

SHORT-TERM EFFECTS OF KINESIOTAPING ON PAIN AND JOINT ALIGNMENT IN CONSERVATIVE TREATMENT OF HALLUX VALGUS

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ABSTRACT

Objective: The main aim of this study was to measure short-term effects of kinesiotaping on pain and joint alignment in the conservative treatment of hallux valgus.

Method: Twenty-one female patients diagnosed with a total of 34 feet with hallux valgus (13 bilateral, 6 right, and 2 left) participated in this study. Kinesiotaping was implemented after the first assessment and renewed in days 3, 7, and 10. The main outcome measures were pain, as assessed using visual analog scale, and hallux adduction angle, as measured by goniometry. Secondary outcome measure was patients' functional status, as measured by Foot Function Index and the hallux valgus scale of the American Orthopaedic Foot and Ankle Society (AOFAS). The radiographic results were also measured before and after 1 month of treatment. The Wilcoxon test was used to compare the differences between initial and final scores of AOFAS, as well as FFI scales and hallux valgus angle assessment scores.

Results: There was a significant reduction in goniometric measurement of hallux valgus angle ($P = .001$). There was a significant reduction in pain intensity ($P = .001$) and AOFAS and Foot Function Index scores at the end of the treatment ($P = .001$ and $P = .001$, respectively). There was a significant difference between radiographic results in 1-month control ($P = .009$).

Conclusions: For this group of female patients, pain and joint alignment were improved after a 10-day kinesiotape implementation in patients with hallux valgus. The findings showed short-term decreased pain and disability in hallux valgus deformity. (*J Manipulative Physiol Ther* 2015;38:564-571)

Key Indexing Terms: *Hallux Valgus; Pain; Conservative Treatment*

Hallux valgus was first proposed as a common pathologic entity affecting the great toe.¹ Although there are predisposing factors leading to hallux valgus, such as family history, female sex, inappropriate shoe wear, and occupation,¹⁻⁷ the underlying mechanism still remains unclear.⁴ The prevalence of hallux valgus increases with age^{4,5} and may cause balance problems and difficulty in walking^{8,9}; it affects the quality of life and function,¹⁰ and it may also alter foot kinematics.¹¹

Orthotic devices,¹²⁻¹⁴ taping,¹⁵ exercise,¹⁶ modification of footwear, physical therapy modalities, and chiropractic mobilization¹⁷ are some of the conservative treatment options for hallux valgus. Surgery is another alternative for treatment and also has been shown to be effective. In 10% to 14% of the cases, recurrences or undercorrections are seen; surgery may also cause postoperative complications.¹⁸ One hundred fifty new surgery methods have been developed to reduce the deformity of hallux valgus, and this clearly shows the limited success of surgery.¹⁹ Conservative treatment plays a very important role in treatment of hallux valgus because it takes less time for the patient to return to activities and typically has reduced costs. However, it is important to maintain treatment effects over longer periods.^{20,21} Review studies in this area emphasize the lack of evidence to show the effectiveness of conservative treatment. Unfortunately, neither orthotics^{22,23} manipulative therapy nor exercise studies²⁴ have shown sufficient evidence for pain relief or a change in hallux abducto valgus angle on hallux abducto valgus deformity in longer periods. This warrants further research in this area.

Although there are various studies on the effectiveness of kinesiotape to restore muscle function and strength,²³⁻²⁶ improve range of motion,^{27,28} reduce pain,²⁵⁻³¹ and increase lymphatic drainage,³² the effects of mechanical correction is limited.

