COMPARISON OF PLATELET RICH PLASMA VERSUS PROLOTHERAPY IN THE MANAGEMENT OF ROTATOR CUFF TENDINOSIS

THESIS

Submitted to

All India Institute of Medical Sciences, Jodhpur

In partial fulfilment of the requirement for the degree of

DOCTOR OF MEDICINE (MD)

(RADIOLOGY)

JULY 2020 **DR. ANKIT SINGH**

AIIMS, JODHPUR

All India Institute of Medical Sciences, Jodhpur

DECLARATION

I hereby declare that the thesis entitled "**COMPARISON OF PLATELET RICH PLASMA VERSUS PROLOTHERAPY IN THE MANAGEMENT OF ROTATOR CUFF TENDINOSIS**" embodies the original work carried out by me.

Ankit Singh.

Dr. Ankit Singh

Department of Diagnostic and Interventional Radiology

AIIMS, Jodhpur

All India **Institute of Medical Sciences,** Jodhpur

CERTIFICATE

This is to certify that the thesis entitled "**COMPARISON OF PLATELET RICH PLASMA VERSUS PROLOTHERAPY IN THE MANAGEMENT OF ROTATOR CUFF TENDINOSIS**" is an original work of **Dr. Ankit Singh** carried out under our guidance and supervision, at All India Institute of Medical Sciences, Jodhpur.

Guide

PSKhera

Dr. Pushpinder Singh Khera

Professor and Head

Department of Diagnostic and Interventional Radiology

AIIMS, Jodhpur

Co-guides

Dr. Pawan Kumar Garg
Additional Professor
Department of Diagnostic and
Interventional Radiology
AIIMS, Jodhpur

Dr. Taruna Yadav
Associate Professor
Department of Diagnostic and
Interventional Radiology
AIIMS, Jodhpur

Dr. Nitesh Gahlot
Additional Professor
Department of Orthopaedics
AIIMS, Jodhpur

Dr. Nitesh Manohar Gonnade
Associate Professor
Department of Physical Medicine
and Rehabilitation
AIIMS, Jodhpur

Dr. Surjit Singh
Additional Professor
Department of Pharmacology
AIIMS Jodhpur

Dr. Saptarshi Mandal
Additional Professor
Department of Transfusion Medicine
and Blood Bank
AIIMS Jodhpur

All India Institute of Medical Sciences, Jodhpur

CERTIFICATE

This is to certify that the thesis entitled "**COMPARISON OF PLATELET RICH PLASMA VERSUS PROLOTHERAPY IN THE MANAGEMENT OF ROTATOR CUFF TENDINOSIS**" is the bona fide work of **Dr. Ankit Singh** carried out under my supervision, in the Department of Diagnostic and Interventional Radiology, AIIMS, Jodhpur.

The work done by Dr Ankit Singh is satisfactory for its submission in partial fulfillment of the requirement for the Degree of Doctor of Medicine (Radiology) by the institute.

PSKhera

Dr. Pushpinder Singh Khera
Professor and Head,
Department of Diagnostic and
Interventional Radiology
AIIMS, Jodhpur.

ACKNOWLEDGEMENT

First and foremost, I would like to thank God Almighty for giving me the strength, knowledge, and ability to undertake this research study and to persevere and complete it satisfactorily. Without the blessings of Almighty, this achievement would not have been possible.

I would like to thank my parents, **Mr. Omprakash Singh** and **Mrs. Lila Devi Singh** who have been my backbone and believed in me all the time, no matter what.

I am deeply grateful and it's my proud privilege to express my deep sense of gratitude and sincere thanks to my guide **Dr. Pushpinder Singh Khera**, Professor and Head, Department of Diagnostic and Interventional Radiology, AIIMS, Jodhpur who provided me an opportunity to work under his guidance. His guidance was paramount in providing a well-rounded experience and knowledge. He has always been a source of encouragement and inspiration. I am greatly in debted to him for devoting valuable time out of his busy schedule and being concerned for completion of this project. I shall remain grateful to him forever.

I express my sincere gratitude to my co guides, **Dr. Pawan Kumar Garg**, Additional Professor, Department of Diagnostic and Interventional Radiology; **Dr. Nitesh Gahlot**, Additional Professor, Department of Orthopaedics; **Dr. Nitesh Manohar Gonnade**, Associate Professor, Department of Physical Medicine and Rehabilitation; **Dr. Taruna Yadav**, Associate Professor, Department of Diagnostic and Interventional Radiology; **Dr. Surjit Singh**, Additional Professor, Department of Pharmacology; **Dr. Saptarshi Mandal**, Additional Professor, Department of Transfusion Medicine and Blood Bank for their constant support, encouragement, guidance and help throughout my work.

I extend my sincere thanks and gratitude to **Dr. Binit Sureka**, Additional Professor; **Dr. Sarbesh Tiwari**, Associate Professor; **Dr. Rengarajan Rajagopal**, Assistant Professor; **Dr. Ananya Panda**, Associate Professor, Department of Diagnostic and Interventional Radiology, AIIMS, Jodhpur for enlightening me on the key points of my research topic, guiding me, paving the way to create a path and making me what I am today.

I would like to thank my brothers and sister, **Mr. Abhishek Singh, Dr. Pratik Singh, Dr. Moushmi Singh** and sister-in-law **Mrs. Sneha Singh** and my little cute nieces **Aaradhya and Yashika** for their support, encouragement and unconditional love**.** Hats off to my very own AIIMS Radiology family, aptly called the "Children of Roentgen", my seniors, co-PGS and juniors for all that you have done.

I am also extremely thankful to my friends **Dr. Atul Kumar Gupta, Dr. Rishi P Nair, Dr. Suman S V, Dr. Rishi Sharma, Dr. Shubham Sabherwal, Mr. Ajay Soni, Mr. Rahul Singh, Mr. Prince Shaw** for their immense support and the willingness to cheer me up in times of stress.

My sincerest thanks to all senior residents, working alongside with me all the time, guiding and helping me in all aspects. A special thanks is extended to **Dr. Suvinay Saxena,** Senior Resident, Department of Diagnostic and Interventional Radiology for his constant support and motivation.

I am thankful to Director, AIIMS, Jodhpur for permitting me to avail all the facilities available in the institute for conducting this study.

SPECIAL ACKNOWLEDGEMENTS

My special acknowledgements go to all those people who made possible the difficult task of completing my MD thesis. My warm appreciation is due to all the Radiology staff who cooperated in my long working hours and constant support during the course of my work in the department. At last words are short to express my deep sense of gratitude to all the participants who willingly and selflessly participated in my research endeavour.

Dr. Ankit Singh

LIST OF ABBREVIATIONS

No.	Abbreviation	Full form
1	PRP	Platelet Rich Plasma
2	RC	RC
3	VAS	Visual analogue scale
4	DASH	Disabilities of arm, shoulder, and hand
5	ICMR	Indian Council of Medical Research
6	MRI	Magnetic Resonance Imaging
7	PDGF	Platelet Derived Growth Factor
8	VEGF	Vascular Endothelial Growth Factor
9	ASES	American Shoulder Elbow Surgeon
10	NRS	Numeric Rating Scale
11	TGF	Transforming growth factor
12	IL	Interleukin
13	CS	Corticosteroid
14	WORC	Western Ontario RC Index
15	SPADI	Shoulder Pain and Disability Index
16	ROM	Range of Motion
17	HGF	Hepatocyte growth factor
18	USG	USG
19	PMR	Physical Medicine and Rehabilitation
20	IEC	Institutional Ethics Committee
21	PI	Principal Investigator
22	T1WI	T1 Weight Image
23	T2WI	T2 Weight Image
24	NF KB	Nuclear factor kappa B
25	DWI	Diffusion Weight Image
26	SMD	Standardized Mean Difference
27	ADC	Apparent Diffusion Coefficient

28	CI	Confidence Interval
29	I2	Statistical test of heterogeneity
30	PDFS	Proton density fat suppressed

CONTENTS

List of Tables

List of Figures

List of Annexures

SUMMARY

Rotator cuff tendinosis is characterized by pain and weakness that are typically felt during shoulder external rotation and elevation motions as a result of an excessive amount of strain on the rotator cuff tissues. There are different therapeutic options available among which PRP and Prolotherapy are emerging treatment options for the management of RC tendinosis. There is limited availability of data regarding superiority of one over the other. So this study was undertaken to provide additional data to choose better option for patients.

This was a prospective, single-centre, randomized, open-label, active-controlled, parallel-group clinical trial. It was a 12 week follow up study comparing the effectiveness of PRP vs. Prolotherapy. 32 patients were recruited and randomized into 2 groups. One group was given PRP and another was given Prolotherapy at baseline. VAS and quickDASH scores were recorded at baseline and at 1, 3, 6, and 12 weeks post-injection to see the improvement in pain.

There was significant reduction in VAS and quickDASH scores in both the groups. In the PRP group VAS changed from 6.75 $\pm$ 0.86 at baseline to 3.50 $\pm$ 1.41 at 12 weeks ($p = <0.001$), while it came down from 6.88 $\pm$ 1.02 at baseline to 3.81 $\pm$ 2.17 at 12 weeks ($p=<0.001$) in Prolotherapy group. Similarly, the quick-dash came down from 62.50$\pm$ 9.14 at baseline to 34.00 $\pm$ 12.15 at 12 weeks ($p=<0.001$) in PRP group, while it came down from 63.69 $\pm$ 12.36 at baseline to 37.50 $\pm$ 20.96 at 12 weeks ($p=<0.001$) in Prolotherapy group. There was no significant difference in change in both the scores between the groups.

Both PRP and Prolotherapy showed similar efficacy and no significant difference between the two interventions were found.

INTRODUCTION

Rotator cuff tendinosis is characterized by pain and weakness that are typically felt during shoulder external rotation and elevation motions as a result of an excessive amount of strain on the rotator cuff tissues (1). It results in tendon degeneration and causes painful shoulder movements with a limited range of motion (2).

ANATOMY OF ROTATOR CUFF:

The rotator cuff encompasses a group of four muscles and tendons that surround the glenohumeral joint and hold the head of the humerus into the scapula. The rotator cuff muscles include : Supraspinatus, Infraspinatus, Teres Minor and Subscapularis (1). The rotator cuff helps maintain shoulder stability and promotes the full range of motion for the arms. Together with the deltoid muscle, it gives the shoulder the flexibility and power it needs for motions above the waist and shoulders (3). (Figure 1)

The RC insertion onto the humeral tuberosities is broad, continuous, multilayered and interwoven. At the proximal end of the bicipital groove, the supraspinatus and subscapularis join forces to create a tunnel for the biceps tendon (4).

EPIDEMIOLOGY:

Rotator cuff disease is among the most common musculoskeletal disorders. It is a disabling condition with a high prevalence rate. Three out of every five people experience issues with their rotator cuff tendons (5). Beginning at the age of 40, the prevalence of RC illness, notably partial and full thickness RC tendon tears, rises with age and may reach as high as 50% by the age of 70 (6). People who engage in repetitive overhead activities, such as throwing sports like baseball or volleyball, or jobs like painting or construction, are more likely to experience shoulder pain (1).

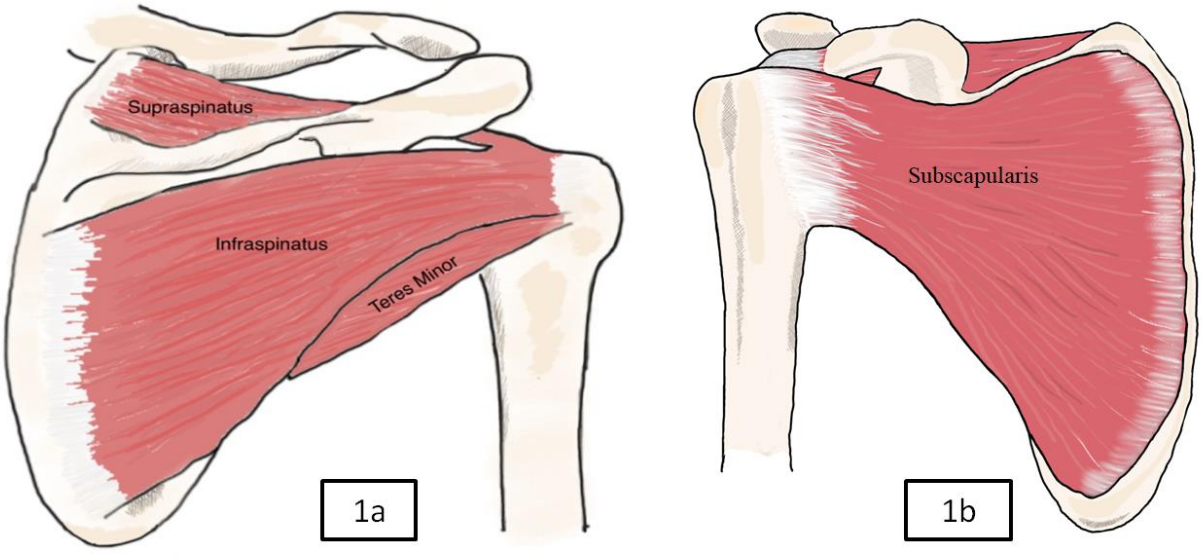


Fig.1 showing Rotator Cuff Anatomy (1a: Posterior View, 1b: Anterior View)
*Concept taken from MedBullets.

Figure 1. RC Anatomy

CLINICAL PRESENTATION:

Shoulder pain, limited range of motion, stiffness, and nocturnal pain are the most frequent symptoms patients report (3). Careful observation, range-of-motion testing, and impingement tests are all part of a thorough examination of the shoulder area that may be supplemented, as necessary, by additional tests.

Full-thickness rotator cuff tears are detected with a sensitivity of 90% and a specificity of 54% by a comprehensive clinical examination(7).

PATHOPHYSIOLOGY OF ROTATOR CUFF TENDINOSIS:

Rotator cuff tendinosis has a complex pathophysiology that includes intrinsic and extrinsic mechanisms, as well as environmental variables (1). Different age groups have different tendinosis mechanisms and pathogenesis. When people are older, it develops in conjunction with

age-related deterioration without trauma. In younger patients, it is produced by recurring overuse injuries or acute traumatic events (5). There is a variety of contributing causes.
Rotator cuff tendinosis is more likely to happen in these situations (3):

i) Repeatedly using your arms, especially in movements above your head;
ii) Not giving your rotator cuff muscles enough time to rest after overuse;
iii) Slumping forward;
iv) Having stiffness in your shoulder socket joint from an injury;
v) Having bone spurs (smooth growths off the edge of bones) that rub up against the tendons of your rotator cuff.

Furthermore, the pathophysiology of tendon discomfort in its early phases, which is typically asymptomatic, is poorly understood. However, tendinopathic changes in the tendon are progressive. A short increase in tendon loading can cause symptoms in many people, but these symptoms often go away on their own and come back later, creating a cyclical pattern of symptoms and remission (2).

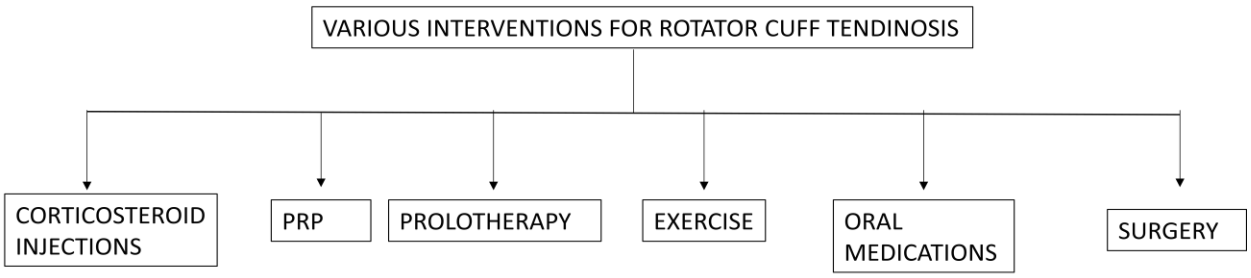
DIAGNOSIS:

Sports medicine specialists, physiatrists, and orthopaedists assess and diagnose the lesions, with a variety of clinical spectrum ranging from acute tendinitis to tendon tears (5). After a preliminary clinical examination, a diagnosis is made based on a number of factors, and MRI and ultrasound are crucial in making that determination. The best method for identifying RC Tendinopathies, partial thickness tears, swollen subacromial bursa, and ruling out a complete thickness tear is diagnostic dynamic ultrasonography (1).

