

The Use of Kinesio Tape for Carpal Tunnel Syndrome

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Abstract:

Carpal tunnel syndrome is the most common peripheral compression neuropathy. Most patients are middle-aged women, and relatively young male and female workers who experience symptoms performing repetitive manual labor. The symptoms of CTS lead to socioeconomic hardship for the patients and high costs for society.

The purpose of this study is to investigate the effect of Kinesio Taping treatment to release the median nerve, increase the wrist joint's range of motion and pinch force of the fingertip. Subjects included two archery players and two computer operators with CTS on the right hand that was diagnosed by physicians. Their symptoms included pain, numbness, and tingling for more than two years.

Subjects in this study were tested after treatment and non-treatment with Kinesio Tape to measure and analyze the accuracy and the variability of pinch force of fingertip and mean power frequency for action muscles.

The results of this study indicated that the MPF of FCU after taping was smaller than when non-treated. But the mean of pinch force and the variability of pinch force in radial deviation were not significantly different. It appears that participants can perform the same tasks while treated with Kinesio Tape or not, but at a different rate of muscular recruit.

Introduction:

Carpal Tunnel Syndrome can result from work related disorders or overuse. It involves sensory and motor deficits arising from median nerve compression caused by such activities as housework, cycling, weightlifting, all of which can provoke or exacerbate the syndrome. The causal risk factors for work-related upper extremity disorders are repetition, prolonged static postures and high force exertions (Cannon et al., 1981).

Many factors can lead to the sensory and motor abnormalities often seen on this local nerve compression syndrome, including hand and wrist overuse; improper wrist and hand positioning; prolonged, repetitive flexion and extension of the wrist and repetitive grasping (Steyers, 1995). The classical findings of a significantly slowed median nerve conduction velocity for both sensory and motor fibers, with a prolonged distal motor latency and reduced amplitude compared to age-related norms are unambiguous, but these criteria are often only partially present. (Westman, 1991)

Most ergonomics instruments for assessing work related exposure risk attempt to quantify one or more of these task characteristics. Repetition or its proxy of cycle time, and static working posture can be assessed visually. In Brian's (1999) study he suggests that individuals with CTS lose some ability to efficiently coordinate grip force on hand tools and exert higher grip forces on tools, at equivalent application forces, than controls. Athenes and Wing (1989) defined coordination as the way in which different motor acts are coupled with regard to their temporal and spatial characteristics to allow for a more efficient motor performance.

NIOSH (1997) illness cases in 1994 found work-related upper extremity disorders comprised 13% of the illness cases involving lost days from work and the annual cost of occupational musculoskeletal disorders is estimated to be between \$13 billion and \$20 billion (Lowe & Freivalds, 1999).

Carpal tunnel syndrome could be treated with surgery, but Vellani (1993) found that within 2 years of surgery, 75% of the patients showed recurrence of pain symptoms. Thus, surgery does not seem to definitively resolve symptoms. Typically, conservative treatment involves activity

modification combined with nonsteroidal anti-inflammatory medication and wrist splints (Steyers & Schelkun, 1995). The purpose of this study was to investigate the effect of fatigue on CTS patients' treatment before and after application of Kinesio Tape.