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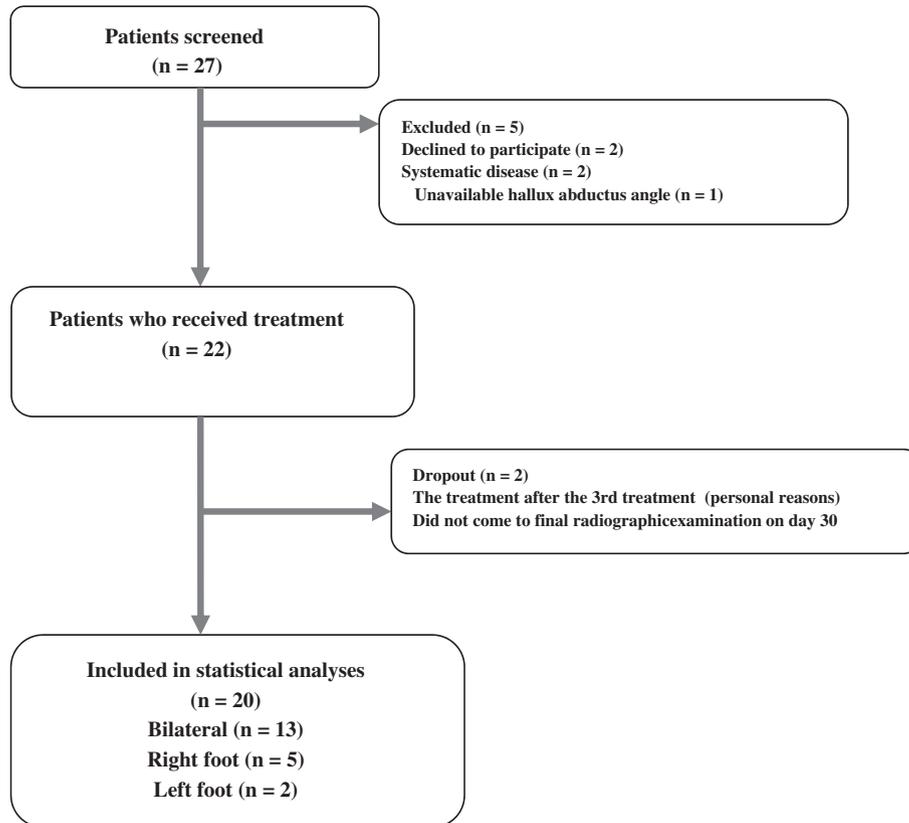


Fig 1. Flow chart for study.

The main purpose of this study was to measure the short-term effects of kinesiotape on hallux valgus deformity. Secondly, this study aimed to measure the short-term effects of taping therapy on pain and functional status in hallux valgus joint function. We hypothesized that a 10-day implementation of kinesiotaping used to realign the hallux would decrease the intensity of deformity on the joint and the pain patients suffer in a month time.

METHODS

Twenty-seven patients admitted to the Beypazari State Hospital were screened for the study. Three were excluded, and 2 refused to participate; thus, 22 female patients diagnosed with totally 35 feet with hallux valgus deformity (13 bilateral, 7 right, and 2 left) participated in this study. Only 1 patient's treatment was ceased on day 5 because the patient had to continue her education. Two patients did not attend the final radiographic assessment. There were no participant dropouts (Fig 1).

The inclusion criteria were female subjects between the ages 18 and 65 years diagnosed with hallux valgus deformity and willing to participate in the study.

The patients were excluded if they had had surgery or fracture related to the great toe, had a systematic disease (rheumatoid arthritis, systematic lupus erythematosus, diabetes mellitus, etc), and were not willing to participate in the study (Fig 2). The treatment was ceased if a surgery including the great toe was planned or if the patient did not want to continue to seek the treatment any longer.

Local ethics committee approval was obtained (Applied and Qualitative Research Ethics Committee reference HEK 10/58-48, 07.10.2010), and all subjects consented to participate in the study. An informed consent was given to patients about the risks, benefits, and the duration of the treatment. This study was performed in Hacettepe University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Prosthetics and Orthotics Unit, during the period from March 2011 to September 2011 (6 months).

