

Autologous Blood and Corticosteroid Injection and Extracorporeal Shock Wave Therapy in the Treatment of Lateral Epicondylitis

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Abstract

Lateral epicondylitis is a common disorder characterized by pain and tenderness over the lateral epicondyle. It occurs most frequently as a result of minor, unrecognized trauma during sports activities and occupation-related physical activities. The goal of this study was to evaluate the short-, medium-, and long-term effects of corticosteroid injection, autologous blood injection, and extracorporeal shock wave therapy in the treatment of lateral epicondylitis.

Sixty patients (32 women, 28 men) with lateral epicondylitis were randomly divided into 3 groups: group 1 received a corticosteroid injection; group 2, an autologous blood injection, and group 3, extracorporeal shock wave therapy. Thomsen provocative testing, upper extremity functional scores, and maximal grip strength were used for evaluation. Outcomes were assessed at 4, 12, 26, and 52 weeks. Corticosteroid injection gave significantly better results for all outcome measures at 4 weeks; success rates in the 3 groups were 90%, 16.6%, and 42.1%, respectively. Autologous blood injection and extracorporeal shock wave therapy gave significantly better Thomsen provocative test results and upper extremity functional scores at 52 weeks; the success rate of corticosteroid injection was 50%, which was significantly lower than the success rates for autologous blood injection (83.3%) and extracorporeal shock wave therapy (89.9%). Corticosteroid injection provided a high success rate in the short term. However, autologous blood injection and extracorporeal shock wave therapy gave better long-term results, especially considering the high recurrence rate with corticosteroid injection. We suggest that the treatment of choice for lateral epicondylitis be autologous blood injection.

Lateral epicondylitis is a common disorder and the most common diagnosis in patients reporting elbow pain.¹ It occurs annually in 4 adults per 1000, particularly in those aged 35 to 54 years.² The most commonly encountered symptom is lateral elbow pain, which increases with grasp and dorsiflexion of the wrist against resistance. This disorder was first recognized more than 100 years ago and is thought to result from degeneration of the common extensor tendon origin.

Overload may be important in the etiology of lateral epicondylitis. It occurs most frequently as a result of minor, unrecognized trauma in young patients during sports activities and in older patients during occupation-related physical activities.^{3,4} Age, sex, leisure- and occupation-based physical activities, and psychosocial factors are considered to be risk factors.⁵⁻⁸ A typical episode of lateral epicondylitis lasts an average of 6 to 24 months.^{3,9}

Conservative treatment is successful in most patients. Conservative options include nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroid injection, rest, physical therapy, a lateral epicondylitis brace, laser therapy, autologous blood, bone marrow plasma, buffered platelet-rich plasma injection, and extracorporeal shock wave therapy. Surgical treatment is reserved for patients with a long-lasting condition that has not responded to conservative treatments. Surgical treatment consists of open, percutaneous, or arthroscopic debridement of the pathological area, close to the epicondylar region. Long-term results are reported to be good or excellent.¹⁰

The purpose of this study was to compare the short-, medium-, and long-term results of conservative modalities, particularly corticosteroid injection, extracorporeal shock wave therapy, and autologous blood injection, in the treatment of lateral epicondylitis.

Materials and Methods

Sixty patients (32 women, 28 men) diagnosed with lateral epicondylitis and matching the inclusion criteria (Table 1)

were included in the study. Mean patient age was 45.6 years (range, 20-64 years). This study was approved by the Izzet Baysal Medical Faculty Ethics Committee. The patients were randomly divided into 3 groups of 20 patients each: group 1 received a corticosteroid injection; group 2, an autologous blood injection; and group 3, extracorporeal shock wave therapy. Thomsen provocative test results, upper extremity functional scores, and maximal grip strength were used for evaluation, with assessment at 4, 12, 26, and 52 weeks.

Table 1
Inclusion and Exclusion Criteria
Inclusion criteria 1. >18 years of age 2. A history of lateral epicondylitis for a minimum of 6 months 3. Tenderness on palpation of the lateral epicondyle 4. >40 mm on the visual analog scale (Thomsen test) Exclusion criteria 1. Pregnancy 2. Local corticosteroid injection for lateral epicondylitis in the previous 3 months 3. Physical therapy in the previous 3 months 4. Nonsteroidal anti-inflammatory drug or acetaminophen medication in the previous week 5. Cervical spondylosis 6. History or radiograph of the upper extremity and elbow arthritis 7. Rheumatologic disease 8. Severe systemic illness 9. Neurological pathology such as carpal tunnel, cubital tunnel syndrome, and radial nerve entrapment 10. Previous surgery or elbow dislocation

Table 2
Activities Related to the Upper Extremity Functional Scale ^a
Sleeping Writing Opening jars Picking up small objects with fingers Driving for >30 minutes Opening a door Carrying a milk jug from the refrigerator Washing dishes ^aThe ability of the patient to perform each activity was rated on a scale of 1 to 10, with 1 indicating no difficulty and 10 indicating the activity could not be performed.

