

Effect of Kinesiotaping and Joint Mobilization on The Metatarsophalangeal Joint Angle and Pain in Hallux Valgus Patients

The aim of this study was to observe the effects of kinesiotaping and joint mobilization on the metatarsophalangeal joint angle and pain in hallux valgus patients. Twenty-one female hallux valgus patients in their 20s were divided into two groups, a Kinesiotaping group (KT, n=10) and another group with the addition of joint mobilization (KTJM, n=11). After undergoing 6 weeks of intervention, the change in the metatarsophalangeal joint and pain were measured. Metatarsophalangeal joint angle was significantly increased both the KT and the KTJM group after intervention. In the change of pain, both the KT and KTJM groups on an individual basis also experienced a significant decrease in pain, though comparison between the two groups failed to represent a significant difference. These findings suggest that Kinesiotaping and joint mobilization increased the joint angle and reduced pain.

Key words: *Kinesiotaping, Joint Mobilization, Hallux Valgus*

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INTRODUCTION

In the case of hallux valgus, the hallux flexor acts as an abductor which causes internal rotation of the hallux or subluxation of the sesamoid. As a result the 2nd, 3rd, and 4th metatarsal bones move downward and the 1st and 5th metatarsal bones move upward causing the transverse metatarsal bone arch to disappear. Consequently the nerves to the transverse arch ligament or the head of the metatarsal bone become compressed causing neuroma or the callusing of the skin underneath the head of the metatarsal bone¹⁾. There are various reasons for the occurrence of hallux valgus, one of which includes the excess movement of the 1st row which acts as the functional unit of the 1st metatarsal bone and the 1st sphenoid bone²⁾. The greatest cause of the longi-

tudinal rotation of the 1st row is thought to be the rotation of the hindfoot, whose rotation is in turn caused when the floor has a relatively steep incline in the axis of the 1st metatarsal joint³⁾. Furthermore, from this region, if the metatarsophalangeal joint were not able to endure the force created from wearing shoes or body weight itself, hallux valgus occurs⁴⁾. Also, imbalance of the agonist and antagonist muscles for the hallux adductor and abductor muscles or overuse of the hallux abductor muscles have also been reported as causing hallux valgus^{4,5)}.

Radiographs can not only identify the abnormal skeletal structure of the hallux valgus but also differentiate the mutation of the surrounding soft tissues⁴⁾. In Mann and Coughlin (1993), the hallux valgus angle and the angle of the 1st and 2nd metatarsophalangeal joint have been commonly

used to classify the severity of hallux valgus⁶⁾. Mild hallux valgus is defined as having a hallux valgus angle of less than 20° and a 1st and 2nd metatarsophalangeal joint angle of less than 11°. Furthermore the subluxation of the lateral sesamoid should be less than 50%. Moderate hallux valgus is defined as a hallux valgus angle between 20~40° and a 1st and 2nd metatarsophalangeal joint angle of less than 16°. The subluxation of the lateral sesamoid should be measured between 50~70%. Severe hallux valgus is defined as having a hallux valgus angle above 40° and a 1st and 2nd metatarsophalangeal joint angle greater than 16°. The subluxation of the lateral sesamoid should be above 75%⁷⁾.

Kinesiotaping is grounded on exercise muscle physiology and kinematic mechanics. The elastic adhesive tape has similar functional properties as human muscle which helps promote muscle contraction and relaxation as well as blood circulation, restoring equilibrium to the muscle. As such, kinesiotaping is used as an intervention method to alleviate symptoms⁸⁾. Jeon et al. (2004) reported a decrease in pain and angle deformation during a 4 week intervention where hallux valgus patients were treated with kinesiotaping⁹⁾. Lee (2001) observed that application of kinesiotaping in patients with pain while walking resulted in the reduction of pain after the intervention¹⁰⁾.

Joint mobilization is a manual therapy technique that applies a combination of passive traction and a sliding motion to a joint surface in order to restore the free movement and normal range of motion¹¹⁾. This technique is used not only for the treatment of disorders with pathological origin such as pain, muscle defect, or muscle spasm but has also proven to be effective in treating hypomobile joints and joints experiencing progressive limitation in movement¹²⁾.

For treatment of hallux valgus, it is common to be recommended for surgery or be given specially designed orthotics^{13,14)}. However, surgery requires patients to endure a long period of recovery, does nothing to aid with other related joint disorders such as arthritis, and report high rates of recurrence^{15,16)}. As such, for a non-surgical alternative, the effect of kinesiotaping and joint mobilization on the metatarsophalangeal joint angle and pain in hallux valgus patients is observed so as to provide practicing therapists with an adequate primary clinical data.