Intervention

Subjects were taped with hallux valgus kinesiotaping method developed by Kenzo Kase.³³ Two Y-shaped kinesiotape pieces were used; the Y-shaped strip's base was placed on the base of the hallux. After the big toe was

Inclusion criteria	Exclusion Criteria	Ending criteria
<ul style="list-style-type: none"> Hallux abductus angle (15 to 40 degrees) VAS pain intensity higher than 6 20- 35 years age female No trauma or surgical history Surgery indicated but the patient is willing to try conservative treatment 	<ul style="list-style-type: none"> Fracture, surgical history of the great toe Systematic disease (Rheumatoid Arthritis, Systematic Lupus Erythematosus Diabetes Mellitus) Using NSAID, analgesic drugs Hallux rigidus diagnosis 	<ul style="list-style-type: none"> Subject does not want to seek the treatment any longer Pain increased Adverse effects of taping

Fig 2. Eligibility criteria for the study. NSAID, nonsteroidal antiinflammatory drug; VAS, visual analog system.

aligned to its estimated correct position (it was adducted by the practitioner manually) with a light to moderate tension, the tape was implemented through the first ray. This correction was done once during the implementation of the tape and took less than 10 seconds. No traction was used. The second tape piece was placed over metatarsophalangeal joints with a mechanical correction technique on hallux (Fig 3). A qualified physiotherapist with 5-year experience in the field performed all taping implementations in this study.

After the first implementation was completed, patients were permitted to walk around for 15 minutes to get used to the tape and to be observed for any adverse effects of taping. After this short period, assessment was repeated.

The taping method was performed on days 1, 3, 7, and 10 of the treatment. Assessments were performed before and after the tape implementation, as well as on days 3, 7, 10, and 30 (Fig 4).

All patients were informed about the importance of using appropriate shoes for their deformities, and they were given an exercise program for hallux valgus deformity at the end of the study. The exercise program consisted of strengthening and mobilization exercises. Strengthening exercise was performed in sitting position by patient was actively abducting the hallux (taking hallux far away from the second phalanx). Participants were instructed to perform this exercise by counting to 5 with 10 repetitions. Mobilization exercise was performed in a sitting position; the patient applied traction to her own hallux in longitudinal direction and then aligned the hallux without releasing traction for 30 seconds. This exercise was repeated 5 times. Each exercise was demonstrated by the physiotherapist, and the patients were instructed to perform the exercises twice a day for a minimum of 6 weeks.

Primary Outcome Measure

Adduction Angle. The primary outcome measure was defined as angle change in hallux valgus adduction angle. This measurement was done in 2 separate ways using clinical goniometry and radiographic measurement. A 360°, clear plastic universal goniometer (Baseline 360 degree rulong

goniometer; NexGen Ergonomics, Inc, Pointe Claire, Canada). Hallux valgus adduction angle measurement by using universal goniometry was performed while the patient was in a non-weight-bearing sitting position before and after the implementation as well as on days 3, 7, 10, and 30.

Manual radiographic assessment was performed with the method explained by Srivastava et al.³⁴ Non-weight-bearing dorsoplantar radiographs were obtained with the patients in sitting position in the same manner. The radiograph measurement was performed by an orthopedic surgeon who had 10 years of experience in the field. Each radiograph was placed on a radiograph viewing box, and each landmark was marked using a transparent ruler and a marking pen. The hallux adductus angle was determined between the 2 lines, which were drawn on the radiograph: (a) the line between bisection of the first metatarsal bone basis and first metatarsal bone head and (b) longitudinal bisection of the first proximal phalanx. The radiographs were collected before the treatment and 1 month after the treatment was completed.

Pain. Pain was measured using a visual analog scale (VAS).³⁵ Patients were instructed to mark their pain intensity on a 100-mm horizontal line, in which 0 states no pain and 100 mm states maximum pain the patient felt. The assessment was performed 4 times: before treatment; immediately after the tape implementation, and on days 3, 7, 10, and 30.

Secondary Outcome Measures

Secondary outcome measures were collected before the treatment (first day) and on days 3, 7, 10, and 30 of the treatment.