MANAGEMENT:

As controversial as the origins of rotator cuff tendinosis are, so are the treatments. For example, oral medicines, exercise, corticosteroid injections, prolotherapy, platelet rich plasma, manipulation, and surgery are all treatment options. Exercise is a good treatment for restoring

function in addition to pain relief in RC tendinosis (8,9). Medication and steroid injection therapy only help to minimize discomfort (6). However, recuperation after exercise takes a while, and patient compliance is required to get the best results.



For many years, doctors have used sub-acromial corticosteroid injection as a short-term treatment option. Due to the tendons' limited ability to heal themselves, novel biological therapeutic modalities have recently been added to the agenda for the treatment of tendinopathies. Recent research has shown that prolotherapy and platelet-rich plasma (PRP) are effective therapies for treating rotator cuff tendinosis. But there isn't much proof either way that PRP or prolotherapy is effective for treating RC tendinosis (5).

PRP therapy involves the concentration and subsequent reinjection of autologous "platelets" that are acquired by whole-blood centrifugation. Regarding relative safety, ease of production, and cost-effectiveness, PRP treatment has many benefits (6). The platelets release growth-promoting agents. The platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), hepatocyte growth factor, and insulin-like growth factor 1 are among these growth factors. These elements result in angiogenesis, epithelization, cell differentiation, extracellular matrix proliferation, and fibrovascular callus in addition to being biologically active (5).

Prolotherapy is a nonsurgical regenerative injection procedure that injects tiny volumes of an irritating solution into the areas around painful and degenerated tendon insertions (entheses), joints, and ligaments (10). Dextrose, phenol-glycerine-glucose (P2G), and sodium morrhuate are different types of prolotherapy (2).

Prolotherapy injections' precise mechanism is not yet fully understood. The injections are made with different amounts of hypertonic dextrose, which might lead to the osmotic rupture of nearby cells. A localized increase in glucose levels in the extracellular matrix causes tissue irritation that sets off an initial inflammatory response, promotes fibroblast proliferation, and then promotes collagen synthesis, which leads to tissue repair and regeneration (11).

AIMS AND OBJECTIVES

AIM AND PRIMARY OBJECTIVE

To evaluate the efficacy of Platelet Rich Plasma versus Prolotherapy in the treatment of rotator cuff tendinosis.

SECONDARY OBJECTIVE

To evaluate the efficacy of ultrasound in comparison with MRI in the diagnosis of rotator cuff tendinosis.

REVIEW OF LITERATURE

The existing literature demonstrates a range of responses to various therapies for pain relief and treatment of rotator cuff tendinosis patients. There are studies determining the efficacy and safety profile of novel biological techniques like platelet rich plasma and prolotherapy in the management of rotator cuff tendinosis. It has been studied in some studies across the globe and a few Indian studies.

Various studies have been included in this literature review. The current literature review shows various studies that have been on platelet rich plasma and prolotherapy in the management of rotator cuff tendinosis as summed up below.

PLATELET RICH PLASMA BASED STUDIES:

- A total of thirty patients were enrolled and split into PRP and control groups in the prospective study "Effect of platelet-rich plasma on the degenerative rotator cuff tendinopathy according to compositions" by Sang Jun Kim et al. In the PRP group, a 22-gauge syringe was used to inject 2 ml of PRP solution into the hypoechoic supraspinatus lesion using the peppering technique. Exercises for strengthening the rotator cuff were given to patients in the control group. Baseline, six weeks post-injection, twelve weeks post-injection, and twenty-four weeks post-injection the American Shoulder and Elbow Surgeons (ASES), Constant-Murley score, and numeric rating scale (NRS) were evaluated. The 1 ml of PRP solution was used to analyze PRP components. At 6 weeks ($p = 0.582$ and 0.258) and at 12 weeks ($p = 0.969$ and 0.795), the ASES and Constant-Murley scores did not significantly differ across the groups; but, at 24 weeks ($p = 0.050$ and 0.048), the scores differed. At 6 weeks ($p = 0.031$), an independent t test revealed a significant group difference in NRS, but not at 12 or 24 weeks ($p = 0.147$ and 0.935). As threshold values to identify significant improvement, 5.19 pg/ml of IL-1 and 61.79 g/ml of TGF-1 were obtained. In comparison to the exercise group, the PRP subgroup over the cutoff values for IL-1 or TGF-1 demonstrated significant differences in all clinical outcomes, whereas the PRP subgroup

below the cut-off values did not exhibit any significant differences in the linear regression analysis(6).

- A total of eighteen level 1 studies were included in a review by Xiao Chen et al. titled "Use of Platelet-Rich Plasma for the Improvement of Pain and Function in RC Tears: A Systematic Review and Meta-analysis With Bias Assessment." There was no change in the VAS scores between the patients who got leukocyte-rich PRP and those who received leukocyte-poor PRP. Although there was no change in VAS scores, patients receiving PRP gel reported higher Constant scores compared to the controls, whereas patients receiving non-gel PRP treatments did not. When PRP was administered to patients with rotator cuff-related problems, long-term retear rates were noticeably reduced. Numerous functional outcomes showed significant improvements in PRP-treated individuals, although none of them met their respective minimal clinically meaningful differences. Overall, the findings implied that PRP might have a positive impact on clinical outcomes, but solid conclusions were difficult to draw due to a lack of data, research heterogeneity, and subpar methodology(12).

- Seventeen patients with a full-thickness rotator cuff injury were included in a study by Chris Hyunchul Jo et al. titled "Allogenic Platelet-Rich Plasma for RC Repair," which was a retrospective cohort study. Seven patients received autologous PRP and ten patients received allogeneic PRP after arthroscopic rotator cuff surgery. Between the torn end and the larger tuberosity, three PRP gels in a volume of three millilitres each were administered. Clinical results were evaluated both before and at least two years after surgery. The occurrence of retear and changes in the supraspinatus' cross-sectional area (ACT) were used to evaluate structural results. During the observation period, there were no negative effects of the allogeneic PRP. The clinical outcome assessments did not significantly differ between the two groups (all $p > 0.05$). In the allogeneic group and the autologous group, the retear rates were 33.3% and 25.0%, respectively ($p = 0.764$). One-year postoperative and immediately postoperative ACT changes did not differ between the two groups differently ($p = 0.373$) (13).

- Ninety-nine patients (47 in the PRP group and 52 in the CS group) were followed up to 12 months after injection in a study by Cory A. Kwong et al. titled "Platelet-Rich Plasma in Patients with Partial-Thickness RC Tears or Tendinopathy Leads to Significantly Improved Short-Term Pain Relief and Function Compared With Corticosteroid Injection: A Double-Blind Randomized Controlled Trial." Age, sex, and symptom duration of the patients' baseline demographic data showed no variations. Patients in the PRP group had lower baseline VAS (46.0 vs 34.7, P =.01), ASES (53.9 vs 61.8, P =.02), and WORC (42.2 vs 49.5, P =.03) ratings despite being randomly assigned. At three months following the injection, the VAS (-13.6 vs 0.4, P =.03), ASES (13.0 vs 2.9, P =.02), and WORC (16.8 vs 5.8, P =.03) scores all improved more favorably in the PRP group. Following ultrasound-guided CS and PRP injections, patients with PTRCTs or tendinopathy reported clinically improved pain and patient-perceived outcome scores. At short-term follow-up, patients who got PRP showed superior improvement in pain and function (3 months). At longer-term follow-up, PRP was not consistently superior to CS (12 months) (14).

- All patients with diagnoses of RC tendinitis between 2014 and 2017 were taken into consideration in a study by H. Dadgostar et al. titled "Corticosteroids or platelet-rich plasma injections for rotator cuff tendinopathy: a randomized clinical trial study." PRP or corticosteroids were randomly assigned to different patients. Under ultrasound guidance, a total of 3cc of PRP was injected into the subacromial joint and a further 3cc into the tendon rupture. 1cc of Depo-medrol 40mg and 1cc of lidocaine (2%) were injected into the subacromial joint for the corticosteroid group. In total, 58 patients participated in the trial. Following treatment, both groups experienced a statistically significant improvement in pain, range of motion (ROM), Western Ontario RC (WORC), Disability of Arm-Hand-Shoulder (DASH) ratings, and supraspinatus thickness (p 0.05). Within the PRP group, pain relief was noticeably better during the three months of follow-up. In most clinical characteristics among patients with RC tendinopathies, the authors discovered that PRP produced effects comparable to those

of corticosteroids; however, pain and range of motion may significantly improve with the administration of PRP. They recommended the use of PRP instead of corticosteroid-based injections among individuals with RC tendinopathy because the use of corticosteroids may be contraindicated in some patients and may be linked to the risk of tendon rupture (15).

PROLOTHERAPY BASED STUDIES:

- In a randomized controlled prospective study by John George et al. titled "Comparative Effectiveness of USG-Guided Intra-tendinous Prolotherapy Injection with Conventional Treatment to Treat Focal Supraspinatus Tendinosis," 12 adult patients with focal supraspinatus tendinosis were enrolled if their functional (DASH) scores had improved by less than 30% one month after their initial presentation. Under ultrasound guidance, 0.5–1.0 ml of prolotherapy injection (12.5% dextrose, 0.5% lignocaine) was administered to seven patients. Five patients underwent normal physiotherapy treatment without any intervention throughout this time. At baseline and after 12 weeks, the regional area of echogenicity, DASH, shoulder range of motion, pain, and sleep ratings were assessed. Both the shoulder abduction score ($p=0.030$) and the sleep score improved significantly ($p=0.027$) in the prolotherapy group. At the conclusion of the course of treatment, the area of tendinosis became considerably more echogenic ($p=0.009$). At 12 weeks, the pain score in both the injection group (43.5%) and the control group (25%) decreased, although this difference was not statistically significant ($p > 0.005$)(2).

- A systematic review and meta-analysis were performed by Meng-Wu Chung et al, titled: "Effects of dextrose prolotherapy on tendinopathy, fasciopathy, and ligament injuries: fact or myth?" For the review, 10 studies with 358 participants were considered. The majority of analyses at the study level did not show any discernible changes in pain management between dextrose prolotherapy and no treatment (or placebo). The meta-analysis revealed that dextrose prolotherapy was only superior to corticosteroid injections in terms of pain relief at short-term follow-up (i.e., 1-3 months) (SMD: 0.70; 95% CI: 0.14-1.27; $I2 = 51\%$) and effective in improving activity only at immediate follow-up

(i.e., 0-1 month) (standardised mean difference [SMD]: 0.98; 95% confidence interval [CI]: 0. In this investigation, no additional significant SMDs were discovered(16).

- In the study, "Dextrose Prolotherapy Versus Control Injections in Painful RC Tendinopathy," Helene Bertrand et al. collected data on 73 individuals with chronic shoulder discomfort, rotator cuff tendinopathy, and ultrasound-verified supraspinatus tendinosis/tear. Three monthly injections of either dextrose onto sore entheses (Enthesis-Dextrose), saline onto entheses (Enthesis-Saline), or saline above entheses (Superficial-Saline) were done. Each solution had 0.1% lidocaine in it. Physical treatment was administered concurrently to all subjects. For 7.6±9.6 years, the 73 patients experienced moderate to severe shoulder discomfort (7.0±2.0). In comparison to Enthesis-Saline (37%; P=.088) and Superficial-Saline (27%; P=.017), Enthesis-Dextrose participants maintained an average improvement in pain of ≥ 2.8over 9 months in 59% of cases. Hypertonic dextrose injection on painful entheses produced superior long-term pain improvement and patient satisfaction compared with blinded saline injection over painful entheses, with entheses injection with saline producing intermediate results in participants with painful rotator cuff tendinopathy who receive physical therapy(17).

- One hundred and twenty patients with chronic rotator cuff lesions and symptoms that persisted for longer than 6 months were enrolled in a study by M.M. Seven on the "Effectiveness of prolotherapy in the treatment of chronic rotator cuff lesions." Two groups of patients were formed: one received prolotherapy injections while the other received exercise treatment (control group; n = 60). In the latter, prolotherapy injections were administered under aseptic settings while being guided by ultrasound. In the former, patients underwent a 12-week physiotherapy routine that included three sessions per week. 101 participants in all (57 in the prolotherapy group and 44 in the control group) completed all research procedures and were enrolled in the trial. The VAS, SPADI, WORC index, and shoulder range of motion were all significantly improved in both groups when compared within groups (P 0.001). A significant difference in the VAS scores at baseline, weeks 3, 6, and 12, as well as the final follow-up, was discovered

using a between-group comparison. Additionally, at weeks 6 and 12, as well as the final follow-up, substantial variations in the SPADIs and WORC indices were discovered. At week 12 and the most recent follow-up, there were significant variations in shoulder abduction and flexion, as well as internal rotation. External rotation, however, showed no meaningful results throughout any follow-up time. 53 patients (92.9%) in the prolotherapy group had excellent or good outcomes, compared to 25 patients (56.8%) in the control group. Prolotherapy is a convenient and effective adjunctive approach for treating persistent rotator cuff disorders (11).

- Sixty-six patients with chronic rotator cuff tendinopathy, confirmed by magnetic resonance imaging, were randomly assigned to 2 groups in a research by M.K. Mofrad et al. titled "Periarticular Neurofascial Dextrose Prolotherapy Versus Physiotherapy for the Treatment of Chronic RC Tendinopathy." Using a questionnaire for the Shoulder Pain and Disability Index, the results were changes in the primary and secondary disability indices for shoulder pain intensity. Participants in the physiotherapy experiment received pulsed ultrasound, transcutaneous electrical nerve stimulation, and superficial heat. In 2 weeks, neurofascial dextrose was more efficient than PT at reducing pain ($p < 0.001$), and 3 months later, they were comparable ($p = 0.055$). Dextrose was more effective than physiotherapy for reducing impairment 2 weeks and 3 months after the therapies (both $p < 0.001$). The physiotherapy group's changes, however, appeared to be more long-lasting. For the short-term therapy of rotator cuff tendinopathy, both methods were beneficial. Prolotherapy, however, was more effective as the first course of treatment. Dextrose prolotherapy also had a substantially shorter treatment period than physiotherapy(18).

PRP VS PROLOTHERAPY BASED STUDY:

- Aylin Sari and Ali Eroglu separated 129 patients into 4 groups for their study, "Comparison of ultrasound-guided platelet-rich plasma, prolotherapy, and corticosteroid injections in rotator cuff injuries." These groups were PRP, COR, PRO, and the lidocaine group. Sub-acromial injections were given to all groups. At 3, 12, and 24 weeks after injection, evaluation was conducted using the Visual Analogue Scale (VAS), the American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES), and the Western Ontario RC Index (WORC). The VAS and WORC scores in the COR group were considerably lower than those in the other groups in the third week ($p < 0.01$ and $p < 0.05$, respectively). In the 24th week, it was discovered that the PRP group's VAS and WORC scores were significantly lower than those of the COR group ($p < 0.01$ and $p < 0.05$, respectively). The ASES score in the COR group was discovered to be considerably higher than the PRP and PRO groups in the third week ($p < 0.01$). With corticosteroid injections, patients with RC lesions have short-term pain alleviation, improved function, and improved quality of life, as well as long-term health(5).