The activities related to the upper extremity functional scale were used to evaluate each patient's function (Table 2).¹¹ The Thomsen provocation test was performed with the shoulder flexed at 60°, the elbow extended, the forearm pronated, and the wrist extended to 30°. Pressure was applied on the dorsum of the hand. The test was performed 3 times, with the patient recording the pain on a 100-mm visual analog scale (VAS). The mean of the 3 measurements was recorded. At follow-up, a 50% decrease in the Thomsen test VAS value was considered a successful result. Maximum grip strength was measured with a hydraulic hand dynamometer (Baseline, White Plains, New York). The measurement was repeated 3 times, and the mean of the 3 measurements was recorded.

The patients in group 1 received a local anesthetic injection (prilocaine 1 mL) to the skin and subcutaneous tissues,

followed by methylprednisolone acetate (1 mL) injection with 5 skin penetrations at the tender part of the tendon, using 1 skin portal according to the technique of Mishra and Pavelko.¹² For the autologous blood injection, blood was taken from the contralateral antecubital fossa of the patients in group 2 and gently shaken to prevent clotting. Prilocaine (1 mL) was used for local anesthesia of the cutaneous and subcutaneous tissues, and the autologous blood (2 mL) was injected with a 22-gauge needle at the most painful part of the lateral epicondyle, using the technique described for group 1. In Group 3, the most tender point at the patient's elbow was determined by palpation, and prilocaine (1 mL) was applied for local anesthesia of the cutaneous and subcutaneous tissues. Ultrasound coupling gel was applied to the skin at the point of contact with the shock wave tube (Stonelith V5 lithotripter; PCK Electronic Industry & Trade Co, Ankara, Turkey). Active treatment consisted of 1 treatment with 2000 impulses at 0.17 mJ/mm^2 once a week for 3 weeks. Patients were closely monitored for vital signs, local pain, and possible side effects.

In group 1, two patients whose pain did not improve significantly received a second dose of corticosteroid at 6 weeks. We applied a second corticosteroid or autologous blood injection to patients who had a decrease in the Thomsen test VAS value $<50\%$. In group 2, fourteen patients received a second dose of autologous blood at 6 weeks. Thomsen test VAS values at 6 weeks for the corticosteroid injection and autologous blood injection groups are summarized in Tables 3 and 4.

Table 3		
Thomsen Provocative Testing Results of the Corticosteroid Injection Group at 6 Weeks		
Patient	Thomsen Test Score	
	Baseline	6 Weeks
1	80	0
2	100	0
3	100	10
4	90	10
5	70	20
6	70	30
7	70	30
8	80	30
9	80	40
10	100	30
11	90	0
12	70	20
13	60	20
14	80	10
15	60	20
16	60	50
17	70	20
18	80	0
19	50	50
20	80	20

Table 4		
Thomsen Provocative Testing Results of the Autologous Blood Injection Group at 6 Weeks		
Patient	Thomsen Test Score	
	Baseline	6 Weeks
1	70	30
2	100	70
3	0	30
4	80	50
5	70	10
6	80	50
7	60	20
8	90	70
9	90	50
10	80	60
11	90	50
12	70	50
13	70	40
14	80	50
15	70	40
16	50	50
17	60	50
18	60	50

Statistical Analyses

Statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS 11.0; SPSS, Inc, Chicago, Illinois). The Kruskal-Wallis test, a nonparametric method, was used to compare the functional score, Thomsen test result, and grip strength among the 3 groups. The Mann-Whitney *U* test was used to compare these parameters between groups. *P* values <.05 were deemed to indicate statistical significance.

Results

Sixty patients who were diagnosed with lateral epicondylitis and matched the related criteria were included in this study. The demographic and clinical characteristics of the 3 groups are shown in Table 5. The patients were divided randomly into 3 groups of 20 patients each. Two patients in group 2 were excluded because they discontinued the follow-up examinations, and 1 patient in group 3 was excluded after being involved in a traffic accident. Thus, a total of 57 patients were examined periodically. The Thomsen provocative test results, upper extremity functional scores, and maximal grip strengths at baseline and at 4, 12, 26, and 52 weeks are summarized in Table 6.

