

The effectiveness of corticosteroid injection and splint in diabetic de Quervain's tenosynovitis patients

A single-blind, randomized clinical consort study

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Abstract

Background: There is no clear information on the efficacy of corticosteroids, and splints in the treatment of patients with diabetes mellitus (DM). The aim of this study was to compare the outcomes of isolated corticosteroid injection therapy with splint treatment with corticosteroid injection in patients with and without DM.

Methods: 84 diabetics, and 84 healthy patients with a diagnosis of de Quervain's tenosynovitis were included in our study. The patients were randomly distributed into four subgroups with and without DM. Groups 1 and group 2 consisted of diabetic patients, while group 3 and group 4 consisted of healthy patients. Corticosteroid injections were administered to groups 1 and 3, and corticosteroid injection and splint treatment were administered to groups 2 and 4.

Results: There was no significant difference in terms of age, gender, dominant/non-dominant hand, pre-treatment Quick Disabilities of the Arm, Shoulder and Hand score and visual analog scale scores between the four groups. Quick Disabilities of the Arm, Shoulder and Hand and visual analog scale scores in the four groups were found to be significantly better than pre-treatment at the 12th month. Finkelstein test results were positive in 37.5% of the patients in the first group, 35% of the patients in the second group, 20% of the patients in the third group and 9.5% of the patients in the fourth group. Groups 1 and 2 and, groups 3 and 4 were compared to evaluate the effect of the splint. While forearm-based thumb splint affected the results positively in healthy individuals, it was determined that it had no effect on the results in diabetic patients.

Conclusion: Although corticosteroid treatment is effective in the treatment of de Quervain's tenosynovitis in healthy and diabetic individuals, the results are worse in diabetic patients than in healthy patients. In addition, the use of splint with corticosteroid injection in healthy individuals positively affects the results, while it does not affect the results in diabetic patients.

Abbreviations: DM = diabetes mellitus, DQT = de Quervain's tenosynovitis, Quick DASH = Quick Disabilities of the Arm, Shoulder and Hand, VAS = visual analog scale scores.

Keywords: corticosteroid injection, de Quervain's tenosynovitis, diabetes mellitus, forearm-based thumb splint

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1. Introduction

De Quervain's *tenosynovitis* (DQT) is caused by stenosis of the extensor pollicis brevis and abductor pollicis longus tendons within the first extensor compartment of the wrist.^[1] It is more common in women between 30 and 50 years of age.^[2] Difficult sliding of the abductor pollicis longus and extensor pollicis brevis tendons within the narrow canal causes pain and, limitation of motion.^[3] The positivity of the Finkelstein test is important for diagnosis.^[4]

There are many treatment options for the DQT. These treatments are grouped under two headings as surgical and conservative.^[5] Although the results of surgical treatments are successful, there are disadvantages such as price, longer recovery period, immobilization, and complications that may occur during surgery. Therefore, conservative treatment is preferred primarily for treatment.^[6] Corticosteroid injection and splint application are frequently used for conservative treatment.^[7,8] Corticosteroid injections are used alone or in combination with a splint.^[9] While some studies found that splint application with corticosteroid injection had no additional effect on the results, some studies found that it positively affected the results.^[10,11,12,13]

The differences in treatment outcomes may be due to differences in patient characteristics, such as coexisting medical conditions.^[13] Diabetic patients have a high rate of carpal tunnel

syndrome, Dupuytren contractures and tendinitis of the hand. DQT is one of the most common types of tendinitis in patients with diabetes.^[14] Neuropathy, vasculopathy and connective tissue disorders in patients with diabetes may lead to increased musculoskeletal diseases.^[15] Tenosynovitis is caused by a mismatch between the tendon and the tendon sheath. This occurs either as a result of the thickening of the tendon due to degeneration of the tendon or narrowing of the tendon sheath. Collagen degeneration caused by diabetes causes both thickening of the tendon sheath and degeneration of the tendon.^[16]

The effectiveness of treatment protocols in patients with diabetes may differ from that in non-diabetic patients. There is a lack of studies comparing the effectiveness of isolated corticosteroid injection and use of splint after corticosteroid injection in the treatment of DQT in diabetic patients. It is necessary to investigate the increase in the number of patients with diabetes mellitus and the high incidence of DQT in diabetic patients.

The aim of our study was to compare isolated corticosteroid injections with splint treatment after corticosteroid injection in patients with and without diabetes mellitus (DM). We hypothesized that patients with DQT and DM would have poorer results than non-diabetic patients in both treatments. The use of splints after corticosteroid injection in patients without additional disease would positively affect the results, but the use of splints in patients with DM would not have any effect on the results.