Table 1. Summary of Review of literature

AUTHOR	NAME OF STUDY	YEAR	CONCLUSION
Sang Jun Kim et al (Sample Size:30)	Effect of platelet-rich plasma on the degenerative rotator cuff tendinopathy according to the compositions.	2019	TGF-b1 and IL-1b, two cellular components of PRP, were linked to clinical efficacy for RC tendinopathy, and PRP had better clinical results for RC tendinopathy than the exercise group when the concentration of IL-1b was above 5.19 pg/ml and TGF-b1 was above 61.79 ug/ml.
Xiao Chen et al. (18 Studies Included)	Use of Platelet-Rich Plasma for the Improvement of Pain and Function in RC Tears: A Systematic Review and Meta-analysis With Bias Assessment	2020	Overall, results suggest that PRP might improve clinical outcomes, but meaningful conclusions are challenging to reach because of a dearth of information, the heterogeneity of the study, and poor methodology.
Chris Hyunchul Jo et al (Sample Size:17)	Allogeneic Platelet-Rich Plasma for RC Repair	2016	When used in arthroscopic rotator cuff procedures, allogeneic PRP is just as effective as autologous PRP in terms of clinical and structural outcomes. It did not result in any local or general problems.
Cory A. Kwong et al (Sample Size: 104)	Platelet Rich Plasma in Patients with	2020	At a short-term follow-up, PRP recipients with partial-thickness

	Partial Thickness RC Tears or Tendinopathy leads to Significantly Improved Short-Term Pain Relief and Function Compared with Corticosteroid Injection: A Double-Blind Randomized Controlled Trial		rotator cuff injuries or tendinopathy experienced superior pain relief and functional improvement (3 months). At longer-term follow-up, PRP did not consistently outperform CS (12 months).
H. Dadgostar et al. (Sample Size: 58)	Corticosteroids or platelet-rich plasma injections for rotator cuff tendinopathy: a randomized clinical trial study	2017	In most clinical characteristics among patients with RC tendinopathy, PRP produces effects comparable to those of corticosteroids; however, pain and range of motion significantly improved with the administration of PRP.
John George et al (Sample Size:10)	Comparative Effectiveness of USG-Guided Intratendinous Prolotherapy Injection with Conventional Treatment to Treat Focal Supraspinatus Tendinosis	2018	Within 12 weeks of treatment, ultrasound-guided intratendinous prolotherapy injection dramatically increases the patient's range of abduction and enhances sleep compared to traditional physiotherapy treatments.
Meng-Wu Chung et al	Effects of dextrose	2020	The clinical advantages of

(Studies Included:10 with 358 participants)	prolotherapy on tendinopathy, fasciopathy, and ligament injuries, fact or myth?		dextrose prolotherapy in treating thick fibrous tissue injuries are not sufficiently supported by the available research. For the benefits of dextrose prolotherapy to be established, more high-quality randomized controlled trials are required.
Helene Bertrand et al. (Sample Size: 73)	Dextrose Prolotherapy Versus Control Injections in Painful RC Tendinopathy	2016	Hypertonic dextrose injection on painful entheses produces superior long-term pain improvement and patient satisfaction compared with blinded saline injection over painful entheses.
M.M. Seven et al. (Sample Size: 101)	Effectiveness of prolotherapy in the treatment of chronic rotator cuff lesions	2017	Prolotherapy is a convenient and effective adjunctive approach for treating persistent rotator cuff disorders.
Morteza Kazempour Mofrad et al (Sample Size: 66)	Periarticular Neurofascial Dextrose Prolotherapy Versus Physiotherapy for the Treatment of Chronic RC Tendinopathy	2019	Compared to physical therapy, prolotherapy is a more successful initial treatment for rotator cuff tendinopathy. Prolotherapy also appears to not have any significant side effects, and its course of treatment is much shorter than that of physiotherapy.

Aylin Sari and Ali Eroglu (Sample Size: 129)	Comparison of ultrasound-guided platelet-rich plasma, prolotherapy, and corticosteroid injections in rotator cuff injuries.	2020	Even though the short-term outcomes of corticosteroid injection for the treatment of rotator cuff lesions did not respond to conservative treatment and were significantly better than those of PRP, this study concluded that the long-term success of PRP injection was high, but all techniques used, including lidocaine, could be helpful for treatment.

MATERIALS AND METHODS

Study setting

The study was conducted in the Department of Diagnostic and Interventional Radiology in collaboration with the Department of Orthopaedics and Physical Medicine & Rehabilitation at All India institute of medical sciences (AIIMS), Jodhpur. Patient recruitment was done in the outpatient divisions of these three departments of AIIMS Jodhpur, which is a tertiary health care centre located in Jodhpur city, Rajasthan state of India. Patient enrolment was done between March 2021 to July 2022.

Study Design

This was a prospective, single-centre, randomized, open-label, active-controlled, parallel-group clinical trial. The Institutional ethics committee (AIIMS, Jodhpur) approved the study (**AIIMS/IEC/2021/3392**) dated 12th March 2021 (**ANNEXURE I**). The study was registered with the Clinical Trial Registry of India (CTRI) with registration number - **CTRI/2022/04/053800**.

The study was conducted as per the International Conference on Harmonization-Good clinical practice (ICH-GCP) and ICMR (National Ethical Guidelines for Biomedical and Health Research involving Human Participants 2017) guidelines. Patients who satisfied inclusion/exclusion criteria were randomized in a 1:1 ratio to receive either PRP injection or Prolotherapy injection. We made no changes to the protocol after the commencement of the study, and no interim analysis was planned.

Patient Selection criteria

The inclusion criteria were:

All patients with confirmed rotator cuff tendinosis with:

1. Non-response to conservative treatment for 3 months.
2. Age over 18 years and less than 75 years of age.

The exclusion criteria were:

1. Previous Intra-articular injection/invasive procedure.
2. Congenital or acquired platelet dysfunction.
3. Uncontrolled Diabetes Mellitus.
4. Non-consenting patient.
5. MRI contraindications.

Randomization, concealment, and blinding

Variable block randomization was used; randomization sequence was generated using R software.

Allocation Concealment

Concealment of randomization was done by storage of randomization sequence in opaque sealed envelopes at central place with principal investigator or by randomization sequence stored with the investigator and telephonically confirming the random number from PI by the investigator assigned for treatment allocation at the time of enrolment of patients.

Blinding

It was an open-labelled study. Participants and investigators were aware of the treatment given. All the assessments were done by investigators who were not blinded.

Study flow

Patients suspected of having rotator cuff tendinopathy underwent USG and MRI of the shoulder.

Patients with imaging confirmation of RC tendinopathy and who were willing to participate in the study were randomly divided into two groups:

i) PRP group and ii) Prolotherapy group

Both groups received the injection. PRP* group received platelet rich plasma injection (2ml) and the Prolotherapy** group received dextrose injection (2 ml) under sterile conditions.

(A prior Biohazard profile*** was done before doing any procedure)

Baseline characteristics were collected from all patients and both groups were referred for common rehabilitation protocol for RC Tendinosis post-injection.

Outcome measures were assessed at baseline pre-treatment and 1, 3, 6, and 12 weeks after the injection.

Patients were requested to report any adverse effects at each visit.

Figure 2. PRP injection under USG guidance

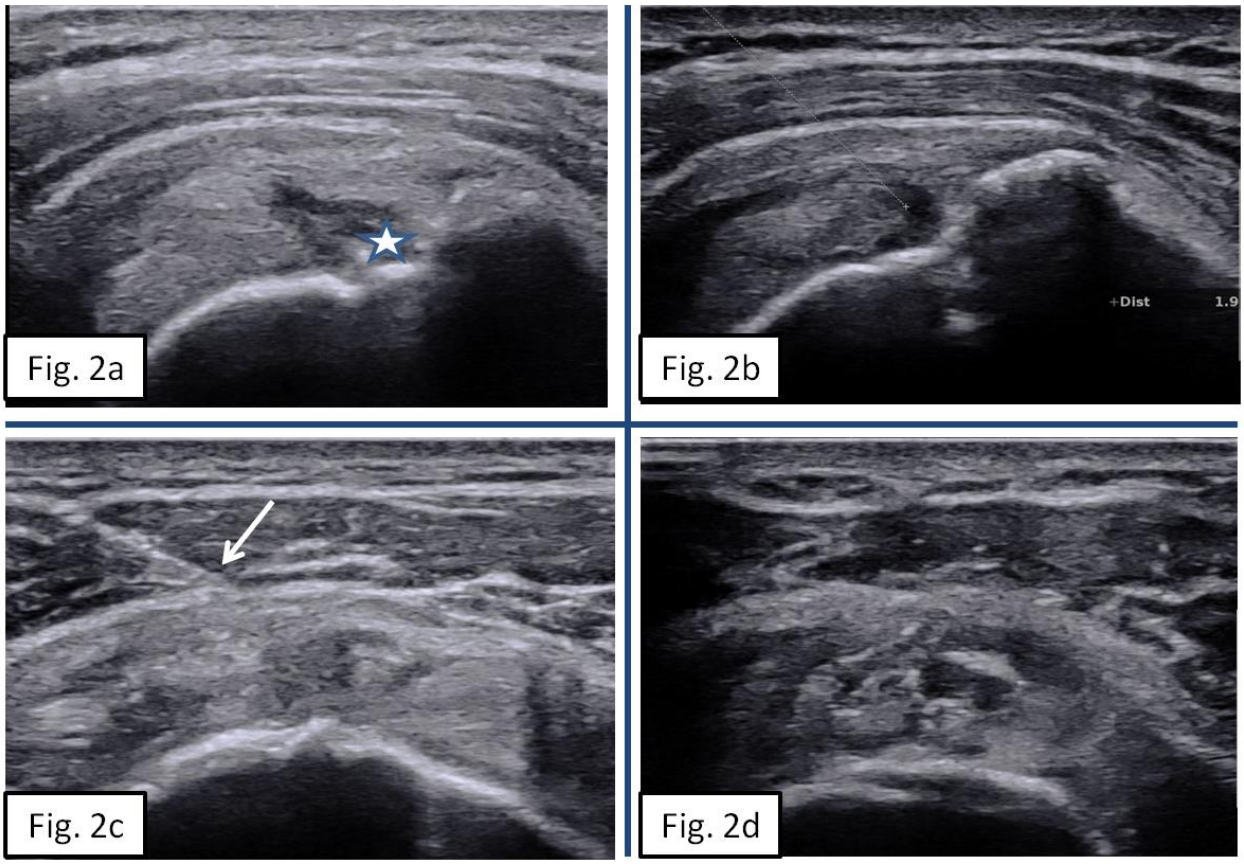


Fig. 2a & 2b : Pre-procedural USG; Fig. 2c : USG at the time of injection;
Fig.2d: Post Procedural USG.
Asterisk (*) in Fig.2a shows area of tendinosis; arrow in fig. 2c shows needle.

*** PRP Preparation:**

Whole blood was withdrawn from the patients just prior to the procedure into 2 citrate tubes. A standardized centrifugation based manual PRP method was used to produce the autologous PRP at the blood bank. It was transported to the procedure room in a closed system maintaining a sterile chain and was finally activated in the procedure room by a clinically approved infusion grade calcium solution just before application.

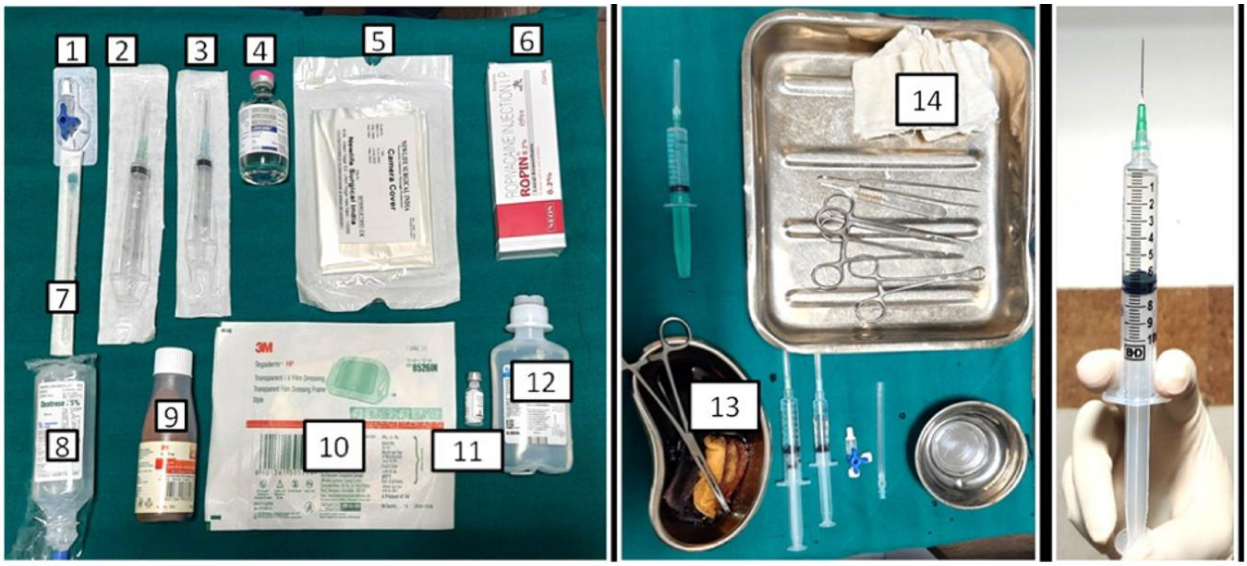
** **PROLOTHERAPY:** 25% Dextrose with 0.1% lidocaine was used.

***BIOHAZARD PROFILE:** It includes Complete Blood Count, Hepatitis, and Retroviral Panel.

INJECTION PROTOCOL:

All patients underwent ultrasound evaluation prior to and at the time of the injection. All injections were USG guided and the approach depends on the involved tendon for both intervention groups. Patients were either asked to sit or lie down with the arm placed by the side. The rotator cuff tendon's pathological region was found. The essential side effects were disclosed to the patients. Standardized sterile protocols were followed for the injection processes. Using a sterile syringe, PRP/Prolotherapy solution was injected following routine sterile preparation and local anaesthetic administration (2% lidocaine to numb the skin). After cleaning the area post-injection, a compression bandage was applied. Following injection, patients were instructed to rest for 3-5 days. Using an ice pack for the first 24 hours after treatment was advised to reduce local discomfort. The patients were informed about red flag signs (exacerbation of baseline shoulder joint pain, allergic reaction, redness, fever, swelling, unable to move arm) and instructed to get in touch with us in case of an emergency (19).

Figure 3. Intervention Procedural Set Up



1. Three way cannula 2. Luer lock 10cc 3. Luer lock 5cc 4. Lignocaine 5. Camera cover 6. Ropivacaine 7. Lumbar Puncture 8. 25%dextrose 9. Betadine 10.Tegaderm 11. Triamcinolone 12. Normal Saline 13. Kidney tray with betadine 14. Sterile gauze

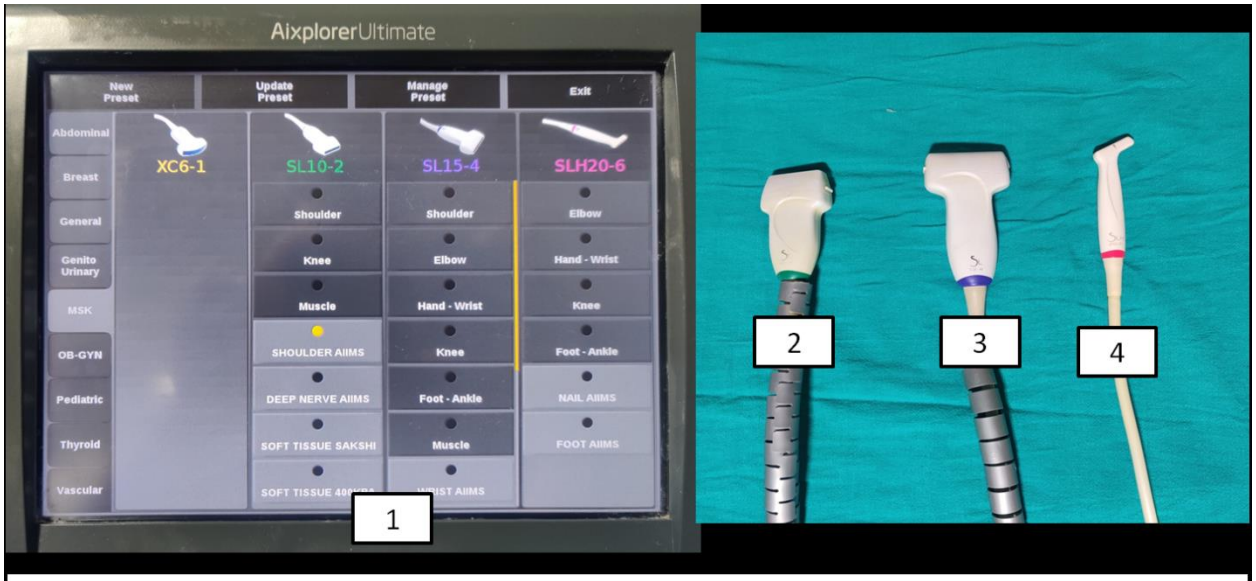
Study Endpoints Assessment

VAS score and quickDASH questionnaire were evaluated during every visit (1st, 3rd, 6th, and 12th-week post-injection). Safety and adverse events were recorded 3-5 days after injection telephonically and at the time of follow-up.