Demographic and Clinical Characteristics of the 3 Groups			
Parameter	CSI (n=20)	ABI (n=18)	ESWT (n=19)
Mean age, y	45.8±8.1	44±8.5	47±8.7
Women, No. (%)	10 (50)	11 (61.1)	11 (57.8)
Dominant elbow affected, No. (%)	15 (75)	14 (77.7)	15 (78.9)
Mean symptom duration, m	9.5±3.1	10±2.7	9.6±2.7
Previous episodes, No. (%)	7 (35)	6 (33.3)	8 (42.1)
Heavy workers, No. (%)	7 (25)	3 (16.6)	2 (10.5)
Abbreviations: ABI, autologous blood injection; CSI, corticosteroid injection; ESWT, extracorporeal shock wave therapy.			

Thomsen Provocative Testing, Upper Extremity Functional Score, and Maximal Grip Strength Results at 0, 4, 12, 26, and 52 Weeks															
	Functional Scale					Thomsen Test					Grip Strength, kg				
	0	4	12	26	52	0	4	12	26	52	0	4	12	26	52
CSI	46.6±10.87	18.4±7.68	20.6±6.88	27.1±7.67	27.5±8.48	77±14.1	18.5±13	30.5±14.6	43.5±13.4	42.5±14.8	30.4±10.2	40.9±9.05	39.2±9.03	34.1±5.9	33.8±6.7
ABI	47.2±10.28	33.8±8	19.5±12.0	20.7±8.87	18.6±10.16	75±12.9	50.5±12.1	25.5±15.4	24.4±13.7	23.3±11.8	31.2±8.77	33.6±8.52	38±6.56	37.5±6.23	37.3±5.83
ESWT	49.9±9.56	30±8.64	18.1±10.3	19.2±8.73	19.5±4.31	77.8±13.6	44.2±16	22.6±16.9	22.1±17.5	21±14.1	29.9±7.10	33.2±7.9	36.9±5.60	37.2±5.06	39.6±4.72
Abbreviations: ABI, autologous blood injection; CSI, corticosteroid injection; ESWT, extracorporeal shock wave therapy.															

Function Score

At the 4-week follow-up, the corticosteroid injection group showed a significantly greater mean improvement in the functional score (28.2, from 46.6 to 18.4; 60.5%) compared with the autologous blood injection group (13.4, from 47.2 to 33.8; 28.3%) and the extracorporeal shock wave therapy group (19.9, from 49.9 to 30; 39.8%) ($P<.001$ for each). No statistically significant difference was found between the autologous blood injection and extracorporeal shock wave therapy groups ($P>.05$).

At 12-week follow-up, the mean improvement in the functional score was not significantly different ($P>.05$) between groups: corticosteroid injection group, 26 (from 46.6 to 20.6; 55.7%); autologous blood injection group, 27.7 (from 47.2 to 19.5; 58.6%); and extracorporeal shock wave therapy group, 31.8 (from 49.9 to 18.1; 63.7%). The functional scores were almost the same at 12 and 4 weeks in the corticosteroid injection group.

At 26-week evaluation, the functional score had increased in the corticosteroid injection group, showing a mean improvement of 19.5 (from 46.6 to 27.1; 41.8%), compared with mean improvements of 26.5 (from 47.2 to 20.7; 56.1%) in the autologous blood injection group and 30.7 (from 49.9 to 19.2; 61.5%) in the extracorporeal shock wave therapy group. Improvement in the corticosteroid injection group was significantly lower than that in the extracorporeal shock wave therapy group ($P=.001$) and in the autologous blood injection group ($P<.05$). No statistically significant difference was found between the autologous blood injection and extracorporeal shock wave therapy groups ($P>.05$).

At 52-week follow-up, the functional score remained high in the corticosteroid injection group. The mean improvement in the corticosteroid injection group was 19.1 (from 46.6 to 27.5; 40.9%), 28.6 (from 47.2 to 18.6; 60.5%) in the autologous blood injection group, and 30.4 (from 49.9 to 19.5; 60.9%) in the extracorporeal shock wave therapy group. Improvement in the corticosteroid injection group was significantly less than that in the autologous blood injection group and in the extracorporeal shock wave therapy group ($P<.001$ for each). There was no significant difference between the autologous blood injection group and the extracorporeal shock wave therapy group ($P>.05$).

Thomsen Provocation Test

At 4-week follow-up, the mean improvement in the Thomsen test result was significantly greater in the corticosteroid injection group (58.5, from 77 to 18.5; 75.9%) than that in the autologous blood injection group (24.5, from 75 to 50.5; 32.6%) and in the extracorporeal shock wave therapy group (33.6, from 77.8 to 44.2; 43.1%) ($P<.001$ for each). The improvement was not significantly different between the autologous blood injection group

and the extracorporeal shock wave therapy group ($P>.05$).