Functional Status

The American Orthopaedic Foot and Ankle Society. We used the American Orthopaedic Foot and Ankle Society (AOFAS) great toe developed by the AOFAS in 1994. The validity and reliability of the scale were shown by Ibrahim et al in 2007.³⁶ The American Orthopaedic Foot and Ankle Society hallux scale consists of 2 components: objective assessment



Fig 3. Taping technique used in the study.

completed by the practitioner and subjective evaluation completed by the patient.

Foot Function Index. Foot Function Index (FFI) was used to show the change in pain, disability, and the quality of life experienced by hallux valgus patients as a result of treatment. Foot Function Index questionnaire consists of 3 components. Patients were instructed to mark a VAS score for each question. The total score was calculated using only the questions answered. The reliability of the questionnaire was shown by Agel et al.³⁷

The assessment was performed 3 times: before treatment (first day) and on days 3, 7, 10, and 30.

The AOFAS and FFI scales were not sensitive enough to show the initial effects seen with taping therapy and were not recorded immediately after the tape implementation because of this reason.

The measurements and taping were performed by the same physiotherapist for consistency. Radiographic measurements were performed by the surgeon.

Statistical Analysis

The sample size was determined as 30 for the reduction in hallux valgus adduction angle due to the treatment protocol to have 80% power with 5% type 1 error to detect the difference of 3.5° angle change in adduction deficiency in hallux valgus patients. Statistical analyses to determine significant differences in pain, adduction angle, and functional tests with time factor were performed using the Friedman test. If any significant difference was established, Wilcoxon test was used to determine pairwise differences. Descriptive analyses were provided with mean values and SDs for the nonnormally distributed variables.

RESULTS

Thirty-four feet (13 bilateral, 89 unilateral; mean age, 43.3 ± 13.3 years; body mass index, 26.2 ± 4.9 kg/m²; deformity duration, 12.0 ± 10.3 years; initial hallux valgus angle, 20.2° ± 4.7°; initial VAS scores, 7.45 ± 1.5) with hallux valgus were included in this study. Demographic data are shown in Table 1.

Changes from baseline were significant at all time points starting from day 3. It was observed that the treatment effect has reached plateau after day 3 (Table 2).

Angular Measurements of Hallux Valgus

Alterations in adduction angle were also shown by radiographic measurement. Radiographic results were obtained 1 month after the treatment ceased. A significant change was detected in radiographic measurement ($P = .001$). A significant reduction in adduction angle was maintained for a month even after the treatment was finished ($P = .002$) (Table 2).

A significant reduction on the goniometric adduction angle was detected with the kinesiotaping treatment ($P < .001$). There was a significant reduction in all treatment days (immediately after implementation $P < .001$; on day 3 $P < .001$; on day 7 $P < .001$; on day 30 $P < .001$). Most significant reduction was observed on day 7 of the treatment (Fig 5).

Pain

There was a significant reduction in pain intensity immediately after the treatment ($P < .001$), on day 3 ($P < .001$), on day 7 ($P < .001$), and on day 10 ($P < .001$). The most reduction in pain was observed on day 3 of the treatment.

Functional Status

A significant difference was found in AOFAS scores with treatment ($P < .001$). The AOFAS scores were significantly increased on days 3 ($P < .001$), 7 ($P < .001$), and 10 ($P < .001$).

Foot Function Index scores were calculated for pain and disability function and as a total score. A significant difference was found in FFI scores with treatment ($P < .001$).

Total FFI Score. A significant reduction was found in FFI scores with treatment ($P < .001$). Foot Function Index scores were significantly decreased on days 3 ($P < .001$), 7 ($P = .001$), and 10 ($P < .001$).

Pain FFI Score. A significant reduction was found in FFI scores with treatment ($P < .001$). Foot Function Index scores were significantly decreased on days 3 ($P < .001$), 7 ($P = .001$), and 10 ($P < .001$).



Fig 4. Treatment used to treat hallux valgus deformity over time (baseline, on days 3, 7, 10, and 30, from left to right).