Imaging Techniques Used

RC tendon integrity was evaluated by USG Imaging using Aixplorer US system (SuperSonic Imagine, Aix-en-provence, France) with a high frequency linear transducer ranging from SL 15- to 4- MHz. The tendons were evaluated for the echotexture, continuity, and insertion site. Additional advanced ultrasound and dynamic imaging were done as and when needed. RC Integrity was evaluated by USG imaging examination before and 12 weeks after the procedure. MRI were done for the patients using Proton Density Weighted imaging in all 3 planes, Coronal T2W imaging, and Sagittal T1 weighted imaging using Flex coil using 3 Tesla MRI system (GE Discovery MR 750 w 3T SYSTEM USA).

Figure 4. USG machine display unit and Transducers



1. Supersonic USG machine display ; 2. SL 10-2 linear probe; 3. SL 15-4 linear probe; 4. SLH 20-6 Hockey Stick Probe

Sample Size

As there was no study in which PRP was compared with prolotherapy, we took the data for sample size calculation from Kim et al. (6). Assuming a standard deviation of 2.6 in the study group and 1.1 in the control group with an effect size of 1.08 and mean difference of 2 in two treatment groups in mean pain scores (based on clinician assessment), with 80 percent power and alpha error of 5%, the, the sample size was estimated to be 16 per treatment group. A total of 32 patients were recruited.

STATISTICAL ANALYSIS

Data were expressed as mean ± standard deviation. Independent Student t-tests were used for the comparison of numerical variables between the two groups. The chi-square test was used to compare categorical variables. Intragroup comparison of mean changes in outcomes were evaluated by Paired t-test. Analysis was done using SPSS version 25 (IBM Corp. Ltd, Newark, USA).

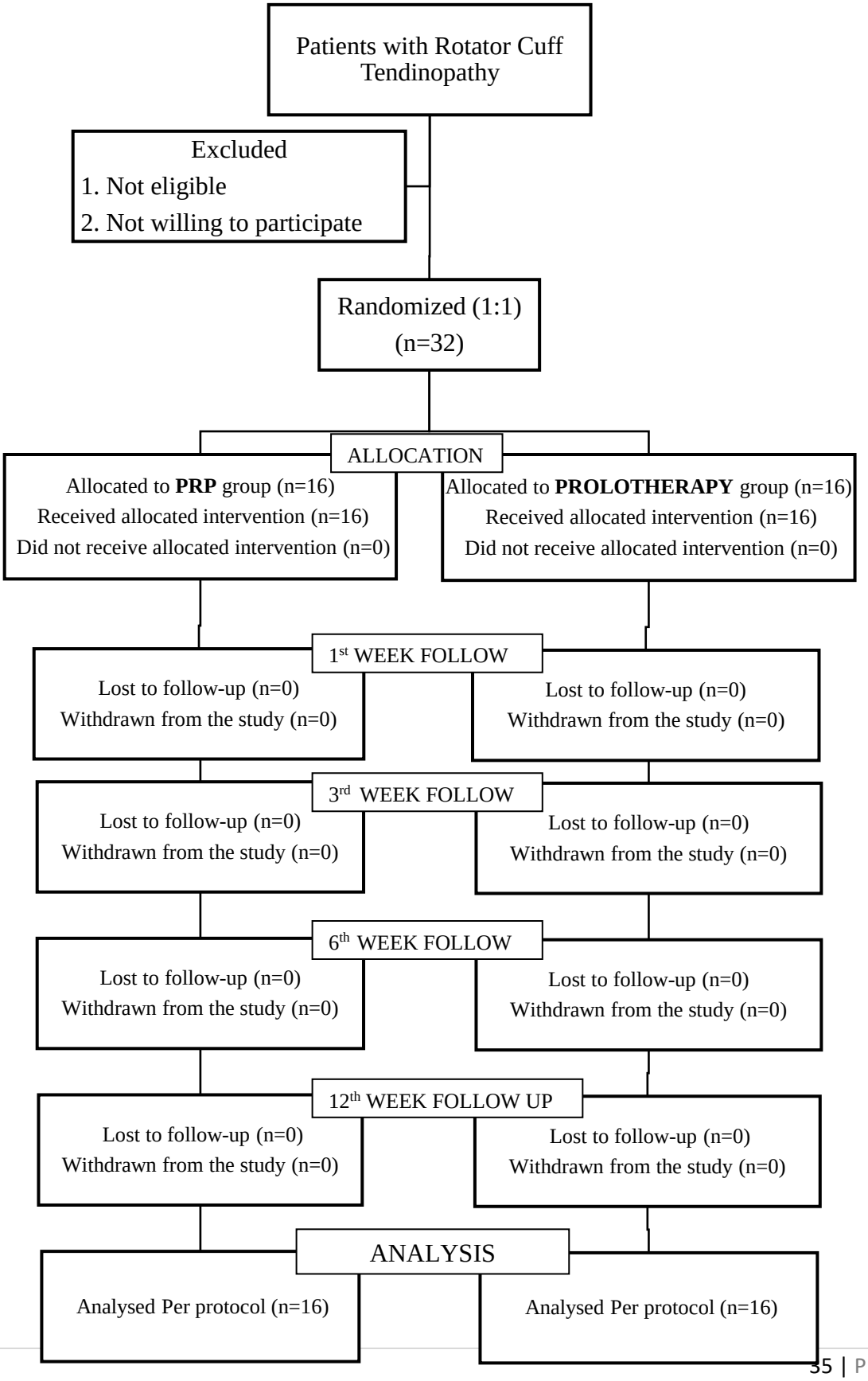
OBSERVATION AND RESULTS

From March 2021 to July 2022, 32 patients were recruited in the study: 16 in the PRP group and 16 in the Prolotherapy group. The mean age of patients in the PRP group was 45.56 $\pm$ 13.82 years and the Prolotherapy group was 48.88 $\pm$ 12.88 years. The baseline mean VAS scores in PRP and Prolotherapy groups were 6.75 $\pm$ 0.86 and 6.88 $\pm$ 1.02, respectively. The baseline mean Quick DASH scores in PRP and Prolotherapy were 62.50 $\pm$ 9.14 and 63.69 $\pm$ 12.36, respectively. There was no significant difference in baseline characteristics between the two groups. The baseline characteristics of the two groups are illustrated in table 2.

Table 2. Baseline demographic, imaging, and clinical data of both groups

Characteristics	**PRP (n=16)**	**Prolotherapy (n=16)**	**p value**
AGE in years	45.56 ±13.82	48.88 ±12.88	0.488
SEX (M/F)	8/8	8/8	1
USG POSITIVE	15 (93.8%)	14 (87.5%)	1
MRI POSITIVE	16 (100%)	16 (100%)	1
VAS SCORE	6.75 ± 0.86	6.88 ± 1.02	0.711
Quick DASH SCORE	62.50 ± 9.14	63.69 ± 12.36	0.759

Figure 5. Consort diagram



Pain Relief:

Difference in change in VAS score

There was progressive decrease in VAS score from baseline at each point time of follow-up. The mean VAS score came down from 6.75 ± 0.86 at baseline to 3.50 ± 1.41 at 12 weeks (p= <0.001) in the PRP group, while it came down from 6.88 ± 1.02 at baseline to 3.81 ± 2.17 at 12 weeks (p=<0.001) in prolotherapy group. However, there was no statistically significant difference in mean VAS between the two groups at any point of follow-up.

Difference in change in QuickDASH score

Similarly, the quickDASH score came down from 62.50 ± 9.14 at baseline to 34.00 ± 12.15 at 12 weeks (p=<0.001) in the PRP group, while it came down from 63.69 ± 12.36 at baseline to 37.50 ± 20.96 at 12 weeks (p=<0.001) in prolotherapy group. However, there was no statistically significant difference in the mean quickDASH score between the two groups at any point of follow-up.

Table. 3 Change in mean VAS between PRP and Prolotherapy groups

Time period	**PRP Group (n=16) (mean ± SD)**	**Prolotherapy Group (n=16) (mean ± SD)**	**p-Value (Inter-group)**
Baseline	6.75 ± 0.86	6.88 ± 1.02	0.711
1 week	5.69 ± 1.14	5.75 ± 1.73	0.905
3 weeks	4.94 ± 1.48	5.31 ±1.81	0.527
6 weeks	3.75 ± 1.24	4.31 ± 2.15	0.372
12 weeks	3.50 ± 1.41	3.81 ± 2.17	0.633
p-Value (intra-group from baseline to 12 weeks)	<0.001	<0.001	--

Figure 6. Bar Diagram showing change in mean VAS between PRP and Prolotherapy Group

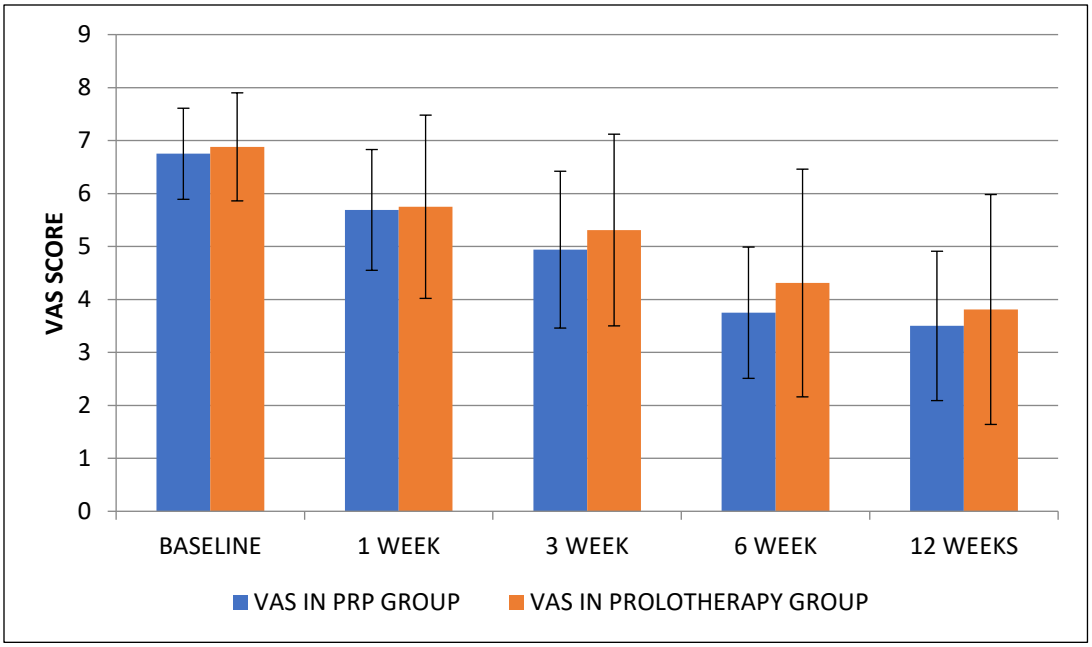


Figure 7. Line Diagram showing change in mean VAS between PRP and Prolotherapy group

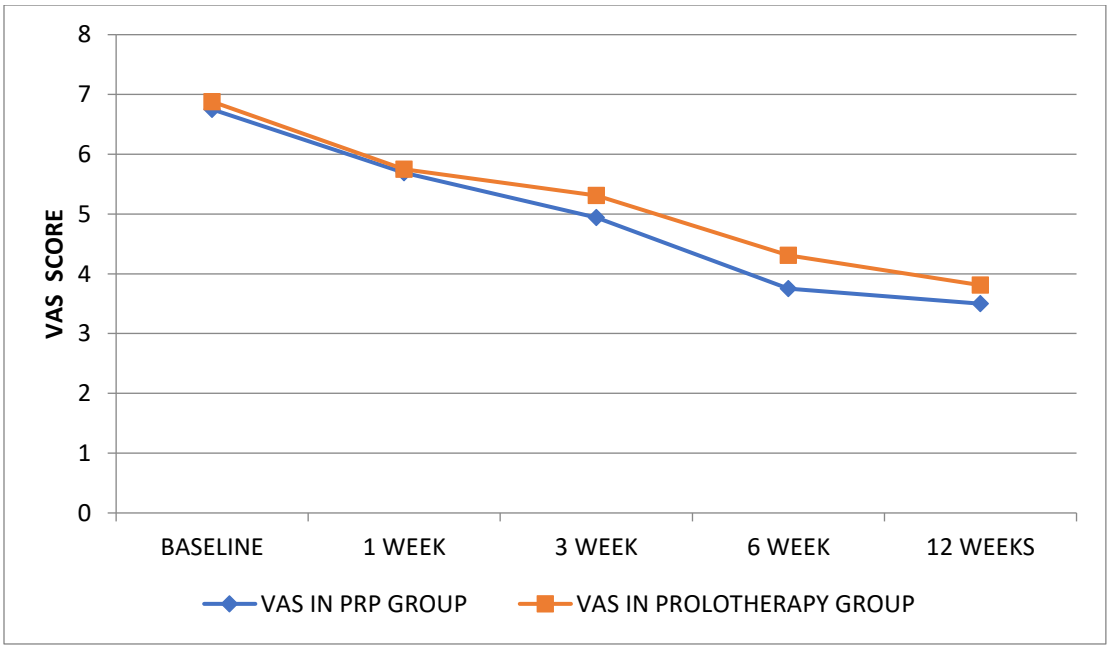


Table 4. Change in QuickDASH between PRP and Prolotherapy Groups

Time period	PRP Group (n=16) (mean ± SD)	Prolotherapy Group (n=16) (mean ± SD)	p-Value (Inter-group)
Baseline	62.50 ± 9.14	63.69 ± 12.36	0.759
1 WEEK	54.13 ± 11.04	56.44 ± 15.38	0.629
3 WEEKS	47.56 ± 14.79	47.56 ± 14.79	0.517
6 WEEKS	37.13 ± 11.53	41.75 ± 20.42	0.436
12 WEEKS	34.00 ± 12.15	37.50 ± 20.96	0.568
p-Value (intra-group from baseline to 12 weeks)	<0.001	<0.001	--

Figure 8. Bar Diagram showing change in QuickDASH between PRP and Prolotherapy groups