At 12-week follow-up, the mean improvement was 46.5 (from 77 to 30.5; 60.3%) in the corticosteroid injection group, 49.5 (from 75 to 25.5; 66%) in the autologous blood injection group, and 55.2 (from 77.8 to 22.6; 70.9%) in the extracorporeal shock wave therapy group, with no statistically significant differences between the groups ($P>.05$).

At 26-week follow-up, the mean improvement in the Thomsen test result was 33.5 (from 77 to 43.5; 43.5%) in the corticosteroid injection group, which was significantly less than the improvement in the autologous blood injection group (50.6, from 75 to 24.4; 67.4%; $P<.001$) and in the extracorporeal shock wave therapy group (55.7, from 77.8 to 22.1; 71.5%; $P<.001$). There was no statistically significant difference between the autologous blood injection and extracorporeal shock wave therapy groups ($P>.05$).

At 52-week follow-up, the mean improvement in the corticosteroid injection group (34.5, from 77 to 42.5; 44.8%) was again significantly less than that in the autologous blood injection group (51.7, from 75 to 23.3; 68.9%) and in the extracorporeal shock wave therapy group (56.8, from 77.8 to 21; 73%) ($P<.001$ for each). There was no statistically significant difference between the autologous blood injection and extracorporeal shock wave therapy groups ($P>.05$).

Grip Strength

At 4-week follow-up, the mean improvement in grip strength was 10.05 (from 30.4 to 40.9; 33.05%) in the corticosteroid injection group, whereas it was only 2.4 (from 31.2 to 33.6; 7.69%) in the autologous blood injection group and 3.3 (from 29.9 to 33.2; 11.03%) in the extracorporeal shock wave therapy group. The improvement in the corticosteroid injection group was significantly greater than that in the autologous blood injection group ($P<.05$) and in the extracorporeal shock wave therapy group ($P<.05$).

At 12-week follow-up, the mean improvement in grip strength was 8.8 (from 30.4 to 39.2; 28.9%) in the corticosteroid injection group, 6.8 (from 31.2 to 38; 21.7%) in the autologous blood injection group, and 7 (from 29.9 to 36.9; 23.4%) in the extracorporeal shock wave therapy group. No statistically significant difference was found among the groups at 12 weeks ($P>.05$).

At 26-week follow-up, the mean improvement in grip strength was 3.7 (from 30.4 to 34.1; 12.1%) in the corticosteroid injection group, 6.3 (from 31.2 to 37.5; 20.1%) in the autologous blood injection group, and 7.3 (from 29.9 to 37.2; 24.4%) in the extracorporeal shock wave therapy group. The difference between the corticosteroid injection and extracorporeal shock wave therapy groups was statistically significant ($P<.05$), but the differences between the corticosteroid injection and autologous blood injection groups and between the extracorporeal shock wave therapy and autologous blood injection groups were not ($P>.05$ for each).

At 52-week follow-up, the mean improvement in grip strength in the corticosteroid injection group was 3.4 (from 30.4 to 33.8; 11.1%), significantly less than that in the extracorporeal shock wave therapy group at 9.7 (from 29.9 to 39.6; 32.4%; $P<.05$), and not significantly different from that in the autologous blood injection group at 6.1 (from 31.2 to 37.3; 19.5%). No statistically significant differences were noted between the corticosteroid injection and autologous blood injection groups and the extracorporeal shock wave therapy and blood injection groups ($P>.05$ for each).

Adverse Effects

All patients in all groups reported temporary pain after the treatment, and acetaminophen was prescribed to treat pain in all patients for 24 to 48 hours. In 15 (75%) of the patients in group 1, pain caused by the injection subsided within 2 days; in the other 5 patients (25%), the mean duration of pain was 5 ± 2 days. Discoloration at the injection site was detected in 1 patient (5%). In group 2, pain after the first injection disappeared within 2 days in 16 patients (88.8%) and lasted for 4 and 6 days in 2 patients (11.1%), respectively. After the second injection, only 1 patient (5.5%) had pain for >2 days; the pain lasted for 4 days. In all of the patients in group 3, pain disappeared within 2 days. Four patients (21%) experienced nausea, 4 (21%) had erythema at the elbow, 3 (15.7%) had swelling at the elbow, and 1 (5.2%) showed tremor in the arm.

