



Comparison of Kinesio Taping Technique with Myofacial Releasing of Retinaculum Musculorum Flexorum, Mobilization of the Median Nerve, and Tendon Gliding Exercises in Patients with Carpal Tunnel Syndrome

Karpal Tünel Sendromlu Hastalarda Retinaculum Musculorum Flexorum'un Miyofasyal Olarak Gevşetilmesi, Median Sinir Mobilizasyonu ve Tendon Kaydırma Egzersizlerinin Kinezyo Bantlama Tekniğiyle Karşılaştırılması

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Abstract

Aim: We aimed to investigate the efficiency of the kinesio taping technique and to compare efficacy of this technique with a treatment programme using all three types of myofacial releasing of flexor retinaculum, mobilization of the median nerve, and tendon gliding exercises in the Carpal Tunnel Syndrome (CTS).

Material and Methods: Forty female patients with CTS, randomly divided into exercise and kinesio taping groups consisted twenty patients in each group and received treatment for 4 weeks. In Group 1 applied mobilization of the median nerve, myofascial releasing of flexor retinaculum, and tendon gliding exercises therapy for 5 days per week, while in Group 2 applied the kinesio taping technique two times per week on Mondays and Thursdays. Patients were evaluated according to Boston Symptom Severity Scale and Boston Functional Capacity Scale before and after treatment. Intragroup and intergroup treatment efficacy were compared.

Results: The Boston Symptom Severity Scale and the Boston Functional Capacity Scale scores were significantly reduced in both groups between before and after treatment in intragroup comparison ($p < 0.005$). There was no significant difference between before and after treatment according to the Boston Symptom Severity Scale scores in intergroup comparison ($p < 0.005$). However, the Boston Functional Capacity Scale scores showed a statistically significant decrease in the exercise group between before and after treatment ($p < 0.005$).

Conclusion: Positive effects on CTS symptoms were observed in both groups, but statistically significant difference was not observed between groups. Exercise group was superior to taping group when we compare two groups in terms of CTS hand function capacity improvement.

Keywords: Carpal tunnel syndrome; myofacial releasing; mobilization of the median nerve; tendon gliding exercises; kinesio taping technique

Öz

Amaç: Karpal tünel sendromu (KTS) tedavisinde, kinezyo bantlama tekniğinin ne kadar etkin olduğunu araştırmak ve bu teknik ile retinaculum musculorum flexorum'un miyofasyal gevşetilmesi, n. medianus mobilizasyonu ve tendon kaydırma egzersizlerinin üçünün birlikte yapıldığı tedavi programının etkinliğini karşılaştırmaktır.

Materyal ve Metod: KTS'li 40 bayan hasta, rastgele yöntemle egzersiz ($n=20$) ve bantlama ($n=20$) olmak iki gruba ayrıldı ve 4 hafta tedaviye alındı. Grup 1'e haftada 5 gün retinaculum musculorum flexorum'un miyofasyal olarak gevşetilmesi, n. medianus mobilizasyonu ve tendon kaydırma egzersizleri; Grup 2'ye pazartesi ve perşembe olmak üzere haftada 2 kez kinezyo bantlama tekniği uygulandı. Hastalar tedavi öncesi ve tedavi sonrasında Boston Semptom Şiddeti Skalası ve Boston Fonksiyonel Kapasite Skalası'na

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göre değerlendirildi. Grup içi ve gruplararası tedavi etkinliği kıyaslandı.

Bulgular: Grup içi karşılaştırmada Boston Semptom Şiddeti Skalası ve Boston Fonksiyonel Kapasite Skalası değerleri her iki grupta da istatistiksel olarak anlamlı düzeyde azaldı ($p \leq 0,005$). Gruplararası karşılaştırmada Boston Semptom Şiddeti Skalası değerlerine göre tedavi öncesi ve sonrasında istatistiksel olarak anlamlı fark görülmedi ($p > 0,005$). Ancak Boston Fonksiyonel Kapasite Skalası değerlerinde egzersiz grubunda tedavi öncesi ve sonrasında istatistiksel olarak anlamlı düzeyde azalma gözlemlendi ($p < 0,005$).

Sonuç: Her iki grupta da KTS semptomları açısından anlamlı iyileşme tespit edilmiş, ancak gruplar arasında istatistiksel olarak anlamlı fark bulunmamıştır. KTS el fonksiyon kapasitesi açısından ise egzersiz grubundaki iyileşme bantlama grubundan istatistiksel olarak daha anlamlı bulunmuştur.

