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Comparative study between corticosteroids and platelet-rich plasma in the treatment of de Quervain's tenosynovitis

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Abstract
Background: De Quervain tenosynovitis is named after the Swiss surgeon, Fritz de Quervain, who first described it in 1895. It is a condition that involves tendon entrapment affecting the first dorsal compartment of the wrist. Pain is exacerbated by thumb movement and radial and ulnar deviation of the wrist. De Quervain tendinopathy can be self-limited and may resolve without intervention. For those individuals with persistent symptoms splinting, systemic inflammatories, and corticosteroid injections are frequently used as non-surgical treatment options. Corticosteroids have both anti-inflammatory and immunosuppressive effects and have been used in the treatment of DQST. With the widespread increase in research in the field of regenerative orthopedics, PRP has become a natural, biological enhancer. Platelet-rich plasma (PRP) is safe and reduces symptoms in different tendon pathologies, such as De Quervain's disease. It has a high concentration of platelets above baseline in comparison to whole blood count to accelerate tissue healing, modulate inflammation, and provide symptomatic relief.
Aim: To evaluate the effectiveness of PRP injection in comparison to corticosteroid injection in the treatment of DQST.
Methods: Patients underwent randomization into groups: corticosteroids and PRP. We followed both groups at 4, 12, and 24 weeks for improvement in wrist pain, disability, and finger motion. The resolution of symptoms and improvements in the Visual Analog Scale (VAS) and Disabilities of the Arm, Shoulder, and Hand (DASH) scores were assessed to evaluate treatment success.
Results:
1) Forty-four patients with suspected DQST were divided into two groups, i.e., PRP group I and corticosteroid group II in a 1:1 by lottery method.
2) Pain measured by VAS score has shown a reduction in pain in the PRP group-I with every follow-up. However, a similar pattern was not shown in the corticosteroid group II. We found in our study that a lower DASH score was found in 14(63.64%) patients of PRP group I compared to 8(36.36%) patients of corticosteroid group II. After PRP injection, pain, disability, and finger motion improve steadily and eventually get better.
Conclusions: Based on results found in the present study, for De Quervain's Tenosynovitis (DQST) condition, PRP injections were superior to corticosteroid injections in terms of pain management, finger motion, and reduced disability.

Keywords: PRP Injection, De Quervain's disease, corticosteroid injection

Introduction
De Quervain's stenosing tenosynovitis (DQST) is a disorder that is characterized by wrist pain and tenderness at the radial styloid. With this condition, thickening of the tendon sheaths around the abductor pollicis longus and extensor pollicis brevis develops where the tendons pass in through the fibro-osseous tunnel located along the radial styloid at the distal wrist. In a large community-based study from the United Kingdom, the prevalence of DQST was found to be 0.5% in men and 1.3% in women [1-2].
DQST is a condition characterized by the thickening of and accumulation of mucopolysaccharide in the sheath of the abductor pollicis longus and extensor pollicis brevis tendons, which cross under the extensor retinaculum in the first dorsal compartment of the wrist [3].

Chronic wrist overuse is the primary cause of the disease and common tendonitis of the wrist is caused by impaired gliding of the tendons of the extensor pollicis brevis (EPB) and abductor pollicis longus (APL) muscles caused by extensor retinaculum thickening. Patients with DQST experience radial wrist pain with tenderness and thumb movements over the first dorsal compartment [4].

Conservative therapies in DQST are splinting or bracing to rest the affected tendons and minimizing thumb movement like pinching. Ice pack application on the affected area also gives relief from pain and swelling. Oral medication, Non-steroidal anti-inflammatory drugs (NSAIDs) are also recommended to relieve pain and reduce inflammation.

Intra- articular injections can be preferred over surgery for those who fail to be managed by conservative therapy due to the severity of the disease condition.

