

Changes in Pain, Dysfunction, and Grip Strength of Patients with Acute Lateral Epicondylitis Caused by Frequency of Physical Therapy: A Randomized Controlled Trial

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Abstract. [Purpose] The purpose of this study was to investigate the changes in pain, dysfunction, and grip strength of patients with acute lateral epicondylitis and to suggest the appropriate treatment frequency and period. [Subjects] The subjects were divided into three: 2 days per week group (n=12), 3 days per week group (n=15), and 6 days per week group (n=13). [Methods] All groups received conventional physical therapy for 40 minutes and therapeutic exercises for 20 minutes per session during 6 weeks. The outcome measurements were the visual analogue scale (VAS), Patient-Rated Tennis Elbow Evaluation (PRTEE), and grip strength. [Results] The results of this study were as follows: at 3 weeks, there were no significant differences in VAS and PRTEE in the 3 groups, but at 6 weeks, 6 days per week group significantly decreased these two outcomes. Grip strength was significantly increased in 3 and 6 days per week groups at 6 weeks. [Conclusion] In conclusion, physical therapy is needed 3 days per week for 3 weeks in patients with acute lateral epicondylitis. After 3 weeks, 6 days per week is the most effective treatment frequency.

Key words: Dysfunction, Frequency of physical therapy, Lateral epicondylitis

(This article was submitted Nov. 22, 2013, and was accepted Jan. 13, 2014)

INTRODUCTION

Lateral epicondylitis, also known as tennis elbow, is a condition in which the outer part of the elbow that attaches the extensor carpi radialis brevis (ECRB) sore and tender. It causes pain, decreased muscle strength, and dysfunction in the arm¹⁾. The pain and dysfunction decrease the work capacity, quality of life, and increase medical costs²⁾. Moreover, there is greater chance that lateral epicondylitis can recur and last for a long time after treatment^{3, 4)}.

The primary goals of treatment of lateral epicondylitis are reduction in pain, preservation of motion, flexibility, and strength, and development of endurance⁵⁾. We routinely use the treatment methods of TENS, vibration, and manipulation. In addition, we have used injection, braces, elbow mobilization with movement technique, massage, tapping, and so on⁶⁻⁹⁾. Most patients with lateral epicondylitis can be treated by conservative physical therapy; however, 3.3~8% of patients require surgery¹⁰⁾.

Among the various conservative treatments, exercise therapy is the most essential and important treatment that

can be effective when performed steadily¹¹⁾. It is also convenient and has little risk of side effects¹²⁾. To date, many studies regarding exercise programs for lateral epicondylitis have been completed. Svernlöv and Adolfsson suggested that eccentric training and static stretching for 12 weeks can reduce pain and increase grip strength in lateral epicondylitis¹³⁾. Finestone and Rabinovitch reported a reduction in pain and improvement of elbow function through application of resistance exercise for 8 weeks¹⁴⁾. There are many other studies about the effectiveness of exercise therapy for lateral epicondylitis. However, it is difficult to decide the frequency and period of treatment because of the different designs of such studies¹⁵⁾. Thus, the purpose of this study was to investigate the changes in pain, dysfunction, and grip strength of patients with acute lateral epicondylitis and to suggest the appropriate protocol of treatment frequency and period.

SUBJECTS AND METHODS

This study was performed with 3 groups with a repeated measures design. The groups were based on intervention frequency, with each group participating in a physical therapy program for 2, 3, or 6 days per week. Subjects were evaluated before the intervention (pretest) and after 3 and 6 weeks of intervention (Fig. 1).

We selected 18- to 65-year-old patients who had been diagnosed with lateral epicondylitis within 6 weeks after

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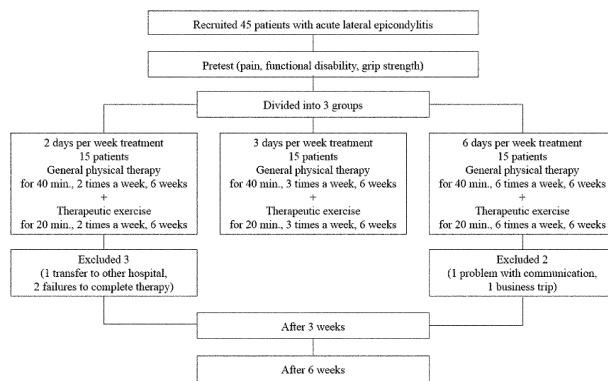


Fig. 1. Experimental procedures

onset and had experienced pain at more than 2 physical examinations in Cozen's test (resistance test for the wrist extensor), Mill's test (maximal passive flexor test for the wrist), and resisted middle finger test (resistance test for the middle finger)¹⁶.