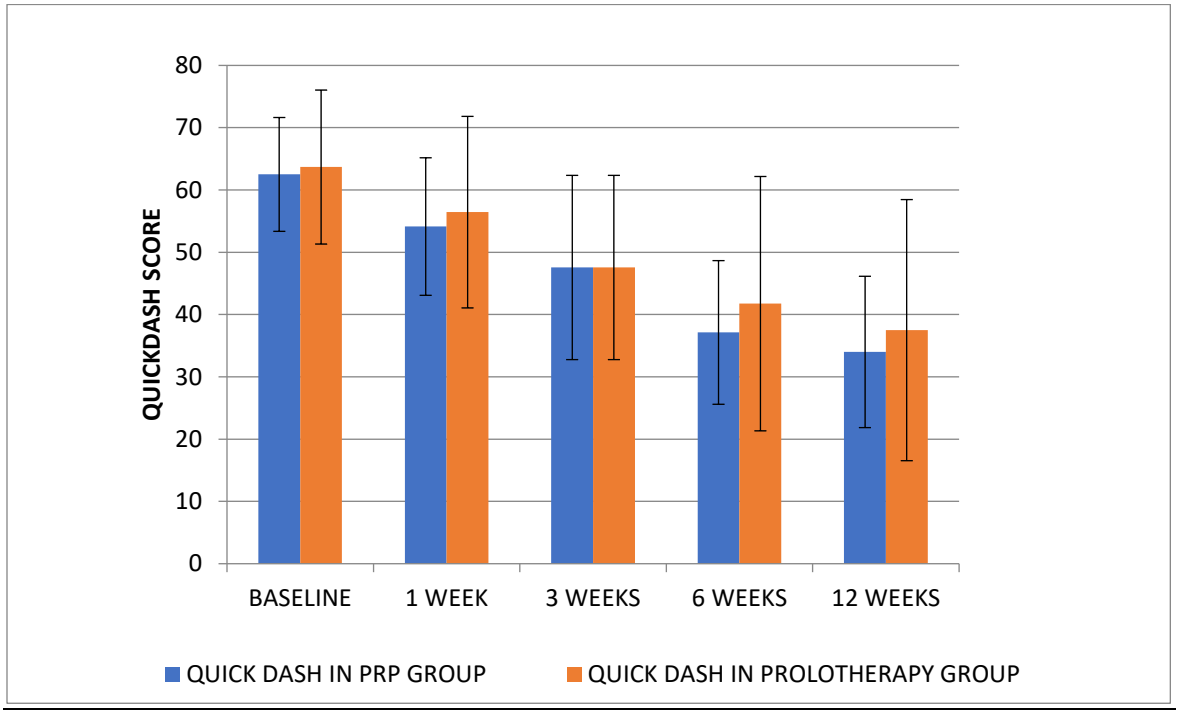


Figure 9. Line Diagram showing change in QuickDASH between PRP and Prolotherapy group

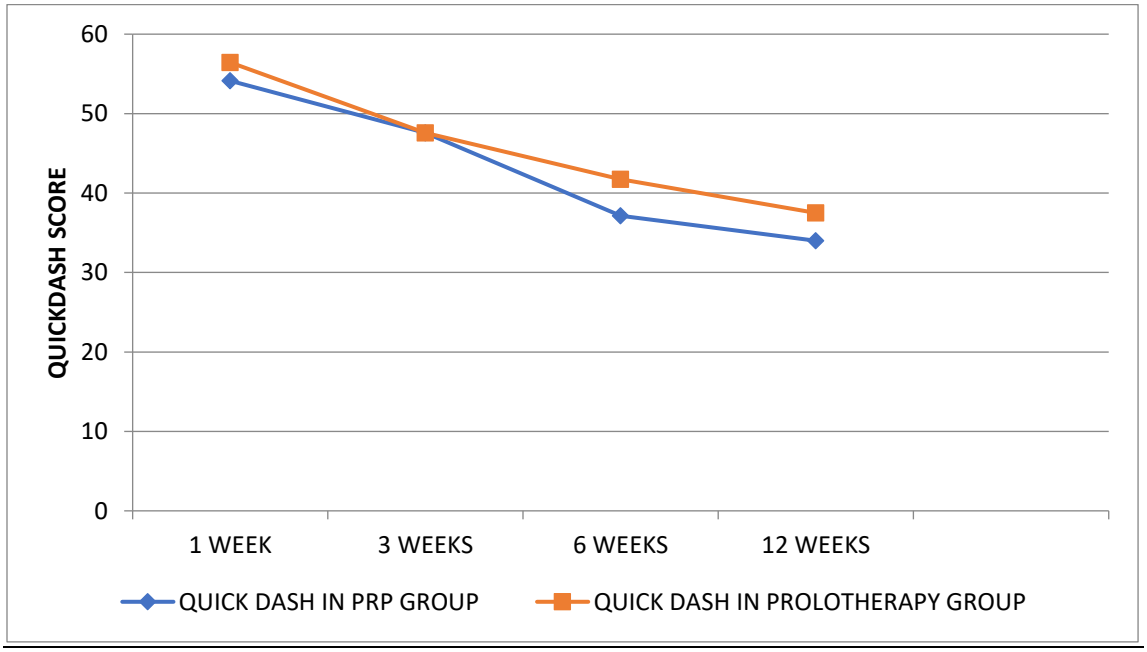


Table 5. Difference in Change in VAS and QuickDASH scores from baseline to 12 weeks between PRP and Prolotherapy groups

Score	PRP (Mean ± SD)	Prolotherapy (Mean ± SD)	Mean Difference between baseline & 12 weeks (95% C.I.)	p value
VAS	3.25±1.39	3.06±2.05	0.19 (-1.08 to 1.45)	0.764
Quick DASH	28.50±13.70	26.19±21.18	2.31 (-10.56 to 15.19)	0.716

USG versus MRI in Diagnosis of RC Tendinosis:

All cases were examined with ultrasonography as well as MRI. The USG findings were compared to that obtained by MRI in all cases. MRI was positive in all 32 patients while USG was positive in 29 out of 32 patients enrolled in the Study. Three patients were negative on USG while they were positive on MRI. In our study, USG was found to be relatively less sensitive than MRI in the detection of rotator cuff tendinosis (90.63 % sensitivity). MRI positive and USG negative representative cases are shown in Figure 17 and Figure 18 under the case gallery section.

DISCUSSION

A concentrated extract of platelets from autologous blood is known as platelet-rich plasma (PRP). It increases growth factor concentration by three to five times of normal plasma and thus aids in the healing of damaged tissue. Its use is reported in the fields of dermatology, plastic surgery, dentistry, otolaryngology, urology, ophthalmology, and neurosurgery (20).

The mechanism of PRP is less understood. The different mechanisms of action are local release of growth factors contained in PRP such as transforming growth factor beta, basic fibroblast growth factor, platelet-derived growth factor, and connective tissue growth factor, combined with high concentrations of activated platelets, stimulate healing and promote the growth of muscle and tendon (21). PRP is promoted as an ideal autologous biological blood-derived product releasing high concentrations of platelet-derived growth factors (22–24). Growth factors and cytokines are among the mediators that are released by activated platelets. Increased chondrocyte proliferation and differentiation may also result from PRP. Furthermore, PRP's suppression of the NF-B pathway may have anti-inflammatory effects (25–27). The synthesis of hepatocyte growth factor (HGF) and vascular endothelial growth factor (VEGF) in the tendon cells is known to be stimulated by PRP, which in turn promotes cellular proliferation and vascular regeneration. But the equilibrium between transforming growth factor-1 (TGF-1) and the pools of chemicals released by platelets may be crucial for therapeutic purposes in the regulation of angiogenesis and fibrosis (20).

At 12 weeks after the intervention, the VAS score in the PRP group had improved from 6.75 $\pm$ 0.86 at baseline to 3.50 $\pm$ 1.41. QuickDASH scores also changed similarly, going from 62.50 $\pm$ 9.14 at baseline to 34.00 $\pm$ 12.15 at 12 weeks. Following the injection, all subjects were evaluated at 1, 3, 6, and 12 weeks. Three patients in the PRP group were unable to attend the follow-up appointment, so their pain scores were obtained through phone calls. The majority of patients experienced improvements in their pain scores at each visit, although significant improvements in pain scores did not occur until six weeks had passed. Our results were consistent with previously reported literature for PRP. In a study by Sang Jun et al, there was improvement in the ASES score and Constant Murley Score at 24 weeks in the PRP group compared with the control group (6). There was improvement in VAS score and ASES scores at

3 months post injection in the study performed by Cory A. Kwong et al. (14). Significant improvement in pain, range of motion (ROM), Disability of Arm-Hand-Shoulder (DASH) ratings were seen following PRP injection in study by H. Dadgostar et al. (15).

Prolotherapy involves the injection of a small amount of solution into tissues with the aim of inducing healing of the injured structure (28). Although several agents have been used, hyperosmolar dextrose is the most popular (22). The proliferative response to dextrose is speculated to be a result of the greater osmolarity of the injected solution relative to the interstitial tissue. There is evidence that different glucose concentrations cause mesangial cells, smooth muscle cells, and gingival fibroblasts to secrete transforming growth factor b-1, platelet-derived growth factor, connective tissue growth factor, epithelial growth factor, and basic fibroblastic growth factor (22,29–31). At concentrations greater than 10%, glucose is presumed to cause an osmotic gradient outside the cells where it is injected, causing some cells to lose water and lyse, leading to an influx of growth factors and inflammatory cells that are then assumed to initiate the wound-healing cascade in the local area, including the deposition of collagen. New collagen loses volume and contracts as it matures, leaving a more robust and tighter ligament or tendon (28,32). Hypertonic dextrose causes a short inflammatory cascade to stimulate native healing and future tissue growth, and that clinical improvement follows the restoration of tissue integrity (17).

Similar to PRP, improvement in VAS and quickDASH score were seen 12 weeks post treatment in the Prolotherapy group. Vas score changed from 6.88 $\pm$ 1.02 at baseline to 3.81 $\pm$ 2.17 at 12 weeks post treatment. QuickDASH score showed change from 63.69 $\pm$ 12.36 at baseline to 37.50 $\pm$ 20.96 at 12 weeks. Telephonic follow up pain score assessments were done for 2 patients. Previously reported literature for Prolotherapy had similar results. Better response in the prolotherapy group in the form of decrease in the pain score (43.5%) in comparison to the control group (25%) at 12 weeks post-injection was seen in the study performed by John George et al (2). Hypertonic dextrose injection on painful entheses produced superior long-term pain improvement and patient satisfaction compared with blinded saline injection over painful entheses in Study by Helene Bertrand et al. (17). Fifty-three patients (92.9%) in the prolotherapy

group had excellent or good outcomes in pain score (VAS score), compared to 25 patients (56.8%) in the control group in Study by M.M. Seven et al (11). Dextrose was more effective than physiotherapy for reducing impairment two weeks and three months after the therapies in Study by M. K. Mofrad et al (18). No significant difference was found between the groups for sex, age, duration of symptoms, shoulder involved and dominant side affected.

USG versus MRI in Diagnosis of RC Tendinosis:

In order to evaluate the pathology of the rotator cuff, both ultrasonography and MRI are frequently employed. For care and decision-making, it is essential to accurately identify the location and extent of rotator cuff tears. Associated findings, such as the health of the muscle and tendon, retracted ends, underlying tendon degenerative changes, and impingement, are crucial for selecting the best course of treatment (33).

USG has several benefits that have contributed to its rapid rise in popularity, including affordability, accessibility, and the ability to provide real-time, high-resolution imaging that facilitates dynamic assessment and needle guidance. However, diagnostic challenges are linked to restricted shoulder motion in uncomfortable situations, a steep learning curve, technical limitations, and a lack of experience(33).

MRI is regarded as the imaging method of choice for identifying rotator cuff disorders since it is non-invasive, multiplanar, and has great soft tissue resolution (34,35). The shoulder joint can be thoroughly examined, including the labrum and ligaments. In addition to absolute contraindications like pacemakers and defibrillators etc, MRI has limitations in terms of accessibility, cost, and time consumption (33). For the diagnosis of rotator cuff pathology, MRI is said to have consistently high sensitivity (80-97%) and specificity (93-94%) compared to USG (36).

According to Prashanth and Prasad's study, ultrasonography demonstrated diagnostic accuracies of 86%, 86%, and 91% for full tears, 75%, 95%%, and 86% for partial tears, and 93%, 81%, and 86% for tendinopathy, respectively, when compared to MRI (33).

In a study of 143 patients, Al Shawi et al. found that ultrasound had a sensitivity of 95.4%, a negative predictive value of 95.7% for full-thickness tears, and an 89.5% accuracy rate for partial-thickness tears (37).

In the Chauhan et al. study, USG demonstrated a sensitivity of 86.7% and a specificity of 100% for full-thickness tears and a sensitivity of 89.7%, and a specificity of 98.8% for partial-thickness tears. The observed accuracy for full-thickness tears was 98.4% and 95.9% for partial-thickness tears (36).

In our study, MRI was positive in all 32 patients while USG was positive in 29 out of 32 patients enrolled in the Study. Three patients were negative on USG while they were positive on MRI. The sensitivity of USG came out to be 90.63%. Our study's limitations include the small number of patients we studied and the fact that we used MRI as the gold standard rather than surgical results to compare our ultrasound results.

Given that USG and MRI have similar diagnostic accuracies, the former modality can be utilized as the initial investigation in the diagnosis of RCT. In cases when surgical correction is required, MRI should be employed secondarily as a problem-solving tool, either after an ambiguous shoulder USG or for defining anatomy.

STRENGTHS & LIMITATIONS

Firstly, the study was conducted in the Indian population which makes the data more relevant for use in Indian patients. Secondly, it is a randomized controlled study removing most of the biases and providing data with a similar distribution of confounders. Thirdly, it was the first head-on study comparing PRP v/s prolotherapy, as per our knowledge which helps to make a better judgement while choosing the treatment options.

Limitations of the study were: first, a small sample size of the study is a drawback, few patients with significant variation of data can alter the overall results. Secondly, the study was not blinded which might add to bias and variation of data. Thirdly, it was a short study duration, usually, it will take 3 to 6 months to see the full effects of the PRP and prolotherapy, hence, the full effects of intervention might have not been seen.

FUTURE PERSPECTIVES

Both therapies interrupt the degenerative cycle associated with tendinopathy and enable the native healing process, ultimately leading to improved clinical outcomes. So PRP and prolotherapy can be used in other musculoskeletal disorders also. Even though the study provided necessary data, due to the limitations enumerated above, studies with larger sample size and longer study duration are needed.

CONCLUSION

Both PRP and Prolotherapy showed similar efficacy and no significant difference between the two interventions. The potential for biologic healing augmentation combined with a low risk for adverse reaction makes both PRP and Prolotherapy as promising treatment options. Therefore, both therapies appear to be effective, thus expanding treatment options for patients in whom conservative care has failed. Further Studies with large samples size will provide more concise data and studies with long study durations are needed to validate the long-term effectiveness and safety of the treatment options.

CASE GALLERY

- **CASE 01:**

  Case History: 35-year-old male complaining of right shoulder pain since 4 months, night pain present. No history of trauma/fever/chronic illness.

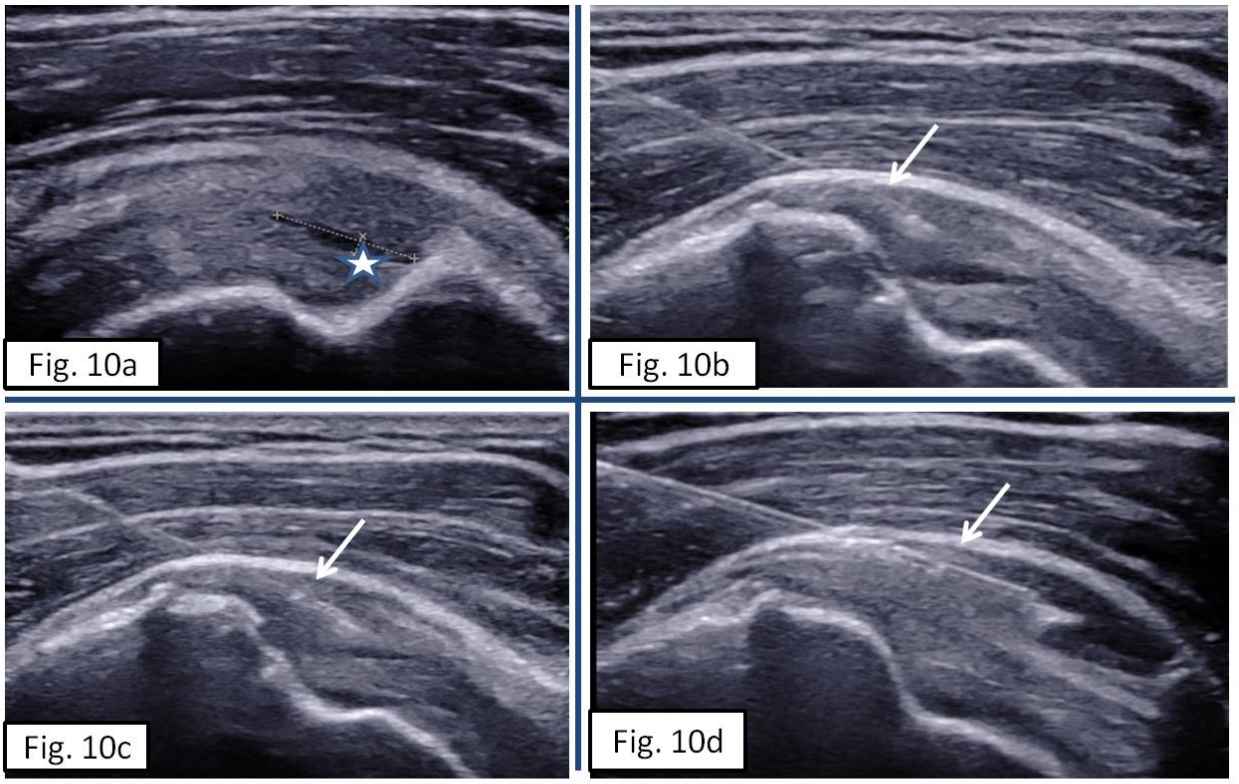


Fig. 10a : Pre-procedural USG; Fig. 10b, 10c & 10d: USG at the time of injection. Asterisk (*) in Fig.10a shows area of tendinosis; arrows in fig.10b ,10c & 10d shows needle.

