, ACL injury of knee tear is a common and major problem in family and sports medicine, intra articular

ozone activated PRP injection appears to be an effective, safe and cheap pain management method improving clinical outcome in ACL tear.

Conflicts of Interests

None declared.

Funding

The authors received no funding for this study. ■

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