Discussion

The etiology and pathophysiology of lateral epicondylitis is not completely understood, but is thought to be multifactorial, including effects of aging and chemical, vascular, hormonal, and hereditary factors.¹³ Lateral epicondylitis is reported to result from degeneration of the common extensor tendon origin; it is not an inflammatory process, and thus is called angiofibroblastic degeneration or tendinosis, instead of tendinitis.¹⁴

Corticosteroid injection is often used in the treatment of lateral epicondylitis. Although the effects of corticosteroid

injection are not fully known, they are thought to be related to the hemorrhage resulting from the high-pressure, forced injection in the tissue planes.¹⁵ Corticosteroids have various effects on cells, and presumably their ability to limit intracellular activity by reducing the nuclear-cytoplasmic communication pathways influences the degenerative and reparative components of this condition.¹⁶ Many different results have been reported with corticosteroid injection. Some studies have described a high success rate in the short term with corticosteroid injection.¹⁷⁻²⁰ In these studies, corticosteroid injection was compared with NSAIDs, physical therapy, elbow band, splintage, and wait-and-see approaches; the early results were successful with corticosteroid injection.²⁰⁻²³ In our study, we also observed a significantly higher short-term success rate with corticosteroid injection compared with autologous blood injection and extracorporeal shock wave therapy. The numbers of patients who showed 50% progress in the Thomsen test were 18 of 20 (90%), 3 of 20 (16.6%), and 8 of 19 (42.1%) in the corticosteroid injection, autologous blood injection, and extracorporeal shock wave therapy groups, respectively; the functional score results were 60.5%, 28.3%, and 39.8%, respectively.

The long-term efficacy of corticosteroid injection and its better medium- and long-term results relative to other conservative treatment methods have not been shown. Evaluations of medium- and long-term results revealed that corticosteroid injection was not superior to other treatment modalities and may even have had a poorer success rate.²⁰⁻²³ In long-term follow-up of corticosteroid injection treatment, high recurrence rates have been reported. This may be related to a tendinous injury caused by the injection or to overloading of the elbow by the patient, because of the pain relief following the injection.²⁰

In our study, at 52 weeks, the success rate of corticosteroid injection was 50%, which was significantly lower than the rates of the other treatment modalities (83.3% and 89.9%). The higher rate of manual workers in the corticosteroid injection group (n=7; 35%) compared with the other 2 groups may also have been part of the reason for the high recurrence and low success rates. The average duration of lateral epicondylitis is reported to be between 6 and 24 months.^{3,9} However, we suggest that occupational activities affect the duration, and that in manual workers, the duration may be longer and the recurrence rate may be higher.

The mechanism of action of autologous blood injection remains unclear. Some chemical modifiers of cell activity present in blood are known to be mitomorphogenic.²⁴⁻²⁶ The autologous blood injection may provide cellular and humoral mediators needed to stimulate the healing cascade. In particular, transforming growth factor- β and basic fibroblast factor act as humoral mediators to induce the healing cascade.²⁴ This method is minimally traumatic, has a low risk for immune-mediated reactions, and is simple to prepare.²⁷

In the short term (4 weeks), with autologous blood injection, a decrease of 32.6%, from 75 to 50.5, was observed in the Thomsen test VAS score, and 3 of 18 patients (16.6%) had a 50% decrease. No significant decrease was obtained in 14 of 18 patients (77.7%), and a second injection was performed. After the second injection, the medium-term (12 weeks) success rate was 13 of 18 patients (72.2%), and the success rate was 15 of 18 patients (83.3%) at last follow-up.

When ultrasound-guided autologous blood injection was performed by Connell et al,²⁸ the VAS score at 4 weeks had decreased from 9 to 6 (27%), which is similar to our short-term results. The 26 patients (74.2%) who did not show a significant improvement after the first injection received a second injection, and according to the results, success was achieved with repetitive injections in patients who had not benefited sufficiently from the first injection.

In lateral epicondylitis treatment, 8 weeks may be required to obtain maximum benefit after the first injection; however, this period may be reduced for repetitive injections, owing to the cumulative effect of the autologous blood.^{27,28} In our study, the success rate of 72.2% at 12 weeks supports this. Connell et al²⁸ reported a success rate of 91.4% at last follow-up. In our study, this rate was 83.3%. However, differences exist between the 2 studies. Connell et al²⁸ used ultrasound to choose the injection site, whereas we used palpation to find the most tender point for application of the multiple penetrations and injections. A penetration procedure was used after local anesthetic injection in both studies, but Connell et al²⁸ applied penetration for 1 minute, whereas we performed only 5 penetrations, using the technique of Mishra and Pavelko.¹² The follow-up period was 6 months in the previous study. Our success rate after 1 year was similar to that at 6 months, indicating that the autologous blood injection technique was effective over the long term. Our lower success rates at 6 and 12 months compared with those in the previous study may be attributable to differences in penetration techniques and better focusing with the use of ultrasound.