METHODS

Subjects

21 female hallux valgus patients who had visited and been diagnosed at "N" orthopedic clinic in Cheonan city were selected to undergo weight bearing radiography and confirmed as having a hallux valgus angle of less than 25°. Patients were also confirmed to have no other podiatric disorders other than hallux valgus. Before commencing the study, the purpose and method of the research were thoroughly explained to the participants and a written form of consent was obtained from each individual in accordance with the Declaration of Helsinki. Subjects were randomly divided into a Kinesiotaping group (KT) consisting of 10 participants and a Kinesiotaping with additional joint mobilization group (KTJM) consisting of 11 participants. The intervention lasted a total of 6 weeks after which the hallux valgus angle and pain was measured.

Table 1. General characteristics of subjects

Variable	KT(n=10)	KTJM(n=11)
Age(years)	21.24±1.27	22.28±1.57
Height(cm)	157.74±4.37	158.39±3.51
Weight(kg)	52.61±6.73	54.17±5.39
VAS(score)	4.61±1.78	4.97±1.51
Duration of disease(month)	17.5±18.4	14.7±22.3

KT: Kinesiotaping, KTJM: Kinesiotaping with jointmobilization, VAS : visual analogue scale

Intervention Methods

The KT group underwent 6 weeks of kinesiotaping and every 3 days, the elasticity and state of adhesion was checked, with the taping being redone if necessary. To ensure the elasticity of the tape, each strip was cut 1/4 of the measured length before application. Details of the method are as follows. Starting from the outside of the foot, the tape was stretched across the top of the foot, and wrapped under and in front the distal joint of the 1st phalange, passing the inner sole. From the outside of the foot, the bottom of the 1st metatarsal joint was crossed and with toes adducted, the tape was passed through the 1st and 2nd phalange, before wrapping around and pulling the 1st phalange back. To ensure that the tape did not attach to the toenail, the width of the tape was cut accordingly. The 1st phalange was also

kept as straight as possible and the tape was attached from the outside of the 1st phalange to the anterior portion of the medial malleolus. For the finish, a narrow strip of tape was wrapped around the portion of the 1st phalange where the toenail ended, being careful to ensure once again that the tape did not adhere to the toenail itself¹⁷.

The KTJM group received both kinesiotaping and joint mobilization for 6 weeks. The kinesiotaping for the KTJM group was conducted in the same manner as the KT group. Subjects underwent joint mobilization 3 times every week. The Maitland joint mobilization technique was used and the method is as detailed in the following. The proximal hand was placed close to the MTP joint line in order to stabilize the metatarsus, while the distal hand was placed on the proximal phalanx. The direction of joint mobilization was aimed laterally with a grade III level of intensity. The rhythm of the mobilization used was staccato and the speed was medium (1 oscillation per 1 second) for a duration of 1 minute with 5 sessions per day¹⁸.

In order to measure the change in foot angle, a radiographic examination was performed. Radiographs were taken bilaterally with the foot in dorsiflexion. The subject was instructed to stand on one foot with the radiograph taken at 15°, at a distance of 40 inches, and the aim centered around the navicular bone. With the angle of the hallux valgus being created by the 1st metatarsal bone and the long axis of the 1st proximal phalanx, the angle between the major axis of

the 1st and 2nd metatarsal bones was measured. Foot pain was measured using the visual analogue scale (VAS). VAS is a pain assessment tool that displays the degree of subjective pain on a scale from 0 to 10 cm, and uses the length measured from start to the indicated spot to identify the severity of pain.

Data Analysis

This study used the SPSS 20.0 for statistical analysis of the data obtained. The Shapiro–Wilk test was used to determine the normality of all categories. The Pearson chi squared and independent sample t test was used in order to examine the homogeneity of the subjects’ characteristics. The paired t test was used to compare the differences between the pre- and post-intervention groups. The independent t test was used for comparison between the two groups. The statistical significance was set at .05.

RESULTS

Both the KT and KTJM groups showed a significant decrease in the angle of the metatarsophalangeal joint. There was also a significant difference between the two groups.

Both the KT and KTJM groups showed a significant decrease in pain. There was no significant difference between the two groups.