2. Methods

2.1. Ethical considerations

This study was approved by the Ethics Committee of Ümraniye Training and Research Hospital (2019–189) and was performed in accordance with the tenets of the Declaration of Helsinki.^[17] All methods were performed according to relevant guidelines and regulations. After informing the patients about the possible side effects of the treatments, written informed consent was obtained from each patient.

2.2. Study design and patients

This was a single-center randomized controlled study that included consecutive inpatients aged over 18 years who had DQT. Our report follows the Consolidated Standards of Reporting Trials guidelines. The diagnosis of the disease was based on a positive Finkelstein test, pain at the radial wrist with resisted extension or abduction of the thumb and tenderness at the first dorsal extensor compartment over the styloid process of the radius. Patients who used insulin under doctor's supervision were included in our study. The exclusion criteria were as follows: a previous history of acute trauma, wrist fracture, history of surgery for DQT, pregnancy, steroid injection, or rheumatoid arthritis, or blood sugar irregularity.

2.3. Randomization and blinding

The original study was a prospective, single-blind, balanced, randomized controlled group trial. No changes were made to the design or protocol of the study. Patients were randomly assigned to one of four groups:

Group 1 (DM group): Corticosteroid injection group,

Group 2 (DM group): Corticosteroid injection + *forearm-based thumb splint* group,

Group 3 (Healthy group): Corticosteroid injection group,

Group 4 (Healthy group): Corticosteroid injection + *forearm-based thumb splint* group.

Randomization was performed using the closed envelope method randomization sequence by an investigator who was not involved in patient care. The group allocation was concealed in sealed opaque envelopes given to an investigator not involved in patient care or assessment. The physician opened the envelope immediately before corticosteroid injection and determined whether to use a forearm-based thumb splint after injection. The evaluation of all patients before treatment and at the 12th month follow-up was performed by the same physiotherapist who was blinded to the group assignments during the entire study.

2.4. Intervention

All patients received an injection of methylprednisolone acetate (40 mg, 1 ml) approximately 2 cm above the styloid process of the radius into the first dorsal compartment of the wrist. The injection was administered to all patients by the same physician (Betül Başar). The patients in groups 2 and 4 wore a forearm-based thumb splint for one month, removing it only to the shower. The patients did not receive additional treatment during the treatment period.

2.5. Evaluation

Quick Disabilities of the Arm, Shoulder and Hand (Quick DASH), Visual Analog Scale (VAS) scores, and Finkelstein test were used to evaluate the patients.^[4,18,19] The patients were evaluated before treatment and at the 12th month follow-up.

2.6. Sample size calculation

The primary outcome of our study was functional score at the 12th months. We calculated the sample size based on the Q-DASH score at the 12th month from a previous study that reported a mean score of 10 ± 9 .^[8] Assuming a 10 point improvement in Q-DASH score in the splint groups with an α of 0.05, and a β error of 0.8, the study required 32 patients in each group. Allowing a 30% dropout rate, 42 patients were recruited in each group.

2.7. Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences for Windows (Version 15.0; SPSS Inc., Chicago, IL). For intergroup comparisons of categorical variables, cross-table statistics were provided, and a chi-square test was used to assess the level of significance. For the comparison of independent samples, analysis of variance (ANOVA) was used if the data were normally distributed, whereas the Kruskal – Wallis test was used if the data were not normally distributed. All demographic and quantitative data are expressed as mean \pm SD. Differences were considered statistically significant at P -values < 0.05 .

3. Results

A total of 168 patients were included in the study. 84 patients had a diagnosis of diabetes mellitus, and 84 patients had no