Table 1. Demographic Data of Patients

	n	Minimum	Maximum	X ± SD
Age (y)	21	18	59	43.1 ± 12.4
Height (cm)	21	150	173	161.2 ± 7.5
Weight (kg)	21	48	90	68.9 ± 11.6
BMI (kg/cm ²)	21	18	35	26.7 ± 4.9
Deformity duration (mo)	21	1	432	144 ± 124

BMI, body mass index; SD, standard deviation.

Quality of Life FFI Score. A significant reduction was found in FFI scores with treatment ($P < .001$). Foot Function Index scores were significantly decreased on days 3 ($P = .002$), 7 ($P = .001$), and 10 ($P < .001$). The largest increase in quality of life was observed on day 3 of the treatment.

Foot Function Index Function Score. A significant reduction was found in FFI scores with treatment ($P < .001$). Foot Function Index scores were significantly decreased on days 3 ($P < .001$), 7 ($P = .001$), and 10 ($P < .001$). The largest increase in function was observed on day 3 of the treatment (Table 3).

DISCUSSION

Hallux valgus may cause pain, and it affects quality of life and function by altering foot kinematics. This study showed the initial effects of kinesiotaping on hallux valgus deformity, pain, function, and the quality of life observed in 30 days. This study showed that a 10-day kinesiotaping implementation may decrease in pain and adduction angle deformity in a month time. Function and the quality of life increased in patients who were subjected to taping.

Hallux valgus is diagnosed by hallux valgus angle greater than 15.¹ Our study reduced the average hallux valgus angle from 20.2 ± 4.7 to 14.3 ± 5.0 . This result shows that our taping method reduced the hallux valgus angle below the point that it is considered to be a deformity. Pain as denoted by VAS reduced from 7.45 ± 1.5 to 1.1 ± 1.7 , and total FFI reduced from 3.2 to 0.82. In a study carried out by Du Plessis et al,²¹ 20% change in hallux valgus was considered to be clinically meaningful. Findings in our study show a clinically meaningful change regardless of very short duration of treatment and the severity of patients' deformity.

A correction was made to the first metatarsophalangeal joint to align it to its adjusted position manually, which did not take more than 10 seconds; this correction was performed without applying any traction to the hallux joint. This method is known as mechanical correction, and it is used to assist in the positioning of muscle, fascia tissue, or joint to stimulate a sensation, which results in body's adaptation to the stimulus.³⁸ This correction method is similar to the light mobilization exercise, which was cited in a study carried out by Brantingham et al,¹⁷ and the exercise reported in this study included repetition of 5 to 10 times. A statistically meaningful decrease in pain and FFI was noted in the treatment group as a result of this chiropractic protocol. In our study, we used a taping method for 10 days by renewing it on days 3, 5, and 10 and had similar results. Our taping technique maintains a functional correction without losing active range of motion or inhibiting the circulation, which happens in orthotic use. When the tape is on the tissue, it acts as if the manipulative correction effect was still effective. So, it may be possible that this taping method may create an effect like axial mobilization exercise by aligning the joint in its correct position.

We used 2 different methods of assessment in the same study because we aimed to observe the progress during the treatment (by using goniometric assessment). Although the assessment using a universal goniometer is a low-cost and easy way of measuring range of motion, it has higher risk of error. Conversely, radiographic assessments are valid and criterion standard way of angular assessments.³⁹ By radiographic assessment, we aimed to see how much the effect of reduction in angular variation of hallux valgus lasted after 1-month treatment was ceased and also to enhance the study's results. As a result, we found that 3.5° of reduction in adduction angle was preserved even after a month.

In addition, the radiologic evaluation was carried out by a radiologist who was blinded to the nature of the study with the aim of preventing bias.