Figure 10. USG guided Interventional procedure (representative case 01)

- **CASE 02:**

  Case History: 60-year-old male complaining of left shoulder and neck pain of insidious onset since 6 months. Dynamic impingement test positive.

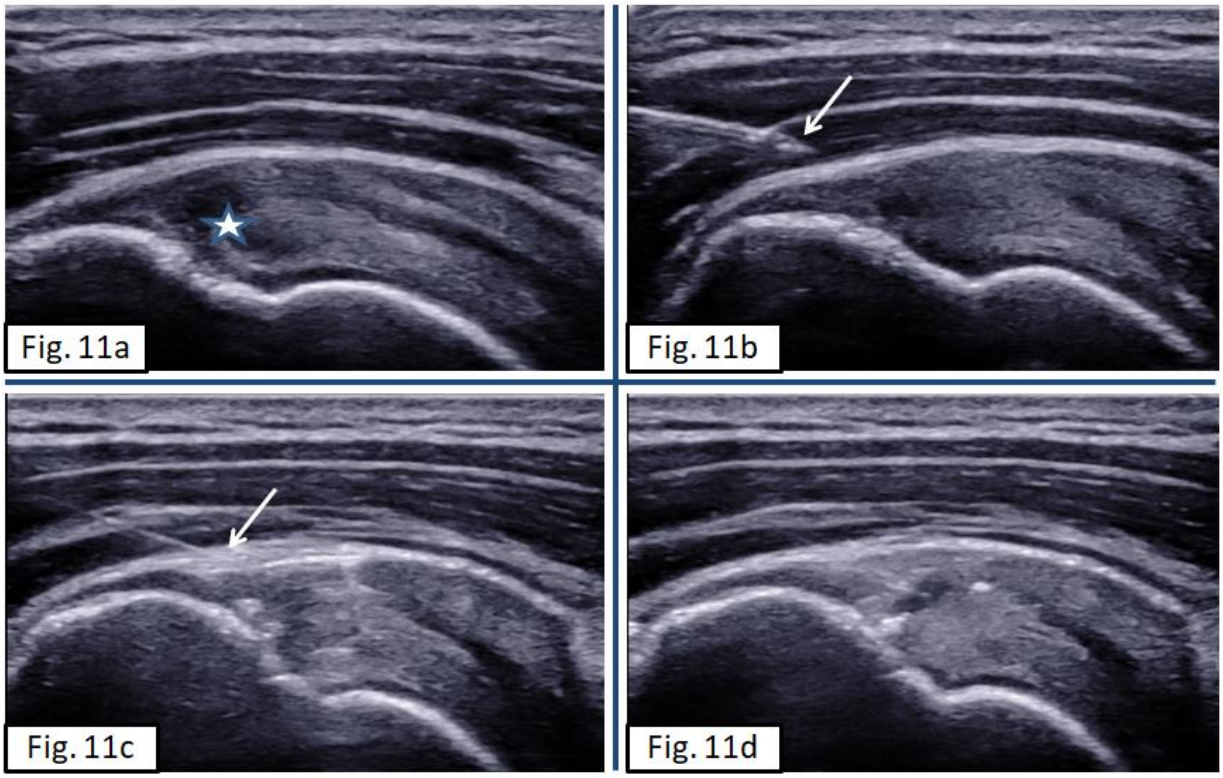


Fig. 11a : Pre-procedural USG; Fig. 11b & 11c: USG at the time of injection; Fig.11d : Post injection.
Asterisk (*) in Fig.11a shows area of tendinosis. Arrows in fig. 11b & 11c shows needle.

Figure 11. USG guided Interventional procedure (representative case 02)

- **CASE 03:**

  Case History: 56-year-old male complaining of left shoulder pain since 3 months, no history of trauma/fever.

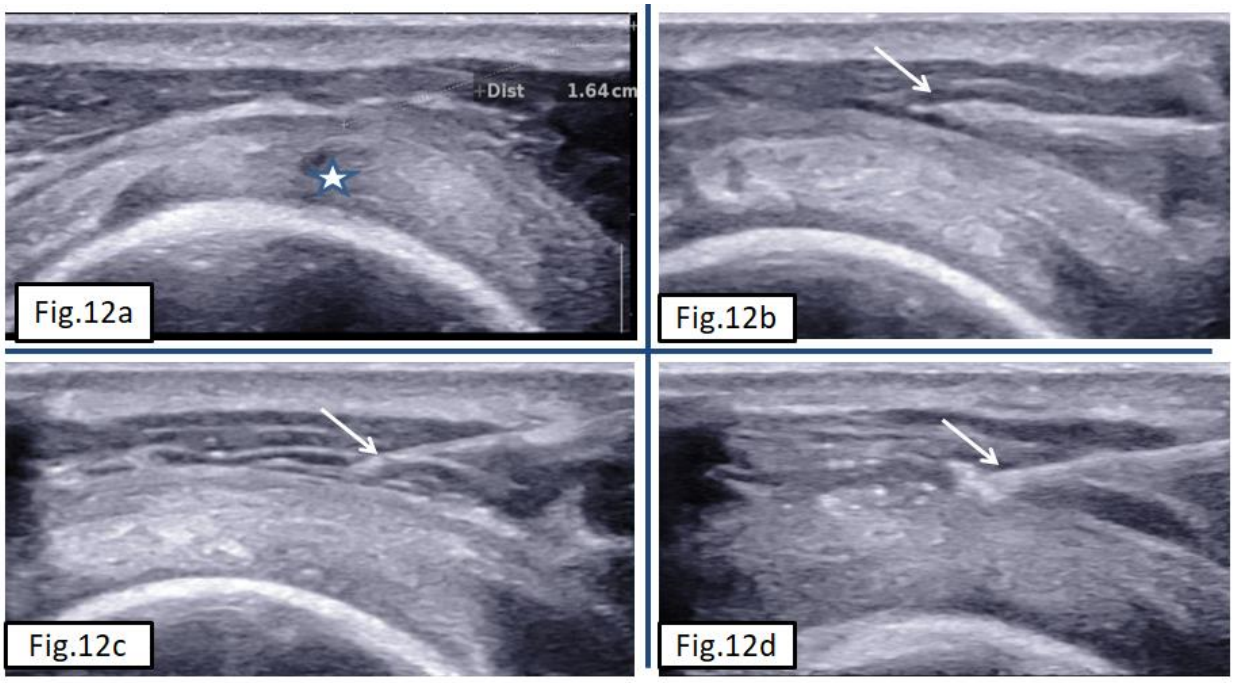


Fig. 12a : Pre-procedural USG; Fig. 12b & 12c: USG at the time of injection Fig. 12d: Post injection.
Asterisk (*) in Fig.12a shows area of tendinosis; arrows in fig.12b ,12c & 12d shows needle.

Figure 12. USG guided Interventional procedure (representative case 03)

- **CLINICAL CASE 01:**

  Case History: 59-year-old male complaining of difficulty in left side overhead abduction since 4-5 months.

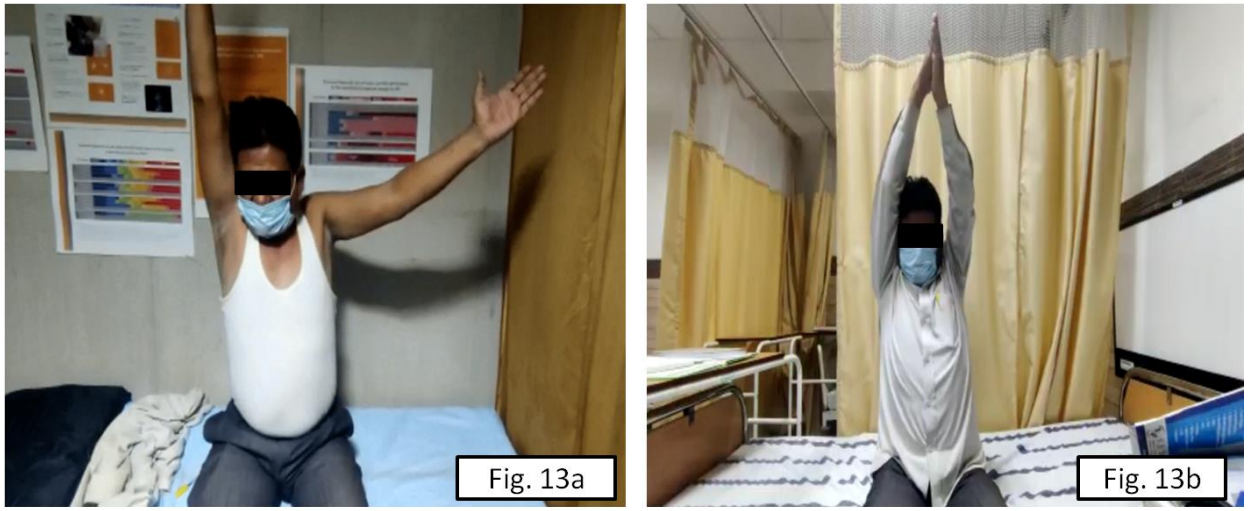


Fig. 13. Clinical Image (Fig. 13a: Decreased Overhead abduction at baseline; Fig. 13b: Improved range of motion at 12- week follow up post intervention)

Figure 13. Clinical Case-01 showing change in range of motion.

- **CLINICAL CASE 02:**

  Case History: 44-year-old female complaining of left sided shoulder pain since 3 months.

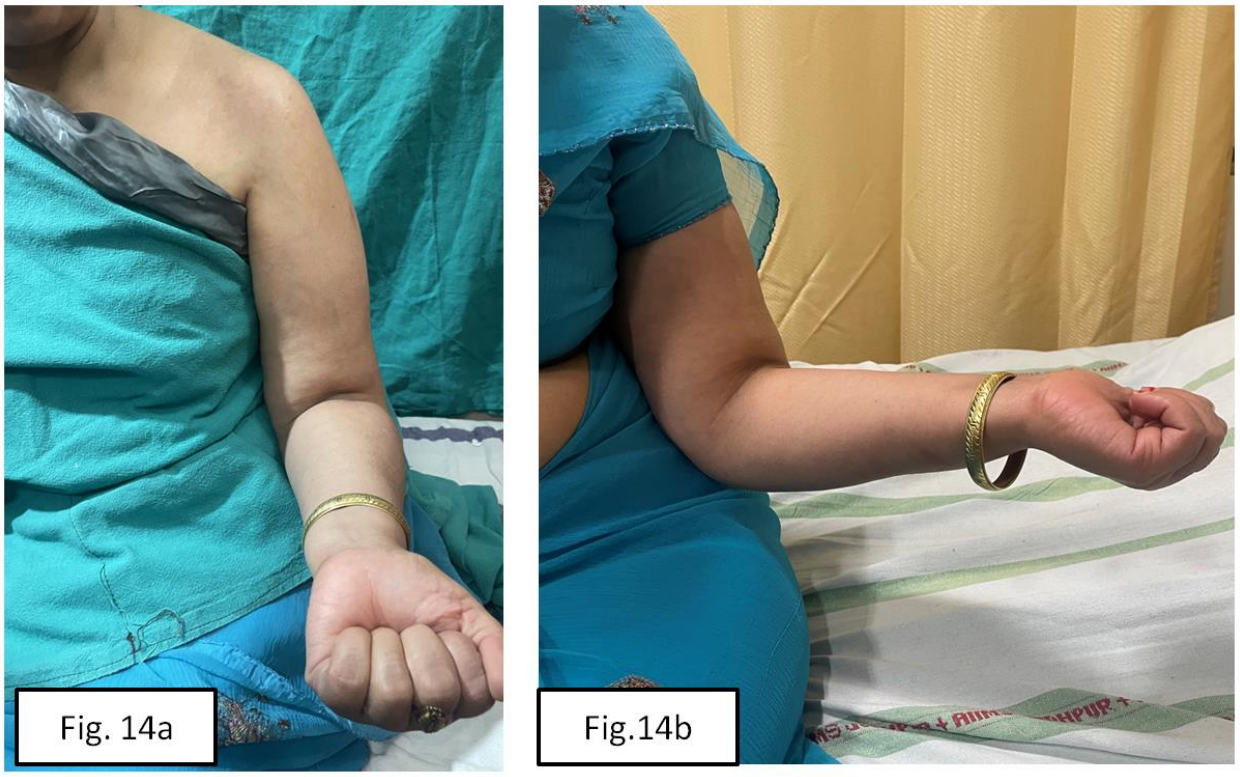


Fig. 14. Clinical Image (Fig. 14a: Decreased external rotation of arm at baseline; Fig. 14b: Improved range of motion at 12- week follow up post intervention)

Figure 14. Clinical Case-02 showing change in range of motion.

- **CLINICAL CASE 03:**

  Case History: 36-year-old male complaining of right sided shoulder pain since 6 months, restricted range of motion present on examination.

Fig. 15. Clinical Image (Fig. 15a & 15c: Decreased range of shoulder motion; Fig. 15b & 15d : Improved range of shoulder motion at 12- week follow up post intervention)

Figure 15. Clinical Case-03 showing improvement in range of motion.

- **CLINICAL CASE 04:**

  Case History: 59 year old male complaining of decreased range of left shoulder motion since 4-5 months.

Fig. 16. Clinical Image (Fig. 16a & 16c: Decreased range of shoulder motion; Fig. 16b & 16d : Improved range of shoulder motion at 12- week follow up post intervention)

Figure 16. Clinical Case-04 showing improvement in range of motion.