Anahtar Kelimeler: Karpal tünel sendromu; miyofasyal gevşetme; n. medianus mobilizasyonu; tendon kaydırma egzersizleri; kinezyo bantlama tekniği

INTRODUCTION

Carpal tunnel syndrome (CTS), occur as a result of compression of nervus medianus in the carpal tunnel as it passes through. CTS is most common between the ages of 40 and 60.

It is more common in women than men (1,2). The most common CTS is idiopathic CTS, which etiological factors are not detected. Endocrinological disorders, rheumatologic diseases, amyloidosis, tumor formations, traumatic conditions, anatomical variations, infections and obesity are also responsible for the etiology of CTS in the literature (2). The first symptoms in the CTS clinic are nocturnal pain and paresthesias along the median nerve trait, and this complaint is initially subjective as a single symptom. Weakness and atrophy of tenar muscles are seen in later periods (3).

Diagnosis in CTS is based on anamnesis, clinical symptoms, physical examination findings, and electroneurophysiological support of these findings (4).

In the literature, the methods used in the conservative treatment of CTS are varied and the advantages of these methods are discussed. Conservative treatment of CTS includes approaches such as use of splints, steroid injections, non-steroidal anti-inflammatory drugs, diuretics, vitamin B6, physical therapy agents, activity modification and job replacement. Contrast bath, ultrasound and transcutaneous electrical nerve stimulation (TENS) which is a modality of analgesic therapy in CTS are among the methods used (1,4). Surgical decompression is applied if the patient has severe median nerve injury (4).

Tendon and nerve gliding exercises used in the treatment of CTS are thought to contribute to local dynamic effects. These exercises allows the mobilization of soft tissues to terminate dynamic ischemia. The movement of the flexor tendons and median nerve in the carpal tunnel are related to each other, and these movements can be increased by tendon and nerve gliding exercises. As a result of this effect, venous return from the median nerve increases and pressure within perineum decreases. Although tendon and nerve gliding exercises are applied after surgery, there is also a place in the conservative treatment of CTS. The longitudinal contact area between ligamentum carpi transversum and median nerve is enlarged by stretching

adhesions, and as a result of the arrangement of venous return to nerve fibers, tenosynovial edema is reduced and the symptoms are improved as a result of reduction in pressure within the carpal tunnel (5).

Myofacial releasing of retinaculum musculorum flexorum which is used for osteopathic manipulative treatment and stretching exercises, is a very effective method. As a result of this method, a potential treatment creates an increase in the width of the ligamentum carpi transversum and allows the nerve functions to be performed (6).

Kinesio taping is used in the treatment of CTS to reduce edema and pain. It is also used to improve decreased ligament elasticity and to reduce pressure on the median nerve (7).

In recent years, kinesio taping technique used in physical therapy and rehabilitation program has been used very effectively in many diseases affecting musculoskeletal system. However, a few studies have been found to investigate the effectiveness of the CTS in our literature surveys (8,9). The aim of this study was to determine how effective kinesio taping technique was used in the treatment of patients with CTS and to compare kinesio taping technique with the treatment program of applied together myofascial releasing of retinaculum flexorum musculorum, mobilization of the median nerve and tendon gliding exercises.

MATERIAL AND METHODS

In this prospective study, 40 female patients who referred to the Physical Medicine and rehabilitation outpatient clinic of Inonu University Turgut Ozal Medical Center between December 2011 and March 2012 were diagnosed as CTS with story, physical examination or electrodiagnostic tests by the doctor. Ethics committee approval was taken from Inonu University (2011/33).

Paresthesia, pain and/or vasomotor symptoms in the hand that fits the median nerve distribution that lasts for more than 6 weeks, at least one of the tests of Tinel, Phalen and Carpal compression is positive in physical examination, three months have not been included in the medical treatment or physical therapy program for CTS patients were included in this study.

Patients who have median nerve injury, severe tenar atrophy, underwent CTS surgery, and sensitivity to kinesio

taping band were excluded from the study.

Written informed consent was obtained from all participants.

Patients were randomly divided as group 1 and Group 2. They were treated for 4 weeks. All patients were trained to avoid the positions and activities that would increase the symptoms of CTS during the treatment.

Group 1 patients were performed mobilization of the median nerve (Figure 1.) for 3 minutes, myofascial releasing of retinaculum musculorum flexorum (Figure 2) for 3 minutes and tendon gliding exercises (Figure 3) for 20 times 5 days a week.