Edwards and Calandruccio²⁷ reported a 78.6% success rate at 9.5-month follow-up in their study of autologous blood injection. In contrast to our study, this study used a combination of autologous blood and local anesthetic injected below the extensor carpi radialis, avoiding multiple penetrations. Dry needling generates new channels and hemorrhage in the degenerative mixoid tissue, and the mechanical disruption may initiate a healing response in the tendon.^{27,29,30} Altay et al³¹ compared corticosteroid and local anesthetic injections. In both groups, they used

peppering techniques. When they compared the results after 1 year, they found no significant differences between the 2 groups, with success rates of 93% and 95%, respectively, and reported that the peppering technique was a reliable treatment method. In the literature, there are 2 previous studies concerning autologous blood injection.

Connell et al²⁸ applied penetration for 1 minute in their study, and Edwards and Calandruccio²⁷ did not use penetrations. We applied 5 penetrations at the most tender point on the tendon, and an evaluation of the long-term results revealed success rates of 91.4%, 78.6%, and 83.3%, respectively. Taking these results into consideration, we believe that multiple penetrations made a positive contribution to the autologous blood injection results.

Extracorporeal shock wave therapy is used for a wide range of indications in orthopedics and traumatology, including calcific tendonitis, plantar fasciitis, chronic Achilles tendonitis, patellar tendonitis, pseudoarthrosis, myositis ossificans, and avascular necrosis. The mechanism by which extracorporeal shock wave therapy acts is not well understood. According to animal experiments, extracorporeal shock wave therapy stimulates the formation of angiogenic markers and neovessels, and may decrease calcitonin gene-related peptide expression in dorsal root ganglia.^{32,33} It has been suggested that shock waves can provoke a painful level of stimulation, leading to pain relief or analgesia through hyperstimulation and increased vascularity.³⁴⁻³⁶

Studies have reported various success rates for extracorporeal shock wave therapy in the treatment of lateral epicondylitis. Short- and mid-term results are typically similar. In a study³⁷ evaluating 31 patients with a mean symptom duration of 16 weeks, pain scores at 4 weeks revealed a 31.3% improvement. Petrone and McCall³⁸ reported a 49% success rate concerning pain reports at 8 weeks; in another study, this rate was reported to be 48.7%.³⁹ Crowther et al⁴⁰ applied extracorporeal shock wave therapy in 48 patients and reported a 60% success rate at 12 weeks. Ko et al³⁵ evaluated 56 elbows in 53 patients and reported 75.5% excellent, good, and acceptable results at 6 weeks and 94.7% at 12 weeks. In our study, the success rate was 42.1% (8 of 19 patients) at 4 weeks and 73.7% (14 of 19 patients) at 12 weeks. In our study, extracorporeal shock wave therapy was found to be successful in treating lateral epicondylitis in the short and medium term, consistent with literature reports.

Different results concerning the long-term efficacy of extracorporeal shock wave therapy have also been reported. In many studies, extracorporeal shock wave therapy was not superior to placebo in the long term for treatment of lateral epicondylitis.^{38,39,41-43} Petrone and McCall³⁸ determined at least 50% improvement in pain reports in 43 of 46 patients (93%) after 1 year. However, Wang and Chen⁴⁴ reported that 91% of patients had complete or almost complete pain relief after 1 to 2 years. The rate in our study was 89.5% (17 of 19 patients) at the end of 1 year.

Helbig et al⁴⁵ showed a correlation between the duration of elbow and heel pain and the success of shock wave therapy: patients with chronic symptoms were more likely to have positive results than those with short-term symptoms. In our study, the mean duration of symptoms was 9.7±2.85 months (range, 6-16 months). This long duration of symptoms might have affected our success rate.

Based on the functional scores, corticosteroid injection was significantly more effective than the other 2 treatments at 4 weeks, whereas no significant difference was found between groups at 12 weeks. At 26 and 52 weeks, a significant decrease was observed in the functional score of the corticosteroid injection group, while the functional improvement observed at 12 weeks continued until the end of the first year in the other 2 groups.

A limitation of the study is the lack of a control group. A typical episode of lateral epicondylitis generally lasts for an average of 6 to 24 months. Although a spontaneous recovery will happen, this is too long for a patient to wait, not only in terms of pain and disability, but also for loss of economic productivity. Treatment with a modality that is safe and has a high success rate will enable patients to return to daily activities quickly.

Conclusion

Treatment with corticosteroid injection provided a high success rate in the short term. However, autologous blood injection and extracorporeal shock wave therapy gave better long-term results, especially considering the high recurrence rate with corticosteroid injection. Compared with extracorporeal shock wave therapy, autologous blood injection has the advantages of lower cost and no requirement for additional equipment, while providing long-term results similar to those with extracorporeal shock wave therapy. We propose that autologous blood injection be the preferred treatment modality for lateral epicondylitis.