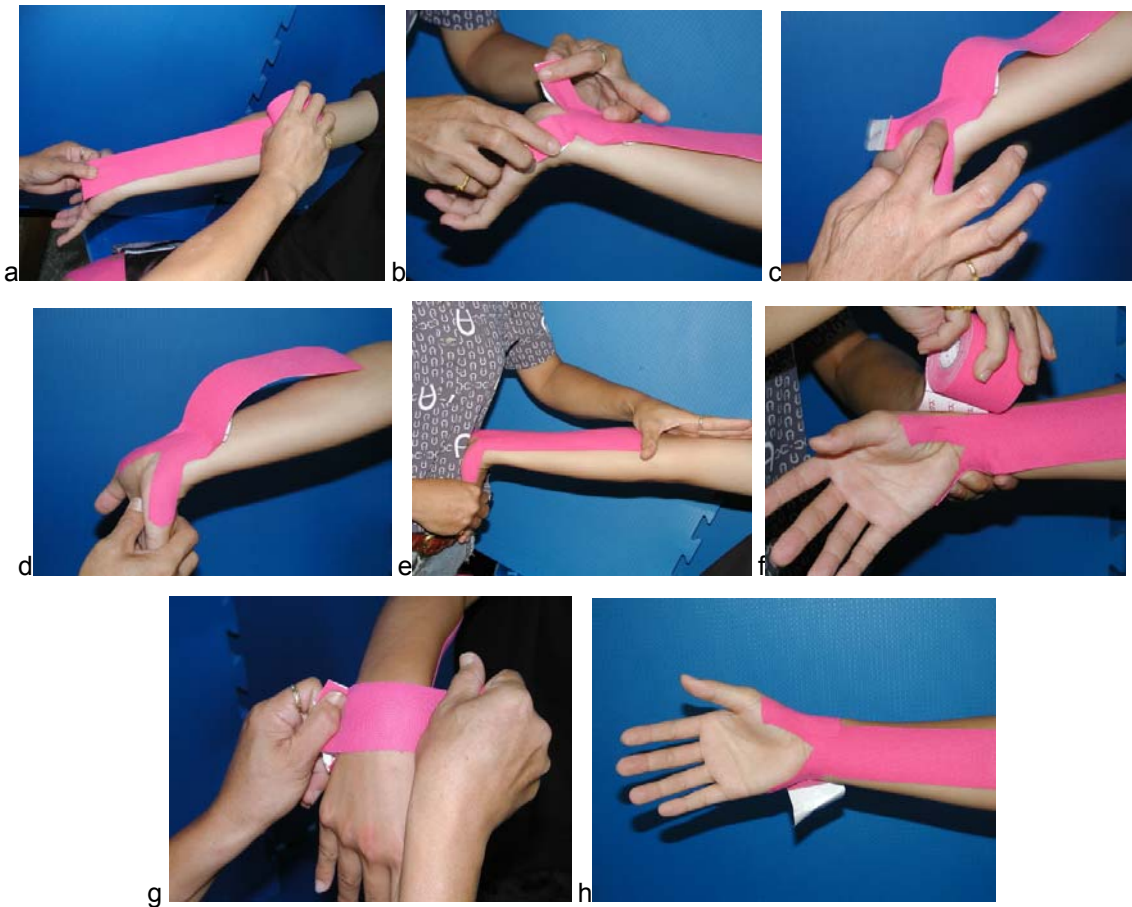


Figure 1. The process of Kinesio Taping for CTS.

Method:

Four housewives with CTS, diagnosed by physicians and with symptoms of pain, numbness, and tingling on the right hand for more than two years, served as participants for this study. Participants were tested for pinch force in wrist flexion, wrist flexion with radial deviation, and wrist flexion with ulnar deviation for one minute with no treatment and then after Kinesio Taping. The method of Kinesio Taping is shown in figure 1.

The BioPac MP100 system with one pinch meter (Takei Kiki Kogyo Co., Ltd.; Serial No. 01002) and two bipolar EMG electrodes (BioPacTSD 150A) was used to record pinch force between the thumb and the index finger, the EMG signal of flexor carpi ulnaris (FCU), and the EMG signal of flexor carpi radialis (FCR) respectively. The sampling rate was set on 2000Hz. The AcqKnowledge version 3.7.2 was used to analyze the pinch force and EMG signals. The mean power frequency (MPF) that presented the fatigue index for the first 10 seconds and the last 10 seconds was transformed from the processing as following: bandpass filter in 50-450Hz, the fast Fourier transformation, square of frequency diagram, and calculated MPF. The repeated measures two-way ANOVA were used to test the statistical differences with the alpha level .05.

Results and Discussion:

Table 1 shows the selected summary of two-way ANOVA for both fatigue and taping. There were no significant statistical differences between the two. This study analyzed the main effect for two factors. Table 1 shows that there was statistical difference in the main effect of MPF for FCU under radial deviation on the CTS hand. After comparison for the mean, the MPF of FCU under taped condition was smaller than under non-treatment condition.

The variables of pinch force in wrist flexion, MPF for FCR in wrist flexion, MPF for FCU in wrist flexion, MPF for FCU in ulnar deviation, and MPF for FCU in radial deviation all showed significant statistical differences. Combined with the results of the mean of pinch force and the variability of pinch force in radial deviation, there were no significant differences.

It appears that participants perform the same task under the with non-treatment and with Kinesio Tape with different rates of muscular recruitment. The recruitment rate with Kinesio Tape treatment was lower than with non-treatment.