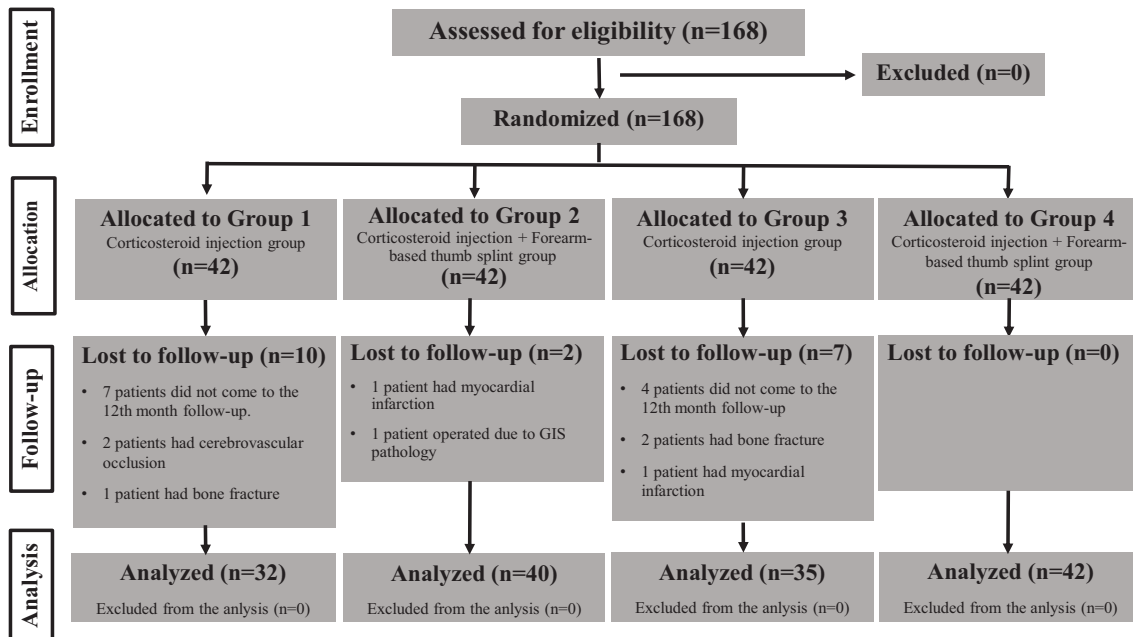


Figure 1. The flow chart for patient recruitment and follow-up.

additional disease (Fig. 1). 84 diabetic patients used insulin under doctor supervision. The diagnosis of diabetes was established an average of 7.96 ± 4.34 years before corticosteroid injection in group 3. In Group 4, the diabetes was diagnosed 9.25 ± 4.57 years ago. There was no statistically significant difference between the groups in terms of the time for the diagnosis of diabetes ($P = .2290$).

Nineteen patients were excluded during the follow-up period. Three patients had bone fractures, one patient underwent surgery due to GIS pathology, two patients had myocardial infarction and two patients had cerebrovascular occlusion. Eleven patients did not attend the 12th month follow-up. Therefore, the pre-treatment and 12th month control results of the 149 patients were evaluated. The 12th month follow-up of 32 patients from the 1st group, 40 patients from the 2nd group, and 35 patients from the 3rd group and 42 patients from the 4th group could be performed (Fig. 1).

A total of 109 female and 40 male patients with a mean age of 47.8 years (range, 29 – 70 years) were included in the study. 72 of these patients were diagnosed with DM. 77 patients were included in the healthy control group. 82 patients used a splint for treatment. Splints were not used in 67 patients. There were no significant differences in age, sex, and dominant/non-dominant hand between the four groups (Table 1).

3.1. In the pre-treatment evaluation

The Finkelstein test was positive in all patients, and there was no significant difference between the groups in terms of VAS and Quick Disabilities of the Arm, Shoulder and Hand (Quick DASH) scores ($P > .05$), (Table 2).

3.2. In the 12th month evaluation

Finkelstein test results were positive in 37.5% of patients in the first group, 35% of the patients in the second group, 20% of the patients in the third group and 9.5% of the patients in the fourth group (Table 2).

VAS and Quick DASH scores were found to be significantly worse in diabetic patients (groups and, 1,2) than in healthy patients (groups 3,4 and); ($P < .05$), (Table 2).

3.3. When the groups are compared according to the use of forearm-based thumb splints

There was no significant difference between the patients in groups 1 and 2 in terms of VAS and Quick DASH scores ($P > .05$). It was determined that the use of splints did not affect the results in patients with diabetes.

Table 1

Demographic characteristics of 4 groups.

	DQT with DM		DQT without DM		P
	Group 1	Group 2	Group 3	Group 4	
Number	32	40	35	42	
Age	$46,7 \pm 9,3$	$49,0 \pm 11,6$	$43,8 \pm 11,6$	$50,6 \pm 12,5$.0612
Sex (F/M)	23/9	28/12	25/10	33/9	.8230
Dominant / Non-Dominant Hand	24/8	34/6	29/6	34/8	.7412

DM=Diabetes Mellitus, DQT=de Quervain tenosynovitis, F=Female, M=Male.

Table 2
Analysis at pretreatment and 12th month follow-up.

	DQT with DM		DQT without DM		P
	Group 1	Group 2	Group 3	Group 4	
Pre-treatment VAS	8,0±0,8	7,8±1,0	7,8±0,9	7,9±0,8	.7912
12th month VAS	1,6±1,3	1,5±1,3	1,2±1,0	0,4±0,6	<.0001
Pre-treatment Q DASH	82,4±9,2	77,5±9,7	77,4±9,6	80,7±9,4	.0718
12 th month Q DASH	20,2±16,9	14,2±11,4	13,5±11,6	8,8±10,1	.0150
12 th month FT +/-	12/20	14/26	7/28	4/38	.0051

FT=Finkelstein test: Tenderness at the first dorsal extensor compartment over the styloid process of the radius, Q DASH=Quick Disabilities of the Arm, Shoulder, and Hand, VAS=visual Analog scale.