References

1. Vicenzino B, Wright A. Lateral epicondylalgia I: epidemiology, pathophysiology, aetiology and natural history. *Phys Ther Rev*. 1996; (1):23-34.
2. Hamilton PG. The prevalence of humeral epicondylitis: a survey in general practice. *J R Coll Gen Pract*. 1986; 36(291):464-465.

3. Murtagh JE. Tennis elbow. *Aust Fam Physician*. 1988; 17(2):90-91,94-95.
4. Gellman H. Tennis elbow (lateral epicondylitis). *Orthop Clin North Am*. 1992; 23(1):75-82.
5. Allander E. Prevalence, incidence, and remission rates of some common rheumatic diseases or syndromes. *Scand J Rheumatol*. 1974; 3(3):145-153.
6. Verhaar JA. Tennis elbow. Anatomical, epidemiological and therapeutic aspects. *Int Orthop*. 1994; 18(5):263-267.
7. Viikari-Juntura E, Kurppa K, Kuosma E, et al. Prevalence of epicondylitis and elbow pain in the meat-processing industry. *Scand J Work Environ Health*. 1991; 17(1):38-45.
8. Haahr JP, Andersen JH. Physical and psychosocial risk factors for lateral epicondylitis: a population based case-referent study. *Occup Environ Med*. 2003; 60(5):322-329.
9. Hudak PL, Cole DC, Haines AT. Understanding prognosis to improve rehabilitation: the example of lateral elbow pain. *Arch Phys Med Rehabil*. 1996; 77(6):586-593.
10. Plancher KD, Pizà PA, Bishai SK. Arthroscopic management of lateral epicondylitis of the elbow. *Tech Orthop*. 2006; 21(4):256-265.
11. Pransky G, Feuerstein M, Himmelstein J, Katz JN, Vickers-Lahti M. Measuring functional outcomes in work-related upper extremity disorders. Development and validation of the Upper Extremity Function Scale. *J Occup Environ Med*. 1997; 39(12):1195-1202.
12. Mishra A, Pavelko T. Treatment of chronic elbow tendinosis with buffered platelet-rich plasma. *Am J Sports Med*. 2006; 34(11):1774-1778.
13. Nirschl RP, Pettrone FA. Tennis elbow. The surgical treatment of lateral epicondylitis. *J Bone Joint Surg Am*. 1979; 61(6):832-839.
14. Almekinders LC, Baynes AJ, Bracey LW. An in vitro investigation into the effects of repetitive motion and nonsteroidal antiinflammatory medication on human tendon fibroblasts. *Am J Sports Med*. 1995; 23(1):119-123.
15. Balasubramaniam P, Prathap K. The effect of injection of hydrocortisone into rabbit calcaneal tendons. *J Bone Joint Surg Br*. 1972; 54(4):729-734.
16. Johnstone AJ, Maffulli N. Tendinopathies around the elbow. In: *Tendon Injuries: Basic Science and Clinical Medicine*. London, England: Springer Verlag; 2005:128-136.
17. Assendelft W, Green S, Buchbinder R, Struijs P, Smidt N. Tennis elbow. *Clin Evid*. 2004; (11):1633-1644.
18. Assendelft WJ, Hay EM, Adshead R, Bouter LM. Corticosteroid injections for lateral epicondylitis: a systematic overview. *Br J Gen Pract*. 1996; 46(405):209-216.
19. Smidt N, Assendelft WJ, van der Windt DA, Hay EM, Buchbinder R, Bouter LM. Corticosteroid injections for lateral epicondylitis: a systematic review. *Pain*. 2002; 96(1-2):23-40.
20. Smidt N, van der Windt DA, Assendelft WJ, Devillé WL, Korthals-de Bos IB, Bouter LM. Corticosteroid injections, physiotherapy, or a wait-and-see policy for lateral epicondylitis: a randomised controlled trial. *Lancet*. 2002; 359(9307):657-662.
21. Verhaar JA, Walenkamp GH, van Mameren H, Kester AD, van der Linden AJ. Local corticosteroid injection versus Cyriax-type physiotherapy for tennis elbow. *J Bone Joint Surg Br*. 1996; 78(1):128-132.
22. Haker E, Lundberg T. Elbow-band, splintage and steroids in lateral epicondylalgia (tennis elbow). *Pain Clinic*. 1993; (6):103-112.
23. Hay EM, Paterson SM, Lewis M, Hosie G, Croft P. Pragmatic randomised controlled trial of local corticosteroid injection and naproxen for treatment of lateral epicondylitis of elbow in primary care. *BMJ*. 1999; 319(7215):964-968.
24. Iwasaki M, Nakahara H, Nakata K, Nakase T, Kimura T, Ono K. Regulation of proliferation and osteochondrogenic differentiation of periosteum-derived cells by transforming growth factor-beta and basic fibroblast growth factor. *J Bone Joint Surg Am*. 1995; 77(4):543-554.
25. Gelberman R, An KN, Banes A, Goldberg V. Tendon. In: Woo SL-Y, Buckwalter JA, eds. *Injury and Repair of the Musculoskeletal Soft Tissues*. Park Ridge, IL: American Academy of Orthopaedic Surgeons; 1988:1-40.
26. Hildebrand KA, Woo SL, Smith DW, et al. The effects of platelet-derived growth factor-BB on healing of the rabbit medial collateral ligament. An in vivo study. *Am J Sports Med*. 1998; 26(4):549-554.
27. Edwards SG, Calandruccio JH. Autologous blood injections for refractory lateral epicondylitis. *J Hand Surg Am*. 2003; 28(2):272-278.
28. Connell DA, Ali KE, Ahmad M, Lambert S, Corbett S, Curtis M. Ultrasound-guided autologous blood injection for tennis elbow. *Skeletal Radiol*. 2006; 35(6):371-377.
29. Kraushaar BS, Nirschl RP. Tendinosis of the elbow (tennis elbow). Clinical features and findings of histological, immunohistochemical, and electron microscopy studies. *J Bone Joint Surg Am*. 1999; 81(2):259-278.
30. Amiel D, Akeson WH, Harwood FL, Frank CB. Stress deprivation effect on metabolic turnover of the medial collateral ligament collagen. A comparison between nine- and 12-week immobilization. *Clin Orthop Relat Res*. 1983; (172):265-270.
31. Altay T, Günel I, Öztürk H. Local injection treatment for lateral epicondylitis. *Clin Orthop Relat Res*. 2002; (398):127-130.
32. Takahashi N, Wada Y, Ohtori S, Saisu T, Moriya H. Application of shock waves to rat skin decreases calcitonin gene-related peptide immunoreactivity in dorsal root ganglion neurons. *Auton Neurosci*. 2003;