Corticosteroids (also known as steroids) are medicines that can be used to treat inflammation. Corticosteroids have both anti-inflammatory and immune-suppressive effects. They interrupt the inflammatory and immune cascade at several levels by acting directly on the nuclear steroid receptor. They reduce vascular permeability and inhibit the accumulation of inflammatory cells, phagocytosis, production of neutrophils, and superoxide's and they prevent the synthesis and secretion of several inflammatory mediators like prostaglandins. Corticosteroids usually relieve inflammation but may have recurrent symptoms while lifting, pulling, and pushing. However, by following successful surgery, permanent relief can be obtained [5-6] with the widespread increase in research in the field of regenerative orthopedics, PRP has become a viable, biological, and natural healing enhancer. PRP is an ortho-biological agent that has a high concentration of platelets (above baseline) intending to accelerate tissue healing, modulate inflammation, and provide symptomatic relief. PRP releases supra-physiological levels of growth factors and other bioactive molecules.

Dense-core granules in platelets contain ADP, Thromboxane A2, 5-hydroxytryptamine, histamine, adrenaline, and Ca2+, all of which are critical for further platelet activation. Once activated they degrade alpha granule which releases Transforming growth factor-beta, Platelet-derived growth factor (PDGF), Insulin-like growth factors 1 and 2, fibroblast growth factor (FGF), Epidermal growth factor (EGF), Vascular endothelial growth factor (VEGF), and many more. Once the growth factor binds to the target cell receptor, it induces an intracellular signal transduction system and produces a biological response critical for chemotaxis, cell proliferation, and osteoblastic differentiation.[7] Platelet-rich plasma (PRP) uses injections of a concentration of a patient's own platelets to accelerate the healing of injured tendons, ligaments, muscles and joints. Corticosteroids (also known as steroids) are medicines that can be used to treat inflammation [8].

Platelet-rich plasma (PRP) has been shown to reduce symptoms in different tendon pathologies [9-10] and seems to be superior to cortisone [11-12]. PRP therapy is safe and feasible [13] but does not reverse the degenerative tendon changes [14].

Platelet-rich plasma (PRP) uses injections of a concentration of a patient's platelets to accelerate the healing of injured tendons, ligaments, muscles, and joints.

Aim

Platelet-rich plasma (PRP) has been shown to reduce symptoms in different tendon pathologies and seems to be superior to corticosteroids. This study aims to evaluate the effectiveness of intra-articular autologous PRP injection in comparison to corticosteroid injection in de Quervain's tenosynovitis.

Source of data

Patients with DQST who came to the Orthopedic Department in Bapu Ji Hospital and Chigateri Government Hospital attached to J.J.M Medical College, Davangere, and fulfilled the inclusion/exclusion were recruited for this study after obtaining informed and written consent.

Health care setup

Tertiary care hospital

Sampling technique

Simple random sampling technique

Type of Study

Prospective comparative study

Ethics clearance

Obtained.

Duration of study

September 2020- September 2022

All the patient data was captured in Case Record Forms after taking the Informed Consent.

Method of data collection

Sample size

44 (nMaster 2.0) calculated from the VAS score of 6 months from Article'[Conservative & Physical therapy vs Corticosteroid therapy vs Percutaneous Needling with Autologous Platelet Rich Plasma therapy for de Quervain's Stenosing Tenosynovitis in a Tertiary Care Hospital by Ramesh R. *et al*., 2019 t tests - Means: Difference between two independent means (two groups).

Analysis

A priori: Compute the required sample size

Output

Tail(s) = Two
Effect size d = 1.27
α err prob = 0.05
Power (1-β err prob) = 0.80
Allocation ratio N2/N1 = 1
Sample Size Group I = 20
Sample Size Group II = 20
Attrition rate = 10% in each arm

20 in each arm (Group I=20 and Group II=20) to be recruited. Moreover, considering an attrition rate of 10% resulting in 22 in each arm. Hence, overall, 44 patients were calculated to be enrolled in the study with 22 in each arm

Demographic information, including age, occupation, and pretreatment VAS and Disabilities of the Arm, Shoulder, and Hand (DASH) scores, were obtained at the start of the study. Patients were evaluated at the 4th, 12th, and 24th-week follow-up. At each of these time points, patients were evaluated for the resolution of radial wrist pain and tenderness to palpation, the presence of a positive Finkelstein test, VAS score, and DASH score.

Inclusion criteria
Age range: 30-80 years old.
Sex: Male and female.

Clinical diagnosis: de Quervain's tenosynovitis (DQST) patients who have taken conservative treatment but have shown no improvement in the past 6 months and are visiting the outpatient department regularly.
Patient in severe pain who has been on anti-inflammatory medication for more than three months with no improvement.
Informed consent given for treatment according to protocol.
Patients who have received physical therapy and orthotic splinting but have not improved in the last 6 months.
Patients with swelling over the first extensor compartment of the hand for the past 3 months.
Patients with a positive Finkelstein's test.

Exclusion criteria
- Patients aged less than 30 years to more than 80 years
- Patients with corticosteroid injections at the treatment site within one month.
- Patients with a history of prior intra-articular injections who are undergoing treatment within 3 months.
- Patients suffering from autoimmune disease.
- Patients with local infections at the procedure site.
- Patients with hemoglobin <10mg/dl and platelets 10 [5] cells/microliter.
- Patients with bleeding and coagulation disorders, HIV, Hepatitis B or C, cellulitis, and septicemia.
- Patients with uncontrolled diabetes mellitus and hypertension.

Preparation of platelet-rich plasma
20 cc of venous blood was withdrawn into vacutainers containing sodium citrate and subjected to first centrifugation at a rate of 3000 rpm for 15 minutes. Then the resultant plasma admixed with platelets was transferred into a plain vacutainer which was subjected to a second centrifugation at a rate of 5000 rpm for 15 minutes. The resultant solution in the vacutainer contains the upper 2/3rd portion of platelet-poor plasma and the lower 1/3rd portion of platelet-rich plasma. 20 ml of autologous venous blood yield 3 – 4 ml of autologous platelet-rich plasma solution. Before injecting autologous PRP injection, 10% of calcium chloride solution was added to autologous PRP in a ratio of 1:10. The patients involved in the study according to inclusion criteria were selected by a convenient random sampling method. They were further divided into two groups (Group I and Group II) in a 1:1 by lottery method.

Routine investigations done were as follows:
- Hemoglobin
- Total WBC count, differential WBC count.
- ESR, bleeding time, and clotting time.
- Random blood glucose
- Blood urea and serum creatinine
- HIV I & II and HBs Ag

CT scan and MRI scan if indicated.
After screening 97 patients we enrolled 22 patients in each group (A total of 44)

Group I: Twenty-two patients were treated with percutaneous needling with 3-4 ml of autologous platelet-rich plasma injection along the inflamed tendon sheath of APL and EPB tendons. The sterile dressing and crepe bandage were applied at the injection site. The mean age of patients was 46.3±9.7.
Group II: Twenty-two patients, mean age 42.3±5.8, were given intra-articular corticosteroid (Triamcinolone 40 mg) injections along the inflamed tendon sheath of APL and EPB tendon. The sterile dressing and crepe bandage were applied at the injection site.

Dosage
The first dose of injection in both groups was given at baseline (Day 0); the second dose was given after 4 weeks, and the third dose was given at an interval of 8 weeks after the first dose. For pain relief after the injection, ice pack application was used in both groups if required. Post-treatment physiotherapy was also the same in both groups.

Follow-up
A short-term follow-up of both groups (Group I and Group II) has been done at regular intervals at the end of the 4th week, 12th week, and 24th week after intra- articular PRP injection and corticosteroid injection, respectively.

Results
In group I-PRP, out of 22 patients, 6 (27.27%) were female and 16 (72.73%) were male, and the mean age was 46.3±9.7. In the corticosteroid group II, out of 22 patients, 7 (31.82%) were female and 15 (68.18%) were male, and the mean age was 42.3±5.8. In the PRP group-I, more patients sustained injuries on the right side, i.e., 15 (68.18%), compared to the left side of the hand, i.e., 7 (31.82%). injuries. Similarly, in corticosteroid Group–II, 14 (63.63%) patients' sustained injuries on the right side, and 8 (36.36%) patients were on the left side of the hand. (Table-1).

Table 1: Demographic details

Variable		Group I-PRP (N-22)	Group II-Corticosteroid (N-22)
Sex	Female	6 (27.27%)	7 (31.82%)
	Male	16 (72.73%)	15 (68.18%)
Side of injury	Left hand	7 (31.82%)	8 (36.36%)
	Right hand	15 (68.18%)	14 (63.63%)

Table 2: Clinical investigation

Variable	Group I –PRP (N-22) (Mean ± SD)	Group II- CS (N-22) (Mean ± SD)	P-value
Hemoglobin	13.78±0.93	13.2±0.96	0.04
Random blood glucose	98.63±9.4	99.31±12.37	0.83
Blood urea	13.95±2.88	14.27±3.56	0.74

Patient allocation

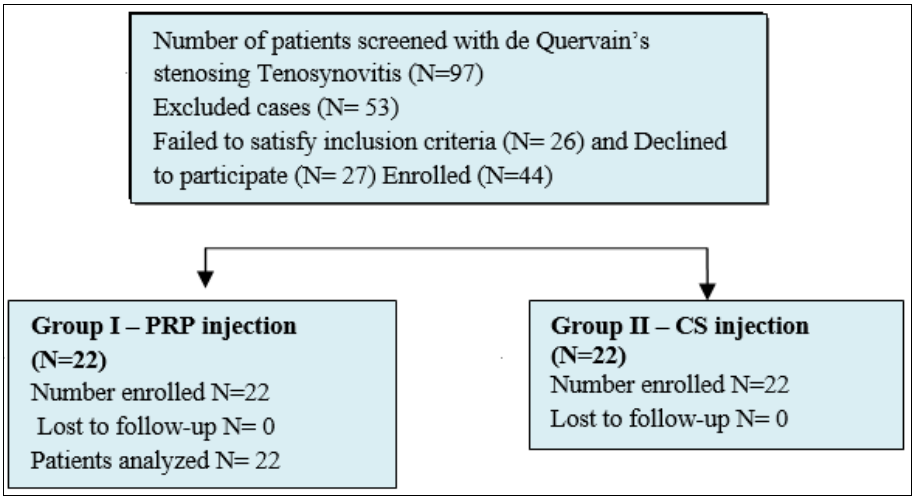

Table 3: Clinical investigation

Variable	Group I –PRP (N-22 Median (Min-Max)	Group II- CS (N-22) Median (Min-Max)	p-value
RBC count	4.9 (3.8 - 5.3)	4 (3.5 - 5.1)	0.0141
Platelet count	130000 – 210000)	130000 - 210000	990*
Serum creatinine	0.6 - 1.0	0.6 - 1.1	990*

Rank sum values are given

Clinical investigations were performed and statistical analysis was done for all variables (Tables 2 and 3).

The quick DASH uses 11 items to measure physical function and symptoms in people with any or multiple musculoskeletal disorders of the upper limb. The Disability/symptom section (11 items, scored 1-5). Outcome scores are measured between 0-100. The scores are numbers on a ruler of low levels of disability (scores closer to 0) through to very high disability (scores up at 100).

Based on the observations of patients in this study, we try to classify the quick DASH score into mild disability (0-30), moderate disability (31-65), and severe disability (66-100) based on minimal upper limb pain, having pain but working, and being unable to work due to upper limb pain.

DASH score evaluation after injection in corticosteroid group II at the end of the 4th week, 12th week, and 24th week shows statistically less significant improvement in comparison to PRP group I, which shows a steady decline in disability with the end of each follow-up (Table 4).

At the end of the 24th week of follow-up, 5 (22.72%) patients have shown mild disability and 4(18.18%) patients have shown moderate disability, whereas no significant response has been shown to shortened disability in the remaining 13 patients (59.09%) of corticosteroid Group II (Chart 1).

At the end of the 24th week of follow-up, 16 (72.72%) patients had a mild disabilities. However, no significant response was found in the other 6 (27.27%) patients of PRP Group I. (Chart 1).

Table 4: Shows Variable Group I –PRP (N-22 Median (Min-Max) Group II- CS (N-22) Median (Min-Max) and its P-value

Variable	Group I –PRP (N-22 Median (Min-Max)	Group II- CS (N-22) Median (Min-Max)	p-value
DASH Score- 4 week	93.1 (36.4-97.7)	61.3 (36.4-97.7)	<0.001
DASH Score - 12 weeks	87.2 (29.45-95.45)	40.9 (18.18-93.2)	<0.001
DASH Score - 24week	72.7 (11.3 -95.5)	13.6 (6.81 -90.75)	<0.001

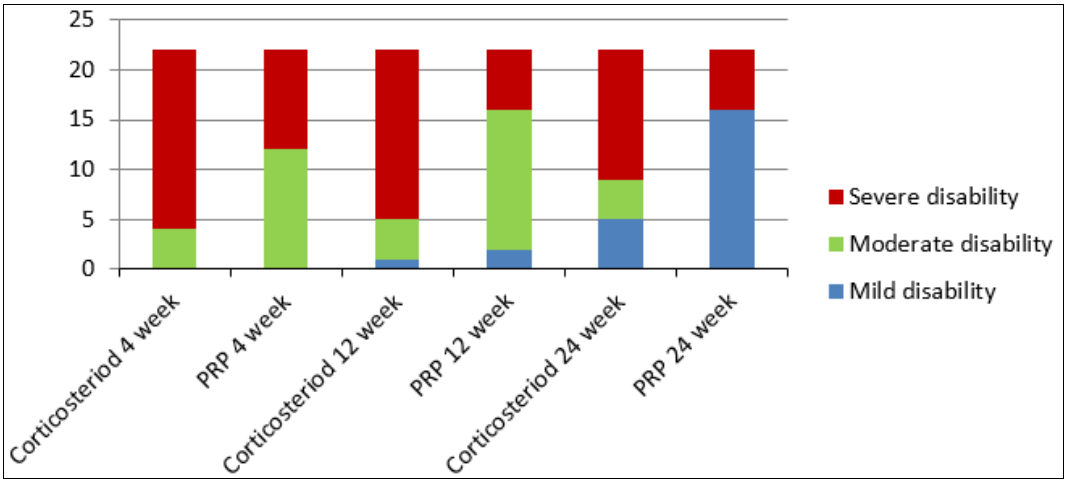

Chart 1: DASH score improvement in both group

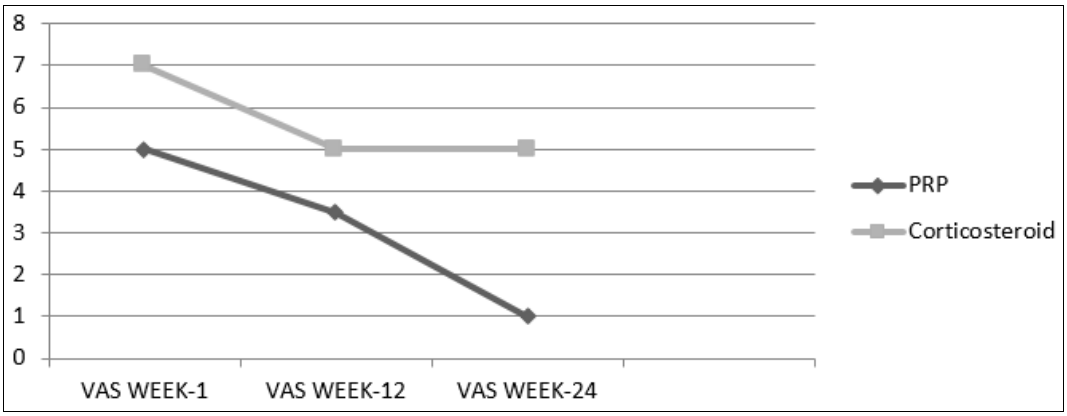

Chart 2: Comparison of VAS score- PRP and Corticosteroid group in follow up

Table 5: VAS score- PRP and Corticosteroid group

Variable	Group I –PRP (N-22 Median (Min-Max)	Group II- CS (N-22) Median (Min-Max)	p-value
VAS-4 Week	5 (3 -9)	7 (6-8)	<0.001
VAS-12 Week	3.5 (2 -8)	5 (4-6)	<0.001
VAS-24 Week	1 (0 -8)	5 (0-6)	<0.001

The visual analogue scale score was evaluated in both groups at the end of the 4th week, the 12th week, and the 24th week. There was more improvement in pain reduction (low VAS score) in the PRP group-I in follow-ups in comparison to the corticosteroid Group II (Table 5).

The visual analogue scale decreased significantly in the PRP group-I at the end of the 24th week of follow-up (Chart-3) whereas there was no significant difference in VAS score in the corticosteroid group-II at the end of the 12th and 24th weeks of follow-up. (Chart 2) In PRP group I, 15(68.18%) patients came out with no pain VAS score (0 or 1) at the end of the 24th week of follow-up.