Figure 1. Mobilization of the median nerve



Figure 2. Myofascial relaxation of retinaculum musculorum flexorum



Figure 3. Tendon gliding exercises

Group 2 patients were performed kinesio taping technique (Figure 4) on Mondays and Thursdays. Button hole technique was used for space correction from kinesio tape applications. I tape was applied from epicondylus medialis to phalanx proximalis on the palmar percent and from phalanx proximalis to epicondylus lateralis on the dorsal percent. Two holes were opened in the middle of the I band. These holes were passed 3. and 4. the fingers and the patient was asked to perform radial deviation with wrist extension. Tape stuck up to epicondylus medialis with 15-25% or paper tension. Then the patient was asked to perform ulnar deviation with wrist flexion. Tape stuck to epicondylus lateralis with 15-25% or paper tension again. An I tape is attached to the dorsal of the wrist horizontally. Kinesio taping was taped to Group 2 patients on Monday and was removed Thursday and renewed. The band was changed during the week of the patients out of the band.



Figure 4. Kinesio taping technique

Patients that meet the study criteria, the patient's demographic information, Body Mass Index (BMI), whether the affected hand is a dominant hand, the etiology of CTS, situations that can cause difficulty in the wrist, EMG results, whether subjective symptoms (pain, paresthesia, loss of strength, vasomotor symptoms) are present, whether physical examination of the Tinel test, Phalen test, Carpal compression test is positive was assessed with a form that contains. All patients were evaluated pretreatment and posttreatment with Boston Symptom Severity Scale and Boston Functional Capacity Scale. The effectiveness of the treatment of each group was determined and the comparison of the treatment efficacy of the two groups was made.

Boston Questionnaire

The Boston Carpal Tunnel Questionnaire developed by Levine and colleagues in 1993 self reported. It consists of two parts: the scale of symptom severity and the scale of functional capacity. It is known as the 'Boston Carpal Tunnel Questionnaire' because it originates from the Boston hospital (10).

Boston Symptom Severity Scale

This questionnaire consists of 11 articles. There are five different answers that are between 1 and 5 points. The

average score is calculated by dividing the total score by the number of questions and varies between 1-5. High scores indicate severe symptoms (10).

Boston Functional Capacity Scale

This questionnaire consists of 8 articles. There are five different answers that are between 1 and 5 points. The average score is calculated by dividing the total score by the number of questions and varies between 1-5. High points indicate reduced functional capacity (10).

Mean score was calculated separately for symptom severity and functional capacity.

Statistical Analysis

In our study, sample size was calculated using power analysis (power: 0.80), 40 volunteers were taken. All patients were randomly divided into two groups (Group 1 and Group 2).

Data were presented as mean ± standard deviation. Shapiro-Wilk test was conducted for normality assumption. Data was normally. Dependent T-test were used for comparison of pretreatment and posttreatment for Boston Symptom Severity Scale and Boston Functional Capacity Scale within groups. Independent T-test were used for comparison of pretreatment and posttreatment for Boston Symptom Severity Scale and Boston Functional Capacity Scale between groups. p<0.05 value was considered as statistically significant. IBM SPSS Statistics 22.0 program was used for analyses.

RESULTS

This study consists of two group. Group 1 is exercises (mobilization of the median nerve, myofacial releasing of retinaculum musculorum flexorum, tendon gliding exercises) and Group 2 is kinesio taping group.

In the statistical analysis, there was no significant difference between the groups in terms of mean age, BMI and job distribution (p<0.005). There were 18 bilateral 2 unilateral involvement in Group 1 while 16 bilateral 4 unilateral involvement in Group 2. 38 patients were using the right hand (95%), while 2 patients were using the left hand (5%). In Group 1 and Group 2, 19 people (95%) were using their right hand. There was no statistically significant difference between the groups in terms of hand laterality (p<0.005) (Table 1).

	Group 1 (N=20)	Group 2 (N=20)	P
Number of wrist which the treatment received	38	36	0.958
Dominant hand (right)	19 (% 95)	19 (%95)	0.999
Age	44.6510.864	50.258.955	0.913
BMI, kg/m ²	27.803.334	29.255.399	0.958
Job Housewife	19 (%95)	17 (%85)	0.936

(BMI: Body mass index)

There was no statistically significant difference between the groups in terms of pain, paresthesias, weakness of muscles and vasomotor symptoms when compared with the initial symptoms (p<0.005) (Table 2).