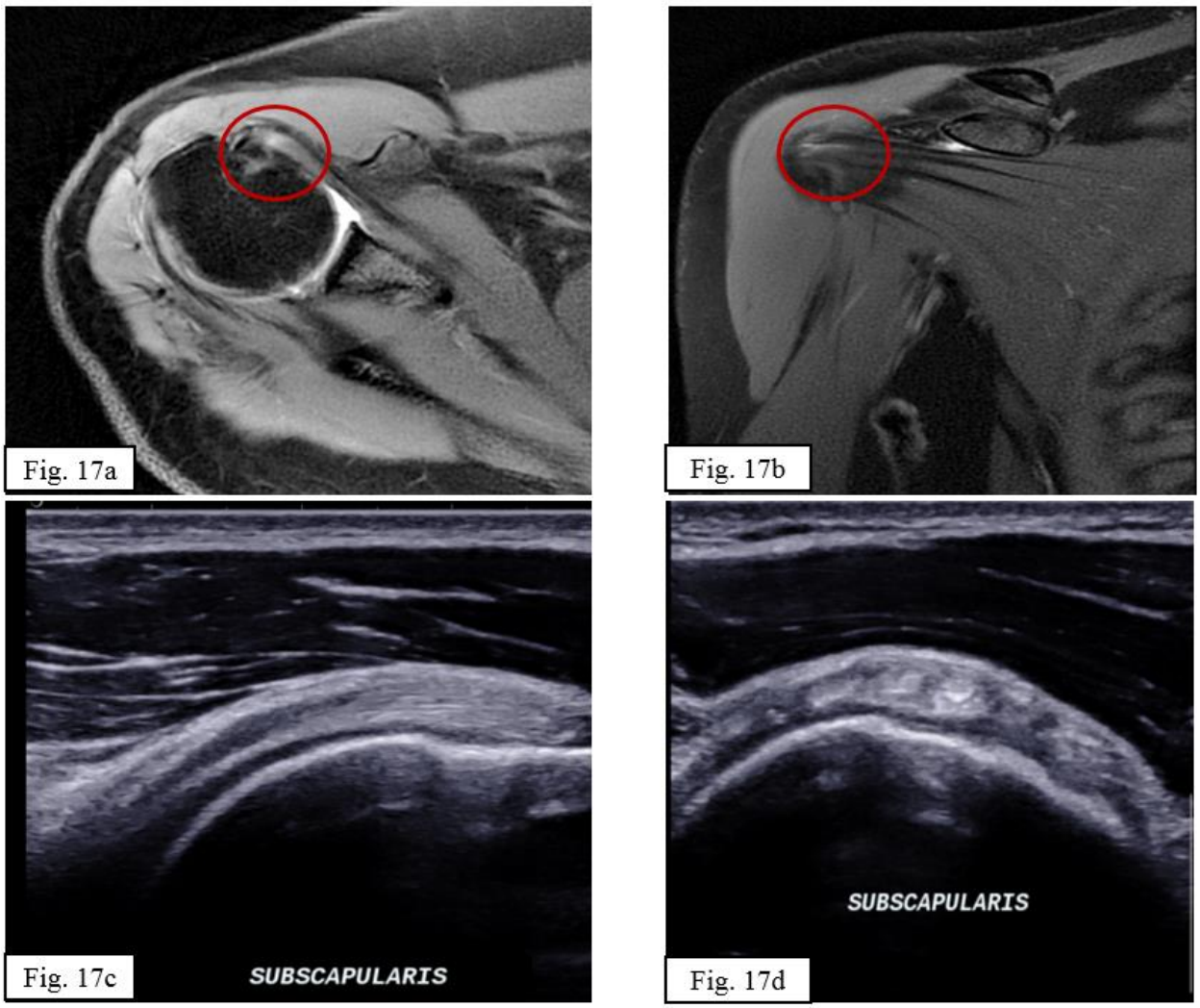
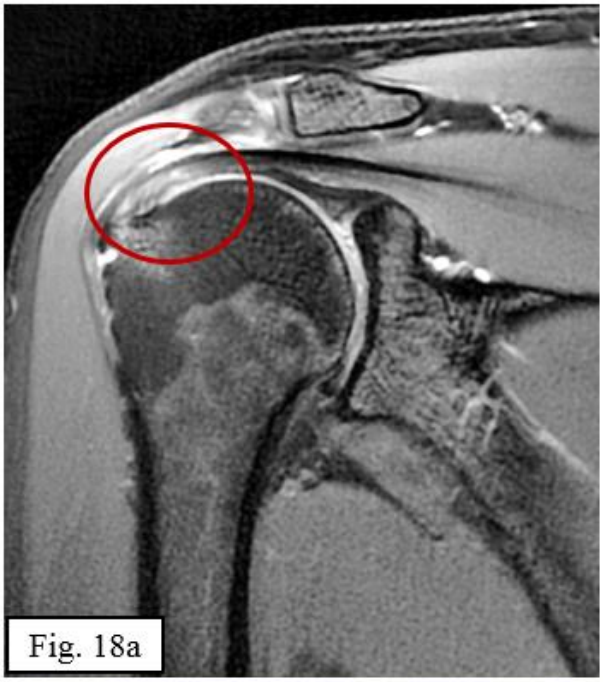
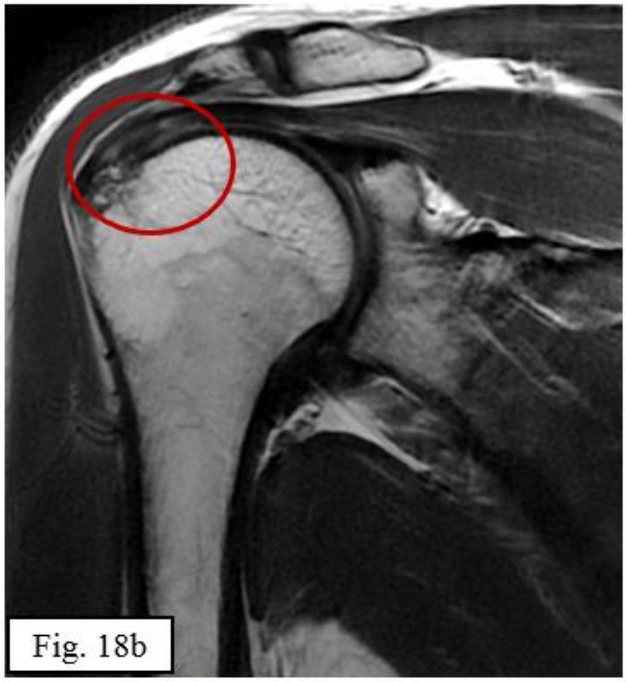


Fig. 17. MRI & USG images of the same patient (Fig. 17a & 17 b: Axial PDFS and Coronal PDFS sequence showing focal tendinosis along articular aspect of subscapularis muscle near the insertion; Fig. 17c & 17 d: Longitudinal and transverse USG shows normal subscapularis tendon). * Red Circle in fig. 17a and 17b shows area of tendinosis.

Figure 17. MRI and USG correlation (representative case 01)





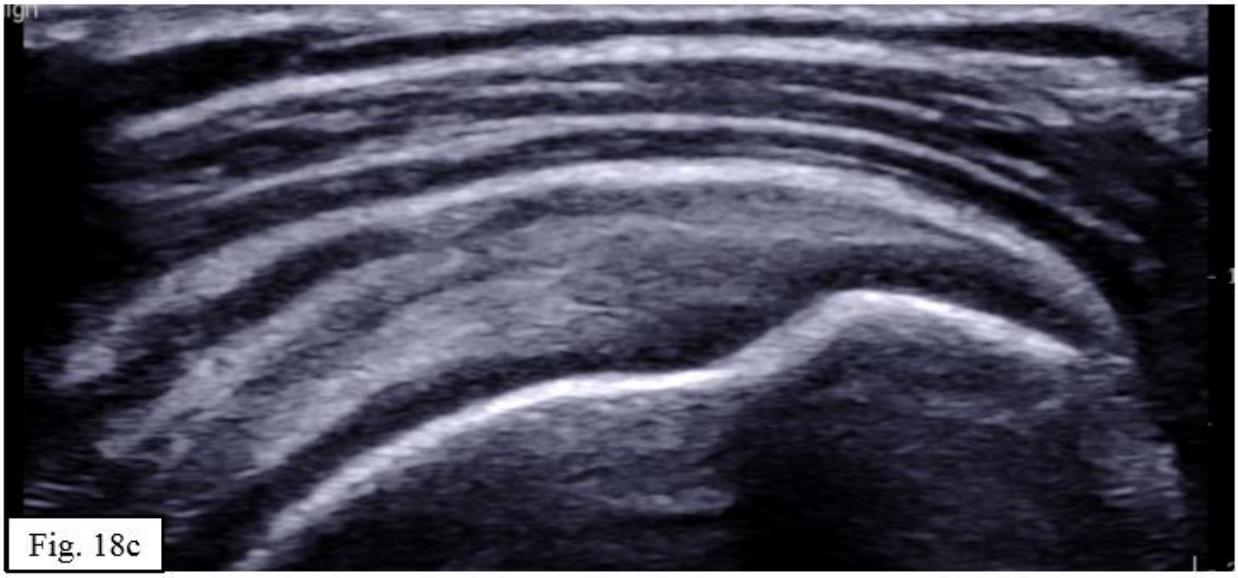


Fig. 18. MRI & USG images of the same patient (Fig. 18a & 18 b: Coronal PDFS and Coronal T2 sequence showing chronic tendinosis with minimal focal articular surface tear of supraspinatus tendon near the insertion; Fig. 18c : Longitudinal USG shows normal supraspinatus tendon). * Red Circle in fig. 18a and 18b shows area of tendinosis.

Figure 18. MRI and USG correlation (representative case 02)

BIBLIOGRAPHY

1. Rotator Cuff Tendinopathy [Internet]. Physiopedia. [cited 2022 Dec 20]. Available from: https://www.physio-pedia.com/Rotator_Cuff_Tendinopathy

2. George J, Li SC, Jaafar Z, Hamid MSA. Comparative Effectiveness of Ultrasound-Guided Intratendinous Prolotherapy Injection with Conventional Treatment to Treat Focal Supraspinatus Tendinosis. Scientifica. 2018;2018:4384159.

3. Contributors WE. What is Rotator Cuff Tendinopathy? [Internet]. WebMD. [cited 2022 Dec 20]. Available from: https://www.webmd.com/pain-management/rotator-cuff-tendinopathy

4. Lewis JS. Rotator cuff tendinopathy. Br J Sports Med. 2009 Apr;43(4):236–41.

5. Sari A, Eroglu A. Comparison of ultrasound-guided platelet-rich plasma, prolotherapy, and corticosteroid injections in rotator cuff lesions. J Back Musculoskelet Rehabil. 2020;33(3):387–96.

6. Kim SJ, Yeo SM, Noh SJ, Ha CW, Lee BC, Lee HS, et al. Effect of platelet-rich plasma on the degenerative rotator cuff tendinopathy according to the compositions. J Orthop Surg. 2019 Dec 2;14(1):408.

7. Moosikasuwan JB, Miller TT, Burke BJ. Rotator Cuff Tears: Clinical, Radiographic, and US Findings. RadioGraphics. 2005 Nov;25(6):1591–607.

8. Heron SR, Woby SR, Thompson DP. Comparison of three types of exercise in the treatment of rotator cuff tendinopathy/shoulder impingement syndrome: A randomized controlled trial. Physiotherapy. 2017 Jun;103(2):167–73.

9. Zhang M, Zhou J, Zhang Y, Zhang X, Chen J, Chen W. Influence of Scapula Training Exercises on Shoulder Joint Function After Surgery for Rotator Cuff Injury. Med Sci Monit Int Med J Exp Clin Res. 2020 Oct 29;26:e925758.

10. Hauser RA, Lackner JB, Steilen-Matias D, Harris DK. A Systematic Review of Dextrose Prolotherapy for Chronic Musculoskeletal Pain. Clin Med Insights Arthritis Musculoskelet Disord. 2016;9:139–59.

11. Seven MM, Ersen O, Akpancar S, Ozkan H, Turkkan S, Yıldız Y, et al. Effectiveness of prolotherapy in the treatment of chronic rotator cuff lesions. Orthop Traumatol Surg Res OTSR. 2017 May;103(3):427–33.

12. Chen X, Jones IA, Togashi R, Park C, Vangsness CT. Use of Platelet-Rich Plasma for the Improvement of Pain and Function in Rotator Cuff Tears: A Systematic Review and Meta-analysis With Bias Assessment. Am J Sports Med. 2020 Jul;48(8):2028–41.

13. Jo CH, Shin JS, Lee SY, Shin S. ALLOGENEIC PLATELET-RICH PLASMA FOR ROTATOR CUFF REPAIR. Acta Ortop Bras. 2017;25(1):38–43.

14. Kwong CA, Woodmass JM, Gusnowski EM, Bois AJ, Leblanc J, More KD, et al. Platelet-Rich Plasma in Patients With Partial-Thickness Rotator Cuff Tears or Tendinopathy Leads to Significantly Improved Short-Term Pain Relief and Function Compared With Corticosteroid Injection: A Double-Blind Randomized Controlled Trial. Arthrosc J Arthrosc Relat Surg Off Publ Arthrosc Assoc N Am Int Arthrosc Assoc. 2021 Feb;37(2):510–7.

15. Dadgostar H, Fahimipour F, Pahlevan Sabagh A, Arasteh P, Razi M. Corticosteroids or platelet-rich plasma injections for rotator cuff tendinopathy: a randomized clinical trial study. J Orthop Surg. 2021 May 21;16(1):333.

16. Chung MW, Hsu CY, Chung WK, Lin YN. Effects of dextrose prolotherapy on tendinopathy, fasciopathy, and ligament injuries, fact or myth?: A systematic review and meta-analysis. Medicine (Baltimore). 2020 Nov 13;99(46):e23201.

17. Bertrand H, Reeves KD, Bennett CJ, Bicknell S, Cheng AL. Dextrose Prolotherapy Versus Control Injections in Painful Rotator Cuff Tendinopathy. Arch Phys Med Rehabil. 2016 Jan;97(1):17–25.

18. Kazempour Mofrad M, Rezasoltani Z, Dadarkhah A, Kazempour Mofrad R, Abdorrazaghi F, Azizi S. Periarticular Neurofascial Dextrose Prolotherapy Versus Physiotherapy for the Treatment of Chronic Rotator Cuff Tendinopathy: Randomized Clinical Trial. J Clin Rheumatol Pract Rep Rheum Musculoskelet Dis. 2021 Jun 1;27(4):136–42.

19. Tafti D, Schultz D. Shoulder Joint Injection. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 [cited 2022 Dec 29]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK559318/

20. Park YG, Han SB, Song SJ, Kim TJ, Ha CW. Platelet-rich plasma therapy for knee joint problems: review of the literature, current practice and legal perspectives in Korea. Knee Surg Relat Res. 2012 Jun;24(2):70–8.

21. Schneider A, Burr R, Garbis N, Salazar D. Platelet-rich plasma and the shoulder: clinical indications and outcomes. Curr Rev Musculoskelet Med. 2018 Dec;11(4):593–7.

22. Kim E, Lee JH. Autologous platelet-rich plasma versus dextrose prolotherapy for the treatment of chronic recalcitrant plantar fasciitis. PM R. 2014 Feb;6(2):152–8.

23. Kon E, Mandelbaum B, Buda R, Filardo G, Delcogliano M, Timoncini A, et al. Platelet-Rich Plasma Intra-Articular Injection Versus Hyaluronic Acid Viscosupplementation as Treatments for Cartilage Pathology: From Early Degeneration to Osteoarthritis. Arthrosc J Arthrosc Relat Surg. 2011 Nov 1;27(11):1490–501.

24. Alsousou J, Thompson M, Hulley P, Noble A, Willett K. The biology of platelet-rich plasma and its application in trauma and orthopaedic surgery: a review of the literature. J Bone Joint Surg Br. 2009 Aug;91(8):987–96.

25. Rahimzadeh P, Imani F, Faiz SHR, Entezary SR, Zamanabadi MN, Alebouyeh MR. The effects of injecting intra-articular platelet-rich plasma or prolotherapy on pain score and function in knee osteoarthritis. Clin Interv Aging. 2018;13:73–9.

26. Boswell SG, Cole BJ, Sundman EA, Karas V, Fortier LA. Platelet-rich plasma: a milieu of bioactive factors. Arthrosc J Arthrosc Relat Surg Off Publ Arthrosc Assoc N Am Int Arthrosc Assoc. 2012 Mar;28(3):429–39.

27. Everts P, Onishi K, Jayaram P, Lana JF, Mautner K. Platelet-Rich Plasma: New Performance Understandings and Therapeutic Considerations in 2020. Int J Mol Sci. 2020 Oct 21;21(20):7794.

28. Cole B, Lam P, Hackett L, Murrell GAC. Ultrasound-guided injections for supraspinatus tendinopathy: corticosteroid versus glucose prolotherapy - a randomized controlled clinical trial. Shoulder Elb. 2018 Jul;10(3):170–8.

29. Oh JH, Ha H, Yu MR, Lee HB. Sequential effects of high glucose on mesangial cell transforming growth factor-β1 and fibronectin synthesis. Kidney Int. 1998 Jan 1;54(6):1872–8.