When groups 3 and 4 were compared, better results were obtained in group 4 in terms of VAS and Quick DASH scores ($P < .05$), (Table 2). The use of splints in healthy patients resulted in significantly better results.

All relevant data are within the paper and its supporting information files.

4. Discussion

We determined that DM had no negative effect on pain, functional results and Finkelstein test results before treatment. However, it negatively affected the results after treatment. We determined that the use of a forearm-based thumb splint together with corticosteroid injection had no effect on diabetic patients, and it positively affected the results in healthy patients.

Forearm-based thumb splints and corticosteroid injections are important non-operative treatment options for the treatment of DQT. Many studies have supported corticosteroid injection as an effective nonsurgical treatment for DQT. The success rates of corticosteroid injection therapy are very different. Some studies found the results to be very successful, while others found that the effectiveness of treatment was limited. The success rate in 18 pregnant and lactating women was found to be 100% by Avci.^[20] Gulzar et al. reported the success rate as 100%. In their study with 50 patients, they found no recurrence during the 24-month follow-up period.^[21] In a study performed by Jinhee et al. in 199 patients, the success rate was 73.4%.^[7] Jirattanaphochai et al. found a success rate of 68% in their study of 160 patients. Recurrence was detected in 33% of patients. The median recurrence time was at the fourth months.^[22] In the study by Brandon et al., 82% of 50 patients showed successful results 6 weeks after the injection. At the 12th month, successful results were achieved in 52% of patients. Symptom recurrence was observed in 58% of the patients at the 6th months.^[23]

Splinting is an important option for the conservative treatment of DQT. *Forearm-based thumb splints* are used more frequently for treatment of DQT.^[3,11] A *forearm-based thumb splint* limits the patient's ability to use his/her hand as it includes the thumb and wrist.^[11] The carpometacarpal joint is the most important joint of the thumb. DQT causes pain and loss of function in the carpometacarpal joint.^[24] Splinting is important in protecting the joint and, minimizing or eliminating stress in the joint during daily life activities.^[25] In a few studies in the literature on the use of isolated *forearm-based thumb splints*, the results were not successful. Weiss et al. with 93 patients, success rate of 66% in the isolated steroid injection group, 57% in the steroid + *forearm-based thumb splint* group, and 18% in the isolated *forearm-based thumb splint* group.^[26] In a study conducted by Lane et al. in 319 patients with a diagnosis of DQT, they determined a success rate

of 85% in those who received steroid injections and 54% in those who received *forearm-based thumb splint* therapy.^[27] There is no clear information on the duration of use of a *forearm-based thumb splint*. Thumb splints are generally used full-time for the treatment of DQT. In a study of 83 patients by Mariano et al., it was determined that there was no significant difference between full-time and desired use. It was also found that the use of a full-time splint did not have a negative effect on disability and grip strength.^[28] The use of a full-time *forearm-based thumb splint* was preferred in our study. In our study, it was found that the use of splint in addition to corticosteroid use in healthy patients positively affected the results in accordance with the literature.

DM is a well-known risk factor for tendinopathy.^[29] Roh et al. prospectively followed up 64 patients diagnosed with DQT with metabolic syndrome for 12 and, 24 months. Some of these patients were diagnosed with DM. They compared functional outcomes and improvements in symptoms in healthy patients. They achieved worse results in patients with a diagnosis of metabolic syndrome in terms of functional results and symptoms compared to healthy patients.^[30] We could not find any study in the literature on the effectiveness of corticosteroid injection in the treatment of DQT in diabetic patients. Patients with and without DM were evaluated in this study. Patients with diabetes were evaluated separately in the present study. We determined that the use of splint in addition to corticosteroid injections in diabetic patients did not have any effect on the results unlike in healthy patients.

The 12-month results were compared in the present study. We achieved successful results in both diabetic and healthy patients during the early period. Our study did not provide information about the late results. The success of treatment may decrease or even disappear in the late period in diabetic patients. Therefore, studies should be conducted on long-term results.

5. Conclusion

Although there was a significant improvement in pain, functional results and positivity in the Finkelstein test at the 12-month follow-up, the results were found to be worse than those in non-diabetic patients. In addition, it was determined that forearm-based thumb splints used with corticosteroids in non-diabetic patients positively affected the results, but not in diabetic patients. It was found that the use of a forearm-based thumb splint after corticosteroid injection was unnecessary in patients with diabetes.

Author contributions

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