	Group 1 N (%) N =20	Group 2 N (%) N =20	P
Pain	18 (% 90)	19 (% 95)	0.200
Paresthesia	19 (% 95)	20 (% 100)	0.200
Weakness of muscles	18 (% 90)	17 (% 85)	0.511
Vasomotor symptoms	12 (% 60)	15 (% 75)	0.322

Values are given as N number and percentage of positive symptom parameters

There was no statistically significant difference between the groups when the clinical evaluation parameters (Tinel test, Phalen test, Carpal compression test) were compared (p<0.005). (Table 3).

	Group 1 N (%) N =20	Group 2 N (%) N =20	P
Tinel testi	17 (%85)	19 (%95)	0.525
Phalen test	20 (%100)	20 (%100)	0.997
Carpal compression test	20 (%100)	20 (%100)	0.997

Values are given as N number and percentage of positive symptom parameters

In both groups, the difference between pretreatment and posttreatment scores of the Boston Symptom Severity Scale (Total S) and the scores of Boston Functional Capacity Scale (Total F) was decreased statistically significantly (p≤0.001) (Table 4).

		Group 1 N=20	Group 2 N=20
Boston Symptom Severity Scale	Pre-T	34.20 9.43	36.10 10.25
	Post-T	17.90 5.69	17.55 5.43
	P	<0.001	0.001
Boston Functional Capacity Scale	Pre-T	26.90 7.65	27.40 5.86
	Post-T	15.90 6.00	12.50 3.36
	P	0.001	<0.001

Pre-T: Pre-Treatment, Post-T: Post-Treatment

The difference between the pretreatment and posttreatment scale of Boston Symptom Severity Scale was expressed as Difference S, the difference between the pretreatment and posttreatment scale of Boston Functional Capacity Scale scores was expressed as Difference F. There was a no statistically significant difference compared to the Difference S, Difference F scores of Group 1 and Group 2 ($p=0.31$) ($p=0.04$) (Table 5).

	Group 1	Group 2	P
Difference S	16.30 6.05	18.55 7.73	0.312
Difference F	11.30 6.35	14.90 4.10	0.040

DISCUSSION

CTS is one of the most common peripheral neuropathies. It affects mainly middle aged women (1,2). That's why in this study had been done in women. Also the mean age of all patients in our study was $47.45 \pm 10,228$. It has been reported that housewives can pose a risk factor in CTS because they use their hands intensively in cleaning and knitting (11). High BMI has been reported to be risk factor for CTS, owing to the increase in fat tissue and the hydrostatic pressure within the carpal tunnel (12). In this study, the majority of patients were housewives and had a high BMI. These findings were supportive of the literature. Bilateral involvement in patients with CTS is 60% more common than unilateral involvement. The dominant hand in bilateral cases has often been shown to be kept more severe and previously. Unilateral cases often have dominant hand involvement (13). In this study, bilateral involvement rate was very high and dominant involvement was found in the patients with unilateral involvement.

The clinical manifestations of CTS include pain and numbness in the lateral three fingers and the radial side of the ring finger as well as decreased muscle weakness in the thenar area and atrophy occur. The symptoms get worse at night and patients try to reduce the physical disturbance by shaking their hands. In previous studies, the most common symptoms of paresthesia and pain were recorded (14,15). In this study we evaluated pain, paresthesia, loss of strength and vasomotor symptoms in the diagnosis. These symptoms we evaluated in both group patients were severe distress.

We used Tinel, Phalen and Carpal compression tests that are most commonly used provocative test in the evaluation of CTS. In the literature, it was reported that the Tinel test was positive between 8%-100% and Phalen test was positive between 10%-88% in patients with CTS (16). In this study, Tinel test was found to be positive in the majority of patients. Also, Phalen and Carpal compression test were positive in two groups worldwide.

When we review the literature information of CTS, it is seen

that there is no standardization in evaluating treatment results. The scale, which was reported by Levine et al. in 1993 is referred to as the Boston Carpal Tunnel Questionnaire. Levine et al. demonstrated that this scale had the characteristics of reproducibility, consistency, validity, and sensitivity to clinical changes, which should be found in a good clinical questionnaire (10). It is noted that this scale has been used in comparative studies such as the questioning of electrodiagnostic tests, which have been accepted as gold standard by some authors in recent years. We also used the Boston Questionnaire to evaluate subjective complaints in patients with CTS because it is easy and feasible to determine the severity of CTS symptoms and to be reliable.

Surgical or conservative methods are used to relieve compression of the median nerve in the treatment of CTS. Although it is defended that CTS surgery is a safe and effective treatment, because of the possible risks and complications of surgery, conservative treatment methods are preferred in some patients (17).

Osteopathic manipulative therapy, a massage technique, is a fast and noninvasive method used in the diagnosis and treatment of CTS. This treatment helps to reduce the pressure in the carpal tunnel, relax soft tissues, relieve stuck carpal and metacarpal bones, strengthen muscles, increase joint range of motion, and increase nervous and circulatory functions. Studies have found improvements in joint range of motion and symptom reduction in patients with CTS using osteopathic manipulative therapy (18). This study results support this. Decrease in CTS symptoms and significant improvements were observed in the treatment group in which osteopathic manipulative treatment was included.

Mobilization of the median nerve, which is another conservative treatment used in this study, is a treatment technique used to improve the symptoms of CTS. There are many conservative and postoperative applications involving the mobilization of the median nerve to improve the glide motion of the nerve in CTS. This technique also helps to oxygenate the nerve, reducing ischemic pain (19). Different results highlighted in different systematic reviews describing nerve mobilization. Two of these systematic reviews emphasized different outcomes. One study said that nerve mobilization had no significant benefits (20), while another study proposed nerve mobilization for the benefits of pain reduction (21). In another study, it has been shown that decreases in the rate of surgical intervention using nerve mobilization are possible (22). In addition the effects of neural mobilization differ in another study, it has emphasized that it may be an appropriate option for improving the pain and function of patients with CTS (23). When these studies are evaluated, it is seen that more studies are needed for the effectiveness of nerve mobilization in the treatment of CTS. We decided to use neural mobilization in this study because of the different results and the need for further information on this subject. As a result

of this study, there were significant improvements in CTS symptoms and function in the treatment group with median nerve mobilization.

The main purpose of tendon gliding exercises used in the treatment of CTS increases the gliding motion of the median nerve in canalis carpi. Tendon and nerve gliding exercises are performed both postoperatively and in the conservative treatment of CTS (24). In the studies, tendon gliding exercises were generally applied together with nerve gliding exercises. In a study, were performed by Akalin et al., one group had only neutral wrist splints and the other group applied tendon and nerve gliding exercises with splint. As a result, it was found that the improvement in the exercise group was slightly higher (25). Sang-Dol Kim evaluated 4 randomized controlled trials in the review and as a result indicated that tendon and nerve gliding exercises in patients with CTS may have a positive effect when combined with classical therapies. However, more randomized controlled studies should be needed to assess the effect of tendon and nerve gliding exercises on CTS (26). In order to support the literature on this subject, we applied tendon gliding exercise to one of the groups. As a result of this study, CTS symptoms decreased and significant improvements were observed in this group.

Kinesio taping techniques, which have recently been increasing in popularity, is used in many diseases as well as CTS. There are a limited number of studies on the use of kinesio taping techniques in the treatment of CTS in the literature. In these studies, effects of kinesio taping techniques and applications such as splint, paraffin, laser, steroid iontophoresis were compared. In a study, kinesio taping techniques was compared with steroid iontophoresis and it was observed that the complaints of the patients decreased posttreatment and after the short-term follow-up (27). Kinesio taping, splint, paraffin applications compared in 3 separate studies performed. Kinesio taping techniques have been more effective. It is also emphasized that this application may be preferred because of the lack of side effects and the patient's compliance is good (28-30). In another study, kinesio taping was compared with low-energy laser treatment. The laser was effective, kinesio taping technique did not contribute to treatment in the short term but it was found to have an effect in the long term (31). In this study, we compared to efficiency of the kinesio taping technique and this technique with a treatment programme using all three types of myofascial releasing of flexor retinaculum, mobilization of the median nerve, and tendon gliding exercises. In both groups, we recorded significant improvements in CTS symptoms and functions.

It has been observed that both treatment groups have positive effects on the symptoms of CTS. When evaluated in terms of CTS functions, exercise group was more effective than kinesio taping group. The reason for this is that according to the information received from the patients during the treatment, especially the

palms are wetted and kinesio taping separated from the skin. In addition, the band creates a feeling that there is a different material on the body with both visual and tactile sense. Therefore, we think that hand functions are restricted by patients.

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