Effects of kinesiology taping on the upper-extremity function and activities of daily living in patients with hemiplegia

EUNG-BEOM KIM, PhD1, YOUNG-DONG KIM, DPT, PT2*

1) Department of Beauty and Health Care, Daejeon University, Republic of Korea
2) Human Movement Research: 497 Wolpyeong-dong, Seo-gu, Daejeon 302-281, Republic of Korea

Abstract. [Purpose] This study determined the effects of kinesiology taping on the upper-extremity function and activities of daily living of patients with hemiplegia. [Subjects] The experimental group and control group comprised 15 hemiplegia patients each. [Methods] This study was performed from June 4 to December 22, 2012, involving 30 hemiplegia patients. The experimental and controls groups performed task practices for 30 minutes, 3 times per week for 28 weeks with and without taping, respectively. [Results] After treatment, there were significant differences in every outcome measures within each group except for the Brunnstrom recovery stage of the hand. However, there was a significant difference in functional independence movements between the groups. [Conclusion] Task practice has the same effectiveness regardless of the taping of the upper extremities. Nevertheless, taping is helpful for improving both the functions and activities of daily living in patients with hemiplegia.

Key words: Activities of daily living, Upper limb function, Taping

INTRODUCTION

Lack of functional ability in the upper extremities after stroke restricts usage, and causes asymmetric posture and contracture in daily life, thus exacerbating functional limitations of the upper limbs. The functional recovery period of the upper limbs in patients with hemiplegia is estimated to be 11 weeks after stroke. However, if there is no functional improvement with intensive treatment in this period, it is difficult to expect better prognosis or improvement. Previous studies demonstrate that applying kinesiology tape in the same direction as the muscle fibers facilitates muscle function, while perpendicular application inhibits muscle function. Moreover, the underlying mechanism of the effect of therapeutic taping remains controversial. However, there is no report on the influence of taping with respect to a neurophysiologic background. Thus, additional in-depth quantitative studies about the effects of taping on balance, gait, injury prevention, strength, range of motion, and proprioception are required to confirm its clinical efficacy. Therefore, this study determined the effects of kinesiology taping on upper-extremity function and activities of daily living (ADL) in patients with hemiplegia. This study involved an alternative medicine intervention in order to demonstrate whether taping improves movement dysfunction after stroke. Thus, the results will provide fundamental data for the application of this technique in clinical practice.

SUBJECTS AND METHODS

This study was conducted from June 4 to December 22, 2012 on 30 post-stroke patients who were hospitalized in a rehabilitation hospital in Chungcheong province, South Korea. The patients were randomly divided into 2 groups. The patients in the experimental group (EG, n = 15) and control group (CG, n = 15) performed task practice with and without 3NS kinesiology taping, respectively. The inclusion criteria were as follows: post-stroke hemiplegia, at least 6 months since onset, and ability to communicate and understand instructions. Meanwhile, patients with peripheral neuropathy, musculoskeletal disease, or dementia were excluded. All patients provided written informed consent to participate in the study prior to its commencement. The inclusion criteria were as follows: post-stroke hemiplegia, at least 6 months since onset, and ability to communicate and understand instructions. The intervention was performed for 30 minutes, 3 times per week for 28 weeks for a total of 84 sessions. Patients rested 2 minutes between each practice. The patients practiced tasks as per the researcher’s instructions, while sitting on a comfortable chair. The task practices included wiping a table with a towel, putting a block into a box, and stacking cups.

The taping was applied as shown in Figs. 1 and 2. For the anterior aspect of the middle deltoid, the patient extended their arm and performed slight external rotation; then, the therapist placed the tape on the region from the humerus prominence to the coracoid process. For the posterior aspect of the middle deltoid, the patient placed the affected
side of the hand on the opposite side of the acromion process, and the tape was placed on the region from the humerus prominence to the lateral third of the scapular spine. For the lateral portion of the quadratus lumborum, the tape was applied from the posterior superior iliac spine to the 12th rib while the trunk was bent laterally to the unaffected side. For the medial portion of the quadratus lumborum, the tape was placed from the posterior superior iliac spine along the transverse processes of the lumbar vertebrae while the trunk was bent forward. Upper-extremity function and ADL were assessed by using the manual function test (MFT) 5), modified motor assessment scale (MMAS) 6), Brunnstrom recovery stage 7), and functional independence measure (FIM) 8).

All data were analyzed by using SPSS version 18 (SPSS Inc., Chicago, IL, USA). The $\chi^2$ test was used to analyze the general characteristics of the patients. Because the Kolmogorov-Smirnov test indicated the data were not normally distributed, the Wilcoxon signed-ranked test and Mann-Whitney U-test were used to determine intra- and intergroup differences, respectively. All data are presented as mean ± standard deviation (SD). The $\alpha$ level was set at $\alpha = 0.05$, and the level of significance was set at $p < 0.05$.

RESULTS

The EG comprised 8 women and 7; 8 and 7 patients had right and left hemiplegia, respectively. Meanwhile, the CG comprised 9 women and 6 men; similar to the EG, 8 and 7 patients had right and left hemiplegia, respectively. The mean ages of the EG and CG were 69.20 ± 7.07 and 67.33 ± 9.50 years, respectively. There were no significant differences in the general characteristics between groups. However, the MFT and MMAS results differed significantly after the intervention in both groups (EG: 22.47 ± 6.55 and, 13.87 ± 5.06; CG: 21.33 ± 6.23 and, 13.80 ± 5.25, respectively). However, there were no significant differences between groups pre- or post-intervention. There was no significant change in the Brunnstrom recovery stage of the hand after the intervention in either group, but the mean of post-intervention score tended to be higher in the EG. However, post-intervention, the FIM changed significantly within each group and differed significantly between groups (Table 1).