According to Enoka (2002) the effect of muscle wisdom says that the muscle possesses the ability to discharge reductively its motor neurons to match the reduction or change in muscular recruitment rate to relax. It also explains the economical activation of muscle. This result indicated that Kinesio Tape would enhance the ability to decrease the motor neurons supplied by the drive of the central system.

Table 1. Summary of two-way ANOVA for fatigue and taping conditions on CTS hand.

Variable and source	df	MS	F	η^2
Variability of pinch force in wrist flexion				
Fatigue	1	9990.019	20.925*	.875
Taping	1	9990.008	0.646	.177
Fatigue × Taping	1	9990.002	0.958	.242
MPF for FCR in wrist flexion				
Fatigue	1	1798.523	15.785*	.840
Taping	1	9991.641	0.002	.001
Fatigue × Taping	1	9990.055	0.000	.000
MPF for FCU in wrist flexion				
Fatigue	1	3864.021	53.114*	.947
Taping	1	9556.309	2.056	.407
Fatigue × Taping	1	9925.319	0.177	.056
MPF for FCU in ulnar deviation				
Fatigue	1	2118.577	57.809*	.951
Taping	1	9245.126	2.075	.409
Fatigue × Taping	1	9948.672	0.260	.080
MPF for FCU in radial deviation				
Fatigue	1	2502.551	22.455*	.882
Taping	1	9992.102	18.189*	.858
Fatigue × Taping	1	9916.995	90.438	.127

*p < .05

The results of testing in the normal hand for the conditions of fatigue and after taping is shown in table 2. The analysis of variance for all parameters indicated there were no significant statistical interactions for the two factors. And further, this study tested the main effect for the two factors. The main effect of taping also showed that there were no statistical differences between the treatment of taping and non-treatment. But the main results for the condition of fatigue showed that the mean force of pinch in wrist flexion, MPF for FCU in wrist flexion, MPF for FCU in ulnar deviation, and MPF for FCU in radial deviation were significantly different.

In a comparison of the results of the hand with CTS and the normal hand, the Kinesio Tape treatment for the normal hand did not seem to enhance the performance on the pinch test. The treatment of Kinesio Tape on hand with CTS could be consistent with the performance of pinch by reduction of the rate of muscular recruitment. It also means that the CTS that causes the compression of center median nerve, is relaxed through slowed median nerve conduction velocity for both sensory and

motor fibers significantly (Westman, 1991). This study of the influence of treatment by Kinesio Tape with a prolonged distal motor latency and reduced amplitude will need further study to verify.

Table 2. Summary of two-way ANOVA for fatigue and taping conditions on normal hand (left hand).

Variable and source	df	MS	F	η^2
Mean force of pinch in wrist flexion				
Fatigue	1	9994.305	12.607*	.808
Taping	1	9990.031	0.035	.012
Fatigue × Taping	1	9990.321	4.029	.573
Variability of pinch force in wrist flexion				
Fatigue	1	9990.011	0.453	.131
Taping	1	9990.005	0.357	.106
Fatigue × Taping	1	9990.012	11.354*	.791
MPF for FCU in wrist flexion				
Fatigue	1	3864.021	53.114*	.947
Taping	1	9556.309	2.056	.407
Fatigue × Taping	1	9925.319	0.177	.056
MPF for FCU in ulnar deviation				
Fatigue	1	2507.481	12.172*	.802
Taping	1	1351.867	91.795	.374
Fatigue × Taping	1	9989.015	94.546	.602
MPF for FCU in radial deviation				
Fatigue	1	1247.838	40.112*	.930
Taping	1	9277.431	0.514	.146
Fatigue × Taping	1	9983.215	3.151	.512

*p < .05

Conclusion:

The carpal tunnel is clinically significant not only because of the importance of the structures within it, but also because of the frequent incidence of carpal tunnel syndrome and its resulting clinical problems. In this syndrome, compression of the median nerve can restrict motor function as well as sensation along the median nerve distribution of the hand. Less frequently, constriction of the tunnel traps the tendons running through it, and restricts, and may even prevent, flexion the fingers.

In testing of wrist flexion toward the radial side, when subject's flexor carpi radialis weakness caused decreases the strength of wrist flexion, and pronation strength may be diminished, causing an ulnar deviation of the hand. Wrist flexion toward the ulnar side, when subject's flexor carpi ulnar weakness caused decrease in the strength of wrist flexion, and may result in a radial deviation of the hand. Flexion of the wrist, when subject's palmaris longus weakness resulted in decrease in the ability to cup the palm of the hand. (Kendall & McCreary, 1983)