30. Di Paolo S, Gesualdo L, Ranieri E, Grandaliano G, Schena FP. High glucose concentration induces the overexpression of transforming growth factor-β through the activation of a platelet-derived growth factor loop in human mesangial cells. Am J Pathol. 1996;149(6):2095–106.

31. Fukuda K, Kawata S, Inui Y, Higashiyama S, Matsuda Y, Igura T, et al. High concentration of glucose increases mitogenic responsiveness to heparin-binding epidermal growth factor-like growth factor in rat vascular smooth muscle cells. Arterioscler Thromb Vasc Biol. 1997;17(10):1962–8.

32. Ryan MB, Wong AD, Gillies JH, Wong J, Taunton JE. Sonographically guided intratendinous injections of hyperosmolar dextrose/lidocaine: a pilot study for the treatment of chronic plantar fasciitis. Br J Sports Med. 2009 Apr;43(4):303–6.

33. Prashanth S, Prasad S. Comparative Study of Ultrasound and MRI In Assessing Rotator Cuff Tear. 2017;2(3).

34. Iannotti JP, Zlatkin MB, Esterhai JL, Kressel HY, Dalinka MK, Spindler KP. Magnetic resonance imaging of the shoulder. Sensitivity, specificity, and predictive value. J Bone Joint Surg Am. 1991 Jan;73(1):17–29.

35. Kneeland JB, Middleton WD, Carrera GF, Zeuge RC, Jesmanowicz A, Froncisz W, et al. MR imaging of the shoulder: diagnosis of rotator cuff tears. AJR Am J Roentgenol. 1987 Aug;149(2):333–7.

36. Chauhan NS, Ahluwalia A, Sharma YP, Thakur L. A Prospective Comparative Study of High Resolution Ultrasound and MRI in the Diagnosis of Rotator Cuff Tears in a Tertiary Hospital of North India. Pol J Radiol. 2016;81:491–7.

37. Al-Shawi A, Badge R, Bunker T. The detection of full thickness rotator cuff tears using ultrasound. J Bone Joint Surg Br. 2008 Jul;90(7):889–92.

ANNEXURES

Annexure 1 . Ethical Clearance Certificate

No. AIIMS/IEC/2021/2557 Date: 12/03/2021

ETHICAL CLEARANCE CERTIFICATE

Certificate Reference Number: **AIIMS/IEC/2021/3392**

Project title: **"Comparison of platelet rich plasma versus prolotherapy in the management of rotator cuff tendinosis"**

Nature of Project:	**Research Project Submitted for Expedited Review**
Submitted as:	**M.D. Dissertation**
Student Name:	**Dr. Ankit Singh**
Guide:	**Dr. Pushpinder Singh Khera**
Co-Guide:	**Dr. Pawan Kumar Garg, Dr. Nitesh Gehlot, Dr. Nitesh Manohar Gonnade, Dr. Taruna Yadav, Dr. Surjit Singh & Dr. Saptarshi Mandal**

Institutional Ethics Committee after thorough consideration accorded its approval on above project.

The investigator may therefore commence the research from the date of this certificate, using the reference number indicated above.

Please note that the AIIMS IEC must be informed immediately of:

- Any material change in the conditions or undertakings mentioned in the document.
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research.

The Principal Investigator must report to the AIIMS IEC in the prescribed format, where applicable, bi-annually, and at the end of the project, in respect of ethical compliance.

AIIMS IEC retains the right to withdraw or amend this if:

- Any unethical principle or practices are revealed or suspected
- Relevant information has been withheld or misrepresented

AIIMS IEC shall have an access to any information or data at any time during the course or after completion of the project.

Please Note that this approval will be rectified whenever it is possible to hold a meeting in person of the Institutional Ethics Committee. It is possible that the PI may be asked to give more clarifications or the Institutional Ethics Committee may withhold the project. The Institutional Ethics Committee is adopting this procedure due to COVID-19 (Corona Virus) situation.

If the Institutional Ethics Committee does not get back to you, this means your project has been cleared by the IEC.

On behalf of Ethics Committee, I wish you success in your research.

Dr. Praveen Sharma
Member Secretary

Member secretary
Institutional Ethics Committee
AIIMS,Jodhpur

Annexure 2 . QuickDASH Questionnaire

www.orthopaedicscores.com

Date of completion
December 26, 2022

The Disabilities of the Arm, Shoulder and Hand Score(QuickDash)

Clinician's name (or ref) ..... Patient's name (or ref .....

INSTRUCTIONS: This questionnaire asks about your symptoms as well as your ability to perform certain activities. Please answer *every question* , based on your condition in the **last week**. If you did not have the opportunity to perform an activity in the past week, please make your *best estimate* on which response would be the most accurate. It doesn't matter which hand or arm you use to perform the activity; please answer based on you ability regardless of how you perform the task.

Please rate your ability to do the following activities in the last week.

1. Open a tight or new jar	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable
2. Do heavy household chores (eg wash walls, wash floors)	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable
3. Carry a shopping bag or briefcase	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable
4. Wash your back	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable
5. Use a knife to cut food	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable
6. Recreational activities in which you take some force or impact through your arm, shoulder or hand (eg golf, hammering, tennis, etc)	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable
7. During the past week, *to what extent* has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups?	Not at all	Slightly	Moderately	Quite a bit	Extremely
8. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?	Not limited at all	Slightly limited	Moderately limited	Very limited	Unable

Please rate the severity of the following symptoms in the last week

9. Arm, shoulder or hand pain	None	Mild	Moderate	Severe	Extreme
10. Tingling (pins and needles) in your arm, shoulder or hand	None	Mild	Moderate	Severe	Extreme
11. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand?	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	So much difficulty I can't sleep

Thank you very much for completing all the questions in this questionnaire.

Print page Close Window Reset

The Disabilities of the Arm, Shoulder and Hand (quickdash) Score 0

To save this data please print or Save As CSV

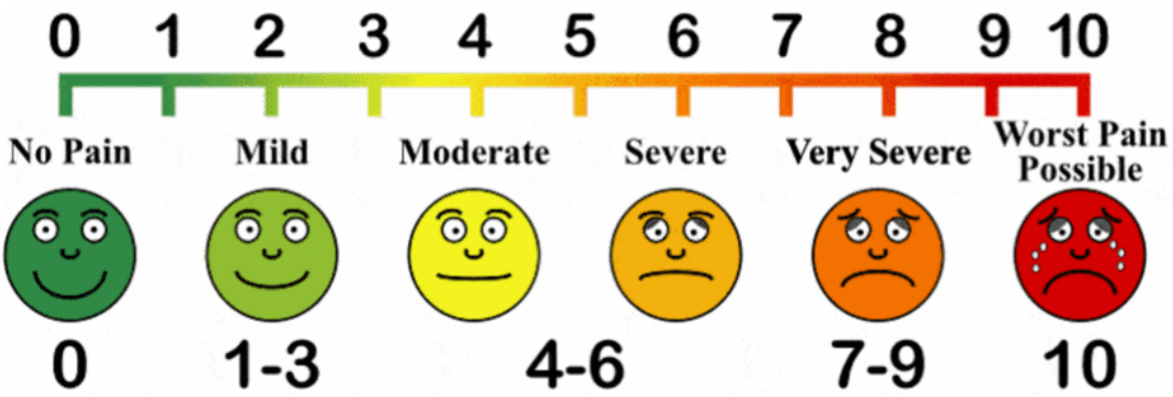
Nb: This page cannot be saved due to patient data protection so please print the filled in form before closing the window.

(**NB.** A DASH score may not be calculated if there are greater than 1 missing items.)

There are two further small sections to this score. They are both optional. Just click below to select

WORK MODULE **SPORTS/PERFORMING ARTS MODULE**

Annexure 3. VAS (Visual Analogue Scale) score



Annexure 4. Patient information sheet (English)

PATIENT INFORMATION SHEET

Title of study: Comparison of Platelet Rich Plasma Versus Prolotherapy in the Management of RC Tendinosis.

Aim of the study: To evaluate the efficacy of platelet rich plasma versus prolotherapy in the treatment of RC Tendinosis.

Expected duration of the subject participation: 18 months

Benefits from the Study: The study if successful, it will help in establishing the role of Platelet rich plasma /Prolotherapy in the management of RC Tendinosis.

Risks to the patients: No risks.

Confidentiality: Your participation will be kept confidential. Your medical records will be treated with confidentiality and will be revealed only to doctors/ scientists involved in this study. The results of this study may be published in a scientific journal, but you will not be identified by name.

Provision of free treatment for research related injury.

Compensation of subjects for disability or death resulting from such injury.

Freedom of the individual to participate and to withdraw from the research at any time without penalty or loss of benefits to which the subject would otherwise be entitled - You have complete freedom to participate and to withdraw from the research at any time without penalty or loss of benefits to which you would otherwise be entitled. Your participation in the study is optional and voluntary. The copy of the results of the investigations performed will be provided to you for your record. You can withdraw from the project at any time, and this will not affect your subsequent medical treatment or relationship with the treating physician. Any additional expense for the project, other than your regular expenses, will not be charged from you.

Costs and source of investigations, disposables, drugs, and Institute charges for USG and MRI-Exempted.

For further information and to report any side effects/complications, kindly contact:

Dr. Ankit Singh (Junior resident)

Department of Diagnostic and Interventional radiology

AIIMS, Jodhpur

Mobile No. 9875395710

Annexure 5. Patient information sheet (Hindi)

रोगी सूचना पत्र

अध्ययन काशीर्षक: **रोटेटर कफ टेंडनोसिस के प्रबंधन में प्लेटलेट रिच प्लाज्मा बनाम प्रोलोथेरेपी के सीओपार**आइसन।

1. अध्ययन का उद्देश्य: रोटेटर कफ टेंडनोसिस के उपचार में प्लेटलेट रिच प्लाज्मा बनाम प्रोलोथेरेपी की प्रभावकारिता का मूल्यांकन करना।
2. विषय की भागीदारी की अपेक्षित अवधि: 18 महीने
3. अध्ययन से लाभ:
   यह अध्ययन सफल होने पर रोटेटर कफ टेंडनोसिस के प्रबंधन में प्लेटलेट रिच प्लाज्मा/प्रोलोथेरेपी की भूमिका स्थापित करने में मदद करेगा ।
4. रोगियों के लिए जोखिम: कोई जोखिम नहीं।
5. गोपनीयता: आपकी भागीदारी गोपनीय रखी जाएगी। आपके मेडिकल रिकॉर्ड को गोपनीयता के साथ इलाज किया जाएगा और इस अध्ययन में शामिल डॉक्टरों/वैज्ञानिकों को ही पता चला जाएगा । इस अध्ययन के परिणाम एक वैज्ञानिक पत्रिका में प्रकाशित हो सकते हैं, लेकिन आपको नाम से पहचाना नहीं जाएगा।
6. शोध से संबंधित चोट के लिए मुफ्त इलाज की व्यवस्था।
7. ऐसी चोट के परिणामस्वरूप विकलांगता या मृत्यु के लिए विषयों का मुआवजा।
8. व्यक्ति की स्वतंत्रता भाग लेने के लिए और दंड या लाभ की हानि है जो विषय अंयथा हकदार होगा बिना किसी भी समय अनुसंधान से वापस लेने के लिए-आप भाग लेने के लिए और दंड या लाभ की हानि के बिना किसी भी समय अनुसंधान से वापस लेने के लिए जो आप अंयथा हकदार होगा । अध्ययन में आपकी भागीदारी वैकल्पिक और स्वैच्छिक है। प्रदर्शन की गई जांचों के परिणामों की प्रति आपको आपके रिकॉर्ड के लिए प्रदान की जाएगी। आप किसी भी समय परियोजना से वापस ले सकते हैं, और यह आपके बाद के चिकित्सा उपचार या इलाज चिकित्सक के साथ संबंध को प्रभावित नहीं करेगा। परियोजना के लिए कोई अतिरिक्त खर्च, अपने नियमित खर्च के अलावा, आप से शुल्क नहीं लिया जाएगा।
9. लागत और जांच, डिस्पोजेबल, और दवाओं के स्रोत
   यूएसजी और एमआरआई के लिए संस्थान शुल्क- छूट।
10. अधिक जानकारी के लिए और किसी भी साइड इफेक्ट/जटिलताओं की रिपोर्ट करने के लिए, कृपया संपर्क करें:

डॉ अंकित सिंह

जूनियर निवासी

नैदानिक और इंटरवेंशनल रेडियोलॉजी विभाग

Annexure 6. Participant informed consent form (English)

PARTICIPANT INFORMED CONSENT FORM

Participant identification number for this trial: _____

Title of project: Comparison Of Platelet Rich Plasma Versus Prolotherapy in the Management of RC Tendinosis

Name of Principal Investigator: Dr. Ankit Singh.

Contact no 9875395710

The Contents of the information sheet dated ……. that was provided have been read carefully by me / explained in detail to me, in a language that I comprehend, and I have fully understood the contents. I confirm that I have had the opportunity to ask questions. The nature and purpose of the study and its potential risks/benefits and expected duration of the study and other relevant details of the study have been explained to me in detail. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal right being affected.

I understand that the information collected about me from my participation in this research and sections of any of my medical notes may be looked at by responsible individuals from AIIMS. I give permission for these individuals to have access to my records.

I agree to take part in the above study.

Date: _ _ _ _ _ _ _ _ Place: _ _ _ _ _ _ _ _

(Signatures / Left Thumb Impression):

Name of the Participant: _____

Son / Daughter / Spouse of: _____

Complete postal address: _____

This is to certify that the above consent has been obtained in my presence: _____

Signature of the Principal Investigator:

Date: Place:

1) Witness – 1 2) Witness – 2

Signature ---------- Signature ----------

Name: Name:
Address: Address:

Annexure 7. Participant informed consent form (Hindi)

प्रतिभागी सहमति फॉर्म की जानकारी

इस परीक्षण के लिए प्रतिभागी पहचान संख्या:

परियोजना का शीर्षक: रोटेटर कफ टेंडनोसिस के प्रबंधन में प्लेटलेट रिच प्लाज्मा बनाम प्रोलोथेरेपी की तुलना

प्रधान अन्वेषक का नाम: डॉ अंकित सिंह।

संपर्क नंबर 9875395710

सूचना पत्र की सामग्री दिनांकित..... कि प्रदान की गई थी मेरे द्वारा ध्यान से पढ़ा गया है/मुझे विस्तार से समझाया, एक भाषा है कि मैं समझ में, और मैं पूरी तरह से सामग्री समझ गया है । मैं इस बात की पुष्टि करता हूं कि मुझे सवाल पूछने का मौका मिला है । अध्ययन की प्रकृति और उद्देश्य और इसके संभावित जोखिम/लाभ और अध्ययन की अपेक्षित अवधि और अध्ययन के अन्य प्रासंगिक विवरणों के बारे में मुझे विस्तार से समझाया गया है । मैं समझता हूं कि मेरी भागीदारी स्वैच्छिक है और मैं किसी भी समय, बिना कोई कारण बताए, मेरी चिकित्सा देखभाल या कानूनी अधिकार प्रभावित होने के बिना वापस लेने के लिए स्वतंत्र हूं ।

मैं समझता हूं कि इस शोध में मेरी भागीदारी से मेरे बारे में एकत्र की गई जानकारी और मेरे किसी भी मेडिकल नोट्स को एम्स के जिम्मेदार व्यक्तियों द्वारा देखा जा सकता है । मैं इन व्यक्तियों को अपने अभिलेखों तक पहुंच बनाने की अनुमति देता हूं ।

मैं उपरोक्त अध्ययन में भाग लेने के लिए सहमत हूं ।

दिनांक: _____ प्लेस: _____

(हस्ताक्षर/बाएं अंगूठे छाप):

प्रतिभागी का नाम:

बेटा/बेटी/पति:

पूरा डाक पता:

यह प्रमाणित करना है कि उपरोक्त सहमति मेरी उपस्थिति में प्राप्त की गई है:

प्रधान अन्वेषक के हस्ताक्षर:

तिथि: स्थान:

1) गवाह - 1	2) गवाह - 2
हस्ताक्षर ----------	हस्ताक्षर ----------
नाम:	नाम:
पता:	पता: