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Platelet-rich plasma versus corticosteroid injection for recalcitrant lateral epicondylitis: clinical and ultrasonographic evaluation

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ABSTRACT

Purpose. To evaluate the clinical and ultrasonographic changes in the morphology and vascularity of the common extensor tendon after injecting platelet-rich plasma (PRP) or corticosteroid (CS) for recalcitrant lateral epicondylitis (LE).
Methods. 30 patients aged 18 to 60 years with recalcitrant (>6 months) LE not responsive to oral medication or non-invasive treatment were randomised to receive PRP (n=15) or CS (n=15) injection. Patients were assessed using the visual analogue scale (VAS) for pain, Disabilities of the Arm, Shoulder and Hand Scale (DASH) score, Oxford Elbow Score, modified Mayo Clinic performance index for the elbow (modified Mayo score), and hand grip strength. Ultrasonography was performed by a musculoskeletal ultrasonologist to evaluate for tear at the common extensor origin, oedema at the common extensor origin, cortical erosion, probe-induced tenderness, and thickness of the tendon.
Results. The VAS for pain, DASH score, Oxford Elbow Score, modified Mayo score, and hand grip strength all improved significantly from pre-injection to the 6-month follow-up in the PRP and CS groups. However, in the CS group, the scores generally peaked at 3 months and then deteriorated slightly at 6 months indicating recurrence of symptoms, which involved 46.7% of the CS patients. At 6 months, the number of patients positive for various ulrasonographic findings generally decreased. However, in the CS group, the number of patients with reduced thickness of the common extensor tendon increased from 2 to 12, and the number of patients with cortical erosion at the lateral epicondyle increased from 9 to 11.
Conclusion. PRP appeared to enable biological healing of the lesion, whereas CS appeared to provide short-term, symptomatic relief but resulted in tendon degeneration.

Key words: *platelet-rich plasma; tennis elbow; ultrasonography*

INTRODUCTION

Lateral epicondylitis (LE) is caused by mechanical overloading and abnormal microvascular response

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Table 1
The visual analogue scale (VAS) for pain, Disabilities of the Arm, Shoulder and Hand Scale (DASH) score, Oxford Elbow Score, modified Mayo score, and hand grip strength of the platelet-rich plasma (PRP) and corticosteroid (CS) groups

Assessment	VAS for pain			DASH score		
	PRP	CS	p Value	PRP	CS	p Value
Pre-injection	7.1±0.8	7.0±0.8	0.650	69.7±6.1	67.5±6.9	0.378
Post-injection						
2 weeks	4.5±1.1	2.1±0.7	0.000	51.6±6.8	39.7±6.7	0.000
6 weeks	2.7±0.8	1.4±0.5	0.000	38.6±5.7	32.7±4.1	0.003
3 months	1.8±0.6	1.7±0.5	0.493	33.6±5.1	34.3±3.3	0.675
6 months	1.6±0.5	2.9±1.2	0.001	32.0±4.5	39.6±1.0	0.012
p Value						
Pre-injection vs. 2 weeks	<0.001	<0.001	-	<0.001	<0.001	-
2 weeks vs. 6 weeks	<0.001	0.016	-	<0.001	0.01	-
6 weeks vs. 3 months	0.001	0.104	-	0.007	0.316	-
3 months vs. 6 months	0.384	0.002	-	0.451	0.066	-
Pre-injection vs. 6 months	<0.001	<0.001	-	0.001	<0.001	-

and affects approximately 1% to 3% of the population.[1–3] Treatment options include rest, non-steroidal anti-inflammatory medication, physical therapy, extracorporeal shock wave therapy, ultrasound therapy, botulinum injection, and corticosteroid (CS) injection. Recalcitrant cases necessitate surgical release.[4] Injection of biological agents achieves a favourable long-term clinical outcome.[5–8] Histological analysis of chronic LE reveals angiofibroblastic and mucoid degeneration secondary to a failure of natural tendon repair mechanism rather than acute inflammation. Platelet-rich plasma (PRP) enhances healing by delivering high concentrations of alpha-granules containing biologically active moieties (such as vascular endothelial growth factor and transforming growth factor-β) to the areas of soft-tissue damage.[9,10] In PRP, platelet count increases 2- to 8-fold, and different growth factors increase 1- to 25-fold.[11] PRP injection for LE reduces pain and induces healing of the common extensor tendon injury and vascularisation of the diseased tendon.[12,13] Ultrasonography enables visualisation of the tendon structures around the elbow.[14,15] This randomised, prospective study evaluated the clinical and ultrasonographic changes in the morphology and vascularity of the common extensor tendon after injecting PRP or CS for recalcitrant LE.

MATERIALS AND METHODS

Between May 2011 and October 2012, 30 patients aged 18 to 60 years with recalcitrant (>6 months) LE not responsive to oral medication or non-invasive treatment were randomised to receive PRP (n=15) or CS (n=15) injection. No patient had bilateral involvement. Pregnant patients or patients with symptoms of carpal tunnel syndrome or cervical radiculopathy or systemic disorders (diabetes, rheumatoid arthritis, or hepatitis) were excluded, as were those who had undergone surgery or local CS injection in the past 6 months.

20 ml of blood was collected in an acid citrate dextrose vacutainer and centrifuged at 1500 rpm for 15 minutes to separate the blood into layers of red blood cells, buffy-coat of leucocytes, and plasma. The platelet counts for PRP and unprocessed blood were calculated. 2 ml of PRP or methylprednisolone (40 mg/ml) was injected at the most tender point over the lateral epicondyle of the humerus using the peppering technique.

After injection, patients rested for 30 minutes and were advised against massage or hot fomentation. Ice packs or paracetamol were advised for discomfort rather than non-steroidal anti-inflammatory drugs, as the latter may interfere with platelet function.

Patients were assessed using the visual analogue scale (VAS) for pain, Disabilities of the Arm, Shoulder and Hand Scale (DASH) score, Oxford Elbow Score, modified Mayo Clinic performance index for the elbow (modified Mayo score), and hand grip strength before and after treatment at 2 weeks, 6 weeks, 3 months, and 6 months. Ultrasonography (HD 11, linear array transducer MF L12-4 MHz, Philips Healthcare, MA) was performed before and after treatment at 3 and 6 months by a musculoskeletal ultrasonologist blind to the treatments to evaluate for tear at the common extensor origin, oedema at

Oxford Elbow Score			Modified Mayo score			Hand grip strength		
PRP	CS	p Value	PRP	CS	p Value	PRP	CS	p Value
27.4±3.9	31.2±4.1	0.015	56.1±6.9	56.8±5.4	0.770	18.5±5.1	19.2±4.6	0.683
34.7±4.3	39.7±3.4	0.001	61.3±3.1	68.5±3.9	0.000	22.5±6.6	25.5±4.9	0.159
39.3±3.1	41.5±2.5	0.045	67.7±2.6	70.4±3.2	0.017	25.5±6.3	25.5±6.0	0.976
39.3±3.3	41.7±2.4	0.029	70.2±2.2	69.6±3.5	0.578	25.5±5.6	25.8±6.7	0.884
41.2±2.7	36.3±5.9	0.007	70.7±3.0	61.5±5.8	0.000	25.9±6.2	23.3±6.5	0.258
<0.001	<0.001	-	0.047	<0.001	-	0.087	0.001	-
<0.001	0.072	-	<0.001	0.159	-	<0.001	1.00	-
1.00	0.788	-	0.013	0.387	-	1.00	0.907	-
0.136	<0.001	-	0.546	<0.001	-	0.844	0.221	-
<0.001	0.022	-	0.001	0.072	-	0.005	0.012	-

the common extensor origin, cortical erosion, probe-induced tenderness, and thickness of the tendon.

The paired *t*-test (or paired Wilcoxon signed rank test) was used for detection of improvement over time. The resulting 2-tailed p value of <0.05 was considered statistically significant.

RESULTS

The VAS for pain, DASH score, Oxford Elbow Score, modified Mayo score, and hand grip strength all improved significantly from pre-injection to the 6-month follow-up in the PRP and CS groups. However, in the CS group, the scores generally peaked at 3 months and then deteriorated slightly at 6 months indicating recurrence of symptoms, which involved 46.7% of the CS patients (Table 1).

At 6 months, the number of patients positive for various ulrasonographic findings generally decreased. However, in the CS group, the number of patients with reduced thickness of the common extensor tendon increased from 2 to 12, and the number of patients with cortical erosion at the lateral epicondyle increased from 9 to 11 (Table 2).

DISCUSSION

CS injection used to be the treatment of choice for LE. CS suppresses the immune system by suppressing the pro-inflammatory proteins. Its potential side effects include lipodystrophy, skin pigmentation changes, and tendon atrophy/ruptures. PRP is an increasingly popular treatment for LE. It increases expression of the collagen gene and production of vascular endothelial growth factor and hepatocyte growth factor in human tenocytes,[16,17] and type-I collagen.[18]

Table 2
Ultrasonographic evaluation of the platelet-rich plasma (PRP) and corticosteroid (CS) groups

Assessment	No. (%) of patients with positive ultrasonographic finding									
	Tear of the common extensor tendon		Oedema of the common extensor tendon		Reduced thickness of the common extensor tendon		Probe-induced tenderness		Cortical erosion at the lateral epicondyle	
	PRP (n=15)	CS (n=15)	PRP (n=15)	CS (n=15)	PRP (n=15)	CS (n=15)	PRP (n=15)	CS (n=15)	PRP (n=15)	CS (n=15)
Pre-injection	10 (67)	5 (33)	7 (47)	7 (47)	3 (20)	2 (13)	15 (100)	15 (100)	14 (93)	9 (60)
Post-injection										
3 months	8 (53)	4 (27)	6 (40)	3 (20)	2 (13)	4 (27)	10 (67)	9 (60)	14 (93)	11 (73)
6 months	4 (27)	5 (33)	1 (7)	2 (13)	1 (7)	12 (80)	6 (40)	10 (67)	14 (93)	11 (73)

Table 3
Studies of platelet-rich plasma (PRP) versus corticosteroid (CS) injection for lateral epicondylitis

Studies	No. of patients	Follow-up	Re-intervention	Improvement in outcome (PRP vs. CS)
Peerbooms et al.,[23] 2010	51 PRP vs. 49 CS	1 year	-	Visual analogue scale (VAS) for pain (25–73% vs. 49%), Disabilities of the Arm, Shoulder and Hand Scale (DASH) score (25–73% vs. 51%)
Gosens et al.,[24] 2011	51 PRP vs. 49 CS	2 years	6 vs. 14	VAS for pain (25–77% vs. 43%), DASH score (25–73% vs. 39%)
Krogh et al.,[25] 2013	20 PRP vs. 20 CS vs. 20 saline	3 months	-	CS is superior to PRP at one month, but no significant difference at 3 months; decrease in tendon thickness after CS and increase in thickness after PRP
Current study	15 PRP vs. 15 CS	6 months	-	VAS for pain (77% vs. 59%), DASH score (54% vs. 41%), modified Mayo score (26% vs. 8%), Oxford Elbow Score (50% vs. 16%), hand grip strength (40% vs. 21%)

PRP initially inhibits the inflammatory process and then stimulates proliferation and maturation of the healing process. It enhances stromal and mesenchymal stem cell proliferation[19] and prevents the fibrous scar tissue healing that occurs with macrophage-mediated tendon-to-bone healing.[20] PRP may also suppress macrophage proliferation and interleukin-1 production within the first 72 hours.[21,22] PRP injection is superior to CS injection for chronic LE (Table 3).[22] The recurrence rate and need for repeated injection or surgery are higher in the CS than PRP group.[23,24] Ultrasonography revealed a decrease in thickness of the tendon after CS injection and an increase in thickness after PRP injection.[25] Increase in tendon vascularity following PRP injection is associated with improved tendon morphology.[26] Autologous blood injection reduces the total number of interstitial cleft formations and anechoic foci, tendon thickness, and neovascularity.[27]

CONCLUSION

PRP appeared to enable biological healing of the lesion, whereas CS appeared to provide short-term, symptomatic relief but resulted in tendon degeneration. PRP injection may be appropriate for other forms of tendinopathies, such as plantar fasciitis and medial epicondylitis.

DISCLOSURE

No conflicts of interest were declared by the authors.

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