We excluded subjects who had neurological manifestations, medial epicondylitis in the ipsilateral elbow, or cervical, shoulder, or wrist functional disability; subjects who had been treated within the past 4 weeks; subjects who required some other therapy (i.e. pacemaker); subjects who had undergone surgery; subjects who had rheumatism, fracture, arthritis, osteoporosis, or pain due to calcium deposition or other causes; and subjects who had difficulty in communication. None of the subjects were on any medication during the study. We explained the purpose of this study and obtained informed consent from the subjects. The study's protocol was approved by the institutional review board (IRB) of Sahmyook University in Seoul.

All subjects received general physical therapy consisting of heat therapy for 20 min, ultrasound (1 MHz, 1.5 W/cm² continuous mode) for 5 min, and TENS (100 Hz). After the pretest, we applied the exercise program in 2 stages for treating the lateral epicondylitis. The first stage of the program was comprised of pain control, stretch exercise for recovery to normal range of motion, isometric contraction exercises, grip strength exercise using a soft ball, and stretch exercise as the final exercise. The second stage consisted of wrist extensor stretching, eccentric contractions, concentric contractions, grip exercise using a grip dynamometer, and stretch exercise as a final exercise. The concentric contractions of the wrist were implemented with the elbow flexed and pronated, and the eccentric contractions were implemented with the elbow extended and pronated using a TheraBand. The grip exercise was comprised of 3 sets with 10–15 repetitions per set. In the interval between sets, the subjects had a break for one minute to prevent fatigue.

The outcomes were measured with the visual analogue scale (VAS)¹⁷ to rate pain and the Patient-Rated Tennis Elbow Evaluation (PRTEE)¹⁸ to rate tennis elbow functional disability. We measured grip strength with the shoulder flexed to 90° and the elbow in maximal extension. In total, tests were repeated 3 times, and we provided a 1-minute break per set; we then computed the mean¹⁹.

The SPSS version 18.0 software was used in performance of statistical analyses for the mean and standard deviation. The normality of the distributions was tested with the Shapiro-Wilk test. Descriptive statistics were used for general features, and one-way ANOVA was used for each group's differences. To determine the differences between the 3 groups and within groups, we used the repeated measure ANOVA. The statistical significance level (p) was less than 0.05.

RESULTS

Regarding the general characteristics of the subjects, no statistically significant differences in age, height, and weight were found (Table 1). The homogeneity test of subjects is shown in Table 2.

The comparison of VAS score, PRTEE score, and grip strength within the groups and between the groups is summarized in Table 3. Pain scores according to interval were assessed with a VAS. At 3 weeks, the difference among the 3 groups was not significant. At 6 weeks, the pain scores of the 6 days per week group showed significant differences compared with the other groups ($p < 0.05$). In the effect test within groups, all 3 groups showed a significant decrease according to the interval ($p < 0.05$).

The dysfunction score according to the interval was assessed with a PRTEE. At 3 weeks, the difference among the 3 groups was not significant. At 6 weeks, the dysfunction scores of the 6 days per week group showed significant differences compared with the other groups ($p < 0.05$). In the effect test within the groups, all 3 groups showed a significant decrease according to the interval ($p < 0.05$). The 2 days per week group showed no significant difference after 3 weeks of intervention ($p < 0.05$), but there was a significant decrease ($p < 0.05$). The 3 days per week group and 6 days per week group showed a significant decrease after 3 and 6 weeks of intervention ($p < 0.05$), and there was a significant decrease at 6 weeks ($p < 0.05$).

The grip strength score according to the interval was assessed with a dynamometer. At 3 weeks, the difference among the 3 groups was not significant. At 6 weeks, the dysfunction scores of the 6 days per week group showed significant differences compared with the other groups ($p < 0.05$). In the effect test within groups, the grip strength scores of the 2 days per week group showed no significant differences difference after 3 and 6 weeks of intervention ($p < 0.05$). The 3 days per week group and 6 days per week group showed significant differences after 3 and 6 weeks of intervention ($p < 0.05$).

DISCUSSION

To prescribe an effective physical therapy program, knowledge concerning the appropriate amount and method of the training is required. For the application of physical therapy, physical therapists need to select the variables, such as frequency, intensity, duration, type of muscle contraction, range of motion, speed of movement, and direction of movement. In past studies, many adjustments have been made to frequency, intensity, and duration²⁰.

Table 1. General characteristics of the subjects

Parameters	Groups		
	2 days per week (n=12)	3 days per week (n=15)	6 days per week (n=13)
Gender			
Male/female (%)	5/7 (41.6/58.3)	7/8 (46.6/53.4)	5/8 (38.4/61.5)
Height, cm	169.6 (7.2)	170.8 (9.8)	169.6 (6.3)
Weight, kg	66.4 (10.1)	66.9 (11.8)	66.4 (8.6)
Age, years	45.5 (8.7)	44.0 (11.8)	43.3 (8.0)

Values are numbers (%) or means (SD)

Table 2. Homogeneity test among the three groups

Parameters	Groups		
	2 days per week (n=12)	3 days per week (n=15)	6 days per week (n=13)
VAS score	6.6 (1.4)	7.0 (0.8)	6.8 (1.0)
PRTEE score	48.6 (9.0)	54.4 (14.4)	50.8 (9.0)
Grip strength	27.1 (10.3)	29.2 (11.1)	26.7 (9.2)

Values are means (SD).