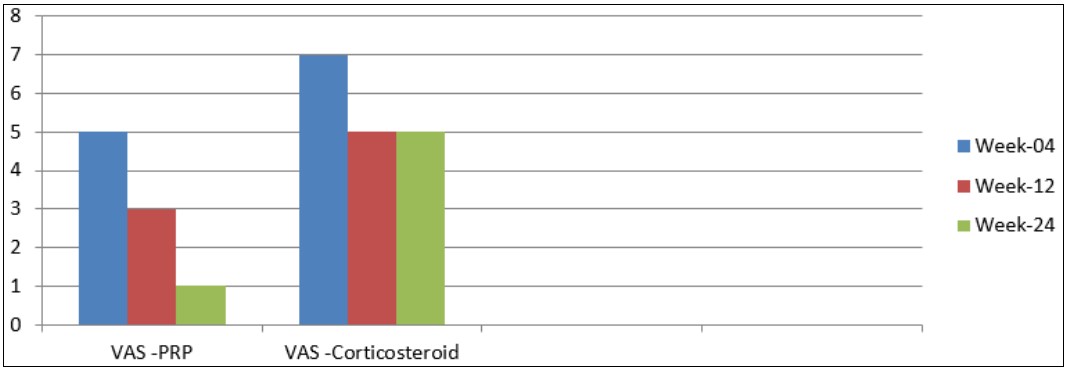

Chart 3: Comparison of VAS score-PRP and Corticosteroid group

Table 6: A Details of Finger active range of motion in Corticosteroid group-II

Finger active range of motion	Corticosteroid group-II 4 Week	Corticosteroid group-II 12 Week	Corticosteroid group- I 24 Week
	Number of Patients (%)	Number of Patients (%)	Number of Patients (%)
No Improvement	16 (72.73)	13 (59.09)	9 (40.9)
Mild Improvement	4 (18.18)	5 (22.72)	5 (22.72)
Moderate Improvement	2 (9.09)	4 (18.18)	4 (18.18)
Improved	0 (0)	0 (0)	4 (18.18)

Finger active range of motion evaluation after injection in the corticosteroid group II at the end of the 4th week, 12th week, and 24th week has shown less improvement in comparison to the PRP group I. At the end of the 24th-week follow-up, complete improvement in finger motion was found in 16 (72.73%) patients, whereas in the corticosteroid group II, only 4 (18.18%) patients recorded complete improvement and moderate improvement was found in 4 (18.18%) patients. (Tables 6A and B).

Table 6: B Details of Finger active range of motion in PRP group-I

Finger active range of Motion	PRP Group-I 4 Week	PRP Group-I 12 Week	PRP Group-I 24 Week
	Number of Patients (%)	Number of Patients (%)	Number of Patients (%)
No Improvement	6 (27.27)	6 (27.27)	5 (22.72)
Mild Improvement	14 (63.63)	0 (0)	1(4.54)
Moderate Improvement	2 (9.09)	15	0 (0)
Improved	0 (0)	1(4.54)	16 (72.73)

Discussion

De Quervain's Tenosynovitis (DQST) is a condition also known as Gamers thumb or mother's thumb. The pathophysiology of de Quervain's tenosynovitis is due to repeated passage of tendon through narrow canal which leads to swelling and fibrotic nodule formation over abductor pollicis longus and extensor pollicis brevis tendons. There are various modalities of treatment for De Quervain's Tenosynovitis.

Surgical therapy

Surgical intervention has been reported to be effective with a 91% cure rate, but is more invasive and associated with higher costs and the possibility of surgical complications.

Pharmacological therapy

Local injection of Corticosteroid into the affected tendon sheath. Corticosteroid injection is a common non-operative treatment utilized in the treatment of DQST. However, a recent Cochrane Review found major shortcomings with this report. The Cochrane group concluded that given the weak evidence base it is not possible to draw any firm conclusions regarding the effectiveness of steroid injections for DQST. Corticosteroid injections are associated with local infections. Studies show that corticosteroid injections are merely the best treatment option in comparison to physiotherapy and a wait-and-see policy in the short term.

Physical therapy

This is a conservative management of DQST consisting of relative rest and activity modification, primarily to minimize repetitive loading of the first dorsal compartment. The use of a thumb spica splint is commonly employed to immobilize the wrist and thumb. Splinting may reduce gliding of the APL and EPB tendons through the stenosed fibro-osseous canal, thereby minimizing mechanical impingement of the tendons against the retinaculum.