Table 2. Comparison of metatarsophalangeal joint angle after KT and KTJM (Unit : angle)

	KT Mean±SD	KTJM Mean±SD	t	p
Pre	20.47±4.17	20.51±3.76	.937	.351
Post	17.23±4.27	15.47±4.31	3.129	.004**
t	3.957	3.870		
P	.001**	.001**		

**p<.05, KT: Kinesiotaping, KTJM: Kinesiotaping with jointmobilization, VAS : visual analogue scale

Table 3. Comparison of Pain after KT and KTJM (Unit : VAS Index)

	KT Mean±SD	KTJM Mean±SD	t	p
Pre	3.72±1.67	4.17±0.74	.627	.531
Post	3.24±1.33	3.17±.57	2.235	.061
t	3.217	3.597		
P	.005**	.004**		

**p<.05, KT: Kinesiotaping, KTJM: Kinesiotaping with jointmobilization, VAS : visual analogue scale

DISCUSSION

Treatment of hallux valgus usually requires surgery or orthotics. In some cases shoes or insoles are also offered to mediate symptoms. Unlike these methods of treatment, this study examines the effect of kinesiotaping and joint mobilization on the change in hallux valgus angle and pain.

In this study, both the KT and KTJM group showed a significant decrease in the metatarsophalangeal joint angle. Kinesiotaping has shown to increase muscle activity and stimulate not only the muscle but also the internal structures underneath the skin where the tape is attached^{19,20}. Taping is also a highly effective auxiliary tool for muscle strengthening as application of the tape to the waist area requires more muscular activity to create motion. Furthermore, kinesio taping has been shown to reinforce muscular strength of the foot, waist, elbow joints, and shoulder joints whilst also improving the range of motion in joints and thus, improving body function as well^{21,22}. There was a significant decrease in the angle of the metatarsophalangeal joint in the KT group. This result is attributed to the increased surface area of the muscle and skin to which the kinesio tape was attached as well as the affected blood and lymphatic vessels which would have increased circulation in both. As such, the areas of attachment would have undergone improvement in muscle function and also received therapeutic effects^{17,23,24}.

In order to create free movement, joint mobilization is applied through traction, sliding, compression, rolling, and spinning techniques. The goal is to increase the range of motion by stretching the stiff tissues and stimulate faster recovery and ease the symptoms of the damaged joint by facilitating supply of nutrition^{25,26}. Joint dysfunction is a state that is either increased, decreased, or kinematically mutated from the normal range of motion²⁷. As such, hallux valgus patients having a similarity to joint dysfunction, can be expected to experience a decrease in the angle of the metatarsophalangeal joint with proper application of joint mobilization²⁷⁻²⁹. In this study, the reduction in metatarsophalangeal joint angle was more significant in the KTJM group than the KT group. This result is attributed to the theory that joint mobilization helps manage joint dysfunction and the combined kinesiotaping also promoted lymph and blood supply to the attachment site which would have allowed for a continued stimulation of

the gamma motor neurons (also referred to as the cutaneous fusimotor reflex). Furthermore, the attachment sites would have also promoted the function of the muscle^{17,23-26,30,31}.

In this study, both the KT and KTJM groups showed a significant decrease in pain. The stimulation in the joints from joint mobilization would have been transmitted to the central nervous system through the A β nerve fibers. This stimulus suppresses the pain transmission of the C fibers that transmit a noxious stimulus to the peripheral nervous system (gate control theory)^{25,26}. Therefore, an explanation can be sought from this physiological mechanism of pain reduction. Furthermore, the positive effects of kinesiotaping mentioned above may also contributed to the reduction of pain^{17,23,24}. The reduction in the metatarsophalangeal joint may also be taken into account.

This study is not without limitations. The results of this study are difficult to generalize to the public as the elasticity of the kinesiotape varied depending on the activity levels of the subject. In another note, the subjects were limited to female patients with mild hallux valgus in their 20s. Further studies on female patients with hallux valgus will be needed in order to take into account a wider breadth of ages and severity of hallux valgus. On a final note, comparison of muscle activity around the hallux was not conducted and further studies should take into account the necessity of these measurements.

CONCLUSIONS

21 female hallux valgus patients in their 20s underwent a 6 week kinesiotaping and joint mobilization intervention program with the following results.

1. Both KT and KTJM groups showed a significant decrease in the angle of metatarsophalangeal joint angle. There was also a significant difference between the two groups.
2. Both KT and KTJM groups showed a significant decrease in pain.

As kinesiotaping and joint mobilization has shown to reduce the metatarsophalangeal joint angle as well as pain, these methods should be

considered as effective forms of hallux valgus treatment in alternative to surgery and application of orthotics. Future studies are recommended to further examine the effect of kinesiotaping and joint mobilization on surrounding muscles of the joint.

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