VAS, visual analogue scale; PRTEE, Patient-Rated Tennis Elbow Evaluation

Table 3. Comparison of VAS score, PRTEE score, and grip strength within groups and between groups

Parameter	Interval	Groups			Post hoc test
		2 days a week (n=12)	3 days a week (n=15)	6 days a week (n=13)	
VAS (score)	Pretest	6.6 (1.4)	7.0 (0.8)	6.8 (1.0)	
	3 weeks	6.0 (1.2) ¹	5.8 (0.9) ¹	5.7 (0.9) ¹	
	6 weeks	5.7 (1.2) ¹	4.6 (1.0) ^{1,2}	2.6 (0.4) ^{1,2*}	A B C
PRTEE (score)	Pretest	48.6 (9.0)	54.4 (14.4)	50.8 (9.0)	
	3 weeks	47.7 (9.7)	46.4 (11.7) ¹	40.1 (7.5) ¹	
	6 weeks	46.4 (9.8) ^{1,2}	40.2 (9.3) ^{1,2}	26.5 (6.2) ^{1,2*}	A B C
Grip strength (kg)	Pretest	27.1 (10.3)	29.2 (11.1)	26.7 (9.2)	
	3 weeks	26.3 (10.5)	31.9 (10.5) ¹	30.0 (9.8) ¹	
	6 weeks	27.0 (10.5)	35.4 (10.0) ^{1,2}	38.2 (7.8) ^{1,2*}	A B C

Values are means (SD); A: 2 days a week group; B: 3 days a week group; C: 6 days a week group.

¹Significant difference compared to pretest. ²Significant difference compared to at 3 weeks.

*Significant difference between groups.

VAS, visual analogue scale; PRTEE, Patient-Rated Tennis Elbow Evaluation

In this study, the VAS and PRTEE were applied to groups performing a 6-week exercise program, which included general physical therapy, stretching, and resistance exercises using a TheraBand. Fyfe and Stanish et al. reported that strengthening exercise is effective for treating diseases or protecting injuries resulting from increases in the threshold of pain in stressful situations²¹). Glazebrook et al. also reported that an exercise program with appropriate stretching and strengthening exercise for the lateral epicondylitis is very important in strengthening the tendon region and improving the functional activities²²).

In the effect test among the groups, the VAS and PRTEE scores of the 6 days per week group showed significant differences at 6 weeks compared with the other groups

($p < 0.05$). In the effect test within the groups, all 3 groups showed a significant decrease according to the interval ($p < 0.05$). Regarding the pain scores, however, the decreases from 3 weeks to 6 weeks were greatest in the 6 days per week group. Regarding the dysfunction scores, the 3 days per week group and 6 days per week group showed significant differences compared with the pretest. However, the decreases at 3 weeks and 6 weeks were greatest in the 6 days per week group.

Above, the close relationship between the two scores and the large reductions in the changes from 3 to 6 weeks compared with baseline to 3 weeks have relevance to the healing process, including the end of the inflammation period, reformation of blood vessels, reoccurring local circulation,

and reconstruction of the synovial membrane²³). We think that after the healing process, a greater physical therapy effect appears. In addition, there were no significant reductions in pain between the pretest and after 3 weeks of intervention in the 3 days per week group and 6 days per week group. Considering these factors, performance of therapy 3 days a week within the initial 3 weeks and then 6 days a week appears to be efficient.

In the present study, there was no significant difference in grip strength in any group, and in the effect test within groups, there were differences in the effects of the interval in each group ($p < 0.05$).

In the within-group test, the 2 days per week group showed no significant changes in grip strength, but the 3 days per week group and 6 days per week group did show significant increases in grip power ($p < 0.05$). It is considered that 2 days per week of exercise is not enough. For strengthening the same muscle fiber, an exercise interval should be less than 3 days²⁴). The 6 days per week group showed no significant increase in grip power compared with the 3 days per week group at 3 weeks. We think that is the result of overtraining for 6 days without rest in the early inflammation period. Muscle fatigue resulting from overtraining causes lack of tissue recovery, excessive physiological stress, and lack of energy for the body²⁵). There were some participants in the 6 days per week group who experienced muscle fatigue; so we adjusted the intensity of the exercise. To decrease pain and increase muscle power, we think it is important to apply training with an appropriate amount of rest.

This study had some limitations. Despite restraints concerning movements of the wrist and hand for each participant, the compliance with the restraints could not be insured. In addition, there was some difficulty in regulating the intervals between days of therapy.

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