DISCUSSION

A previous study evaluating the effects of kinesiology taping indicates that applying tape to the affected upper limbs of post-stroke patients reduces spasms, resulting in improved range of motion, strength, and function 9). Another study reports that muscle recruitment patterns can be altered because of better proprioception by stimulating mechanoreceptors 10). In the present study, both groups showed significant improvements in the MFT and MMAS results. This indicates that task practice positively influenced upper-extremity function, regardless of taping. However, an additional benefit was observed in the EG. This suggests that applying tape can improve the restricted coordinated movement of joints in the upper extremities because of dysfunc-

| Table 1. Changes in upper-limb function and activities of daily living ($N = 30$) |
|----------------------|----------|----------|----------|----------|----------|----------|
|                     | MFT     | MMAS    | BRSH     | FIM      |
| Pre                 | Post    | Pre     | Post     | Pre     | Post     | Pre      | Post    |
| EG (n = 15)         | 16.40 ± 5.85 | 22.47 ± 6.55\(^a\) | 9.87 ± 4.37 | 13.87 ± 5.06\(^a\) | 5.13 ± 1.30 | 5.27 ± 1.33 | 83.73 ± 16.03 | 90.53 ± 16.65\(^a\) |
| CG (n = 15)         | 19.80 ± 6.05 | 21.33 ± 6.23\(^a\) | 12.60 ± 5.19 | 13.80 ± 5.25\(^a\) | 5.40 ± 1.24 | 5.40 ± 1.24 | 77.13 ± 16.66 | 78.40 ± 16.62\(^a\) |

\(^a\): $p < 0.01$ within a group, \(^b\): $p < 0.05$ between groups.

EG: experimental group; CG: control group; MFT: manual functional test; MMAS: manual motor assessment scale; BRSH: Brunstrom recovery stage of the hand; FIM: functional impairment movement.

Fig. 1. Taping of the deltoid muscle

Fig. 2. Taping of the quadratus lumborum muscle
This indicates that applying tape to the shoulder and lumbar region improves postural control and shoulder girdle stability. In other words, mobility improved because of better stability. However, there was no significant difference in the Brunnstrom recovery stage of the hand either within each group or between the groups. This demonstrates that taping does not affect the control of muscle tone or coordination in the distal part of the upper extremities. Furthermore, limited ability in manipulation did not improve prior to the recovery of the movement and stability in the proximal part of the upper limbs. Even if patients with hemiplegia can reach with their arm to grasp an object, they cannot do so because of an inability to manipulate the object using their hands. Thus, they have more restrictions for using the affected upper limb and will therefore have fewer opportunities to use it(12). This may be why patients with hemiplegia use support for their disabled hand or are unable to use it at all. Consequently, such patients experience many life difficulties after their stroke, because the functions of the upper limbs and hands are vital for ADL. Future studies should perform surface electromyography to verify that muscles affected by taping regain strength after the intervention.

REFERENCES

1) Ryerson SD: Hemiplegia. In: D. A. Umphred (Ed) Neurological Rehabilitation, 4th ed. St. Louis: Mosby, 2001, pp 741–789.
2) Levy CE, Nichols DS, Schmalbrock PM, et al.: Functional MRI evidence of cortical reorganization in upper-limb stroke hemiplegia treated with constraint-induced movement therapy. Am J Phys Med Rehabil, 2001, 80: 4–12. [Medline] [CrossRef]
3) Morrissey D: Proprioceptive shoulder taping. J Bodyw Mov Ther, 2000, 4: 189–194. [CrossRef]
4) Tobin S, Robinson G: The effect of McConnell’s vastus lateralis inhibition taping technique on vastus lateralis and vastus medialis obliquus activity. Physiotherapy, 2000, 86: 173–183. [CrossRef]
5) In TS, Jung KS, Lee SW, et al.: Virtual reality reflection therapy improves motor recovery and motor function in the upper extremities of people with chronic stroke. J Phys Ther Sci, 2012, 24: 339–343. [CrossRef]
6) Loewen SC, Anderson BA: Predictors of stroke outcome using objective measurement scales. Stroke, 1990, 21: 78–81. [Medline] [CrossRef]
7) Hirayama M, Nagata Y, Tsutou A: Relationship between body composition and functional outcomes in males with subacute stroke. J Phys Ther Sci, 2007, 19: 177–182. [CrossRef]
8) Granger CV, Cotter AC, Hamilton BB, et al.: Functional assessment scales: a study of persons after stroke. Arch Phys Med Rehabil, 1993, 74: 133–138. [Medline]
9) Sun SF, Hsu CW, Hwang CW, et al.: Application of combined botulinum toxin type A and modified constraint-induced movement therapy for an individual with chronic upper-extremity spasticity after stroke. Phys Ther, 2006, 86: 1387–1397. [Medline] [CrossRef]
10) Semple S, Esterhuysen C, Grace J: The effects of kinesio ankle taping on postural stability in semiprofessional rugby union players. J Phys Ther Sci, 2012, 24: 1239–1242. [CrossRef]
11) Kopp B, Kunkel A, Mühlニックel W, et al.: Plasticity in the motor system related to therapy-induced improvement of movement after stroke. Neuroreport, 1999, 10: 807–810. [Medline] [CrossRef]
12) Ryerson S, Levit K: Functional movement reeducation. Churchill, Livingstone, 1997.