Surgical Therapy

Surgical intervention has been reported to be effective with a 91% cure rate, but is more invasive and associated with higher costs and the possibility of surgical complications.

Biological Therapy

C ryotherapy with -110 °C to -140 °C provides anti-inflammatory and analgesic effect to the degenerated tendon sheath. Autologous platelet rich plasma (PRP) injection. Has been shown to reduce symptoms in different tendon pathologies and seems to be superior to corticosteroids. PRP therapy is safe and feasible but does not reverse the degenerative tendon changes. Platelet-rich plasma (PRP) stimulates the inflammatory cascade within the generated tendon sheath by providing cellular and humoral mediators for regeneration.

In Ramesh R *et al* (2019) study, they concluded that, though the availability of various modalities of management for DQST, percutaneous needling with autologous platelet-rich plasma injection is the most superior modality for de Quervain's stenosing tenosynovitis, which minimizes the pain and improves the functional quality of life. Autologous PRP injection acts as an osteointegration and histopromotive agent which minimizes the need for surgical management and decreases the morbidity of the patient [15].

Mallick *et al.* in 2018 conducted a study on a sample size of 100, with an objective to compare the outcome of corticosteroid injection versus splinting for the treatment of de Quervain's tenosynovitis. They concluded, that though steroid injection has excellent outcome, splinting can be an alternative viable treatment option for DQST especially in patients with low grade disease or reluctant to injection because of fear of probable adverse reactions [16].

Jinhee K. *et al.* in 2017 conducted a study having an objective to determine the effectiveness of corticosteroid injections as treatment for de Quervain's tenosynovitis and to evaluate patient characteristics as predictors of treatment on a sample size of 222 and concluded that corticosteroid injections are a useful treatment for de Quervain's tenosynovitis, leading to treatment success of 73.4% of the time within 2 injections. This study also suggests that female sex and BMI >30 are associated with increased treatment failure [17].

Niraj Narain Singh & Rajiv Ranjan in 2018 conducted a study with an objective to evaluate the effect of intrasheath injection of local corticosteroids on dorsum compartment of wrist on patients with de Quervain's disease on a sample size of 60 and concluded that "local intrasheath injection of hydrocortisone was most effective treatment of de Quervain disease for resolution of symptom, decrease in pain and improvement of daily activity of life. After failure of injection of hydrocortisone, surgical decompression was second choice of treatment of de Quervain's disease" [18].

EL Sheikh *et al.* in 2020 conducted a study to evaluate the effect of platelet rich plasma in the treatment of De Quervain's tenosynovitis in comparison to corticosteroid local injection on a sample size 40. Group I (n = 20 CS injection); Group II (n = 20 PRP injection). The study concluded that 'PRP injection is an effective treatment option for those patients with DQST. The patients improved in pain intensity, disability and ultrasound findings. It is better than CS in the intermediate term by its ability to induce self-healing with no side effects'. The study highlighted the need of more studies to test the efficacy of PRP on the long term. [19] Similarly, Muhammad Akram, (2014) conducted a study having an objective to assess the results of injecting corticosteroids injections for De Quervain's tenosynovitis on 80 patients and concluded that "two or three local steroid injections in the first dorsal compartment lead to significant improvement in patients with de Quervain's tenosynovitis [20] C Peters-Veluthamaningal, J C Winters, K H Groenier, B Meyboom-de Jong (2008) conducted a study with an objective to study efficacy and safety of corticosteroid injections for trigger finger (flexor tenosynovitis) in adults in general practice concluded that "Local injection with triamcinolonacetonide (TCA) is effective and safe for treating trigger finger as compared to placebo injection. The effects of steroid injections last up to 12 months [21].

In our protocol we treated patients with PRP and based on the VAS and DASH score, patients have shown a significant improvement in the PRP group as compared to the corticosteroid group. This study's findings are consistent with previous prospective studies that demonstrate benefits conferred by PRP injections.

Conclusion

PRP injections are an effective treatment compared to corticosteroid injections in the long term in terms of pain intensity and disability. It minimizes the need for surgical management.

Conflict of Interest

Not available

Financial Support
Not available

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