107(2):81-84.

33. Wang CJ, Wang FS, Yang KD, et al. Shock wave therapy induces neovascularization at the tendon-bone junction. A study in rabbits. *J Orthop Res*. 2003; 21(6):984-989.
34. Haupt G. Shock waves in orthopedics [in German]. *Urologe A*. 1997; 36(3):233-238.
35. Ko JY, Chen HS, Chen LM. Treatment of lateral epicondylitis of the elbow with shock waves. *Clin Orthop Relat Res*. 2001; (387):60-67.
36. Rompe JD, Hope C, Küllmer K, Heine J, Bürger R. Analgesic effect of extracorporeal shock-wave therapy on chronic tennis elbow. *J Bone Joint Surg Br*. 1996; 78(2):233-237.
37. Chung B, Wiley JP, Rose MS. Long-term effectiveness of extracorporeal shockwave therapy in the treatment of perviously untreated lateral epicondylitis. *Clin J Sport Med*. 2005; 15(5):305-312.
38. Pettrone FA, McCall BR. Extracorporeal shock wave therapy without local anesthesia for chronic lateral epicondylitis. *J Bone Joint Surg Am*. 2005; 87(6):1297-1304.
39. Chung B, Wiley JP. Effectiveness of extracorporeal shock wave therapy in the treatment of previously untreated lateral epicondylitis: a randomized controlled trial. *Am J Sports Med*. 2004; 32(7):1660-1667.
40. Crowther MA, Bannister GC, Huma H, Rooker GD. A prospective, randomised study to compare extracorporeal shock-wave therapy and injection of steroid for the treatment of tennis elbow. *J Bone Joint Surg Br*. 2002; 84(5):678-679.
41. Speed CA, Nichols D, Richards C, et al. Extracorporeal shock wave therapy for lateral epicondylitis—a double blind randomised controlled trial. *J Orthop Res*. 2002; 20(5):895-898.
42. Haake M, König IR, Decker T, et al. Extracorporeal shock wave therapy in the treatment of lateral epicondylitis: a randomized multicenter trial. *J Bone Joint Surg Am*. 2002; 84(11):1982-1991.
43. Melikyan EY, Shahin E, Miles J, Bainbridge LC. Extracorporeal shock-wave treatment for tennis elbow. A randomised double-blind study. *J Bone Joint Surg Br*. 2003; 85(6):852-855.
44. Wang CJ, Chen HS. Shock wave therapy for patients with lateral epicondylitis of the elbow: a one- to two-year follow-up study. *Am J Sports Med*. 2002; 30(3):422-425.
45. Helbig K, Herbert C, Schostok T, Brown M, Thiele R. Correlations between the duration of pain and the success of shock wave therapy. *Clin Orthop Relat Res*. 2001; (387):68-71.

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