In the study of Tang et al,¹⁴ a new foot orthosis was developed and used for 3 months by participants, and this orthosis was shown to reduce the adduction angle by 6.5°. In our study, we obtained 3.5° of improvement in 10 days.¹⁴ Kinesiotaping is a cheap and easy method compared to the use of foot orthosis or insole. It does not need casting; it is light and tolerable, the patient is oblivious to it 10 minutes after implementation. In recent research studies, there is a

Table 2. Main Results of the Study

	Before Treatment,						P
	n = 35	Initial Effect, n = 35	Day 3, n = 35	Day 7, n = 34	Day 10, n = 34	Day 30, n = 31	
	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD	
Adduction angle (°)	20.2 ± 4.7	16.3 ± 5.2	13.8 ± 3.8	12.3 ± 4.3	13.2 ± 4.9	14.3 ± 5.0	a,b,e
VAS (cm)	7.45 ± 1.5	2.7 ± 2.7	2.2 ± 2.8	1.7 ± 2.1	1.2 ± 1.8	1.1 ± 1.7	a,d,e,f
AOFAS	42.8 ± 19.5	–	73.1 ± 10.0	75.0 ± 8.3	76.7 ± 8.4	76.7 ± 8.3	a
FFI (cm) Total	3.2 ± 1.6	–	1.6 ± 1.7	1.0 ± 1.1	0.76 ± 1.2	0.84 ± 1.24	a,b,c,d
Pain	4.4 ± 2.1	–	2.0 ± 2.1	1.4 ± 1.7	1.0 ± 1.5	1.19 ± 1.44	a,b,c,f
Quality of life	1.3 ± 1.7	–	0.72 ± 1.6	0.28 ± 0.74	0.18 ± 0.53	1.03 ± 1.23	a,c
Function	4.0 ± 2.5	–	2.0 ± 2.3	1.2 ± 1.4	0.96 ± 1.3	0.77 ± 0.40	a,b,c,d,e

AOFAS, American Orthopaedic Foot and Ankle Society; FFI, Foot Function Index; SD, standard deviation; VAS, visual analogue scale.

^a P < .005 significant difference according to initial assessment.

^b P < .005 significant difference between 3 and 7 days.

^c P < .005 significant difference between 3 and 10 days.

^d P < .005 significant difference between 7 and 10 days.

^e P < .005 significant difference between 7 and 30 days.

^f P < .005 significant difference between 10 and 30 days.

growing use of great toe adduction exercises involving repetitive stretch or mobilization.^{14,17,20,21} Actually, kinesiotaping also appears to do the same. It implements a force on the great toe to align it on the correct position. The corrective effect continues even when the patient is not wearing shoes because patients do not need shoes for correction effect, like insoles. It is more durable than adhesive taping. In our study, our participants used the taping for 3 days, and some also had showers with the tape.

Jeon et al¹⁵ used adhesive taping to reduce the hallux valgus deformity. The patients were taped 15 times in a 4-week period, and improvement from 21.95 to 18.73 was seen after treatment. Our results were similar with the finding of Jeon et al, although we only taped the patients 4 times in a 10-day period.¹⁵

In the present study, we found that the pain was diminished significantly by taping. The reduction in pain was especially evident after the first implementation (initial effect). We used the visual analog scale to show the alterations in perceived pain. There was a significant reduction in pain with taping; this reduction was evident in the beginning of the treatment. We believe that this reduction in pain was due to corrected foot mechanics, which was obtained by kinesiotaping. According to Easley and Trnka,⁴ ground reaction forces may have a role in the gradual development of hallux valgus. Easley and Trnka⁴ explained that when these forces are channeled through the medial aspect of the hallux, the structures in the medial aspect of the metatarsophalangeal joint tend to become attenuated over time. With the taping method used in this study, we aimed to correct and align the hallux in the correct place to obtain the ground reaction force to come to its normal physiological place. Hallux valgus is a deformity, which actively develops itself during gait, and hallux valgus orthosis is not sufficient to control the deformity while walking. According to Thomas and Barrington,⁷ in hallux valgus deformity, the abductor hallucis is an important

medial support to the normally aligned joint. If hallux valgus is present, abductor hallucis muscle place alters to plantar aspect of the MTP joint and in each step causes hallux to medially deviate.

Both AOFAS and FFI scales were selected for this study because they were the most frequently referenced, reliable, and validated foot and ankle health measurement scales in the literature.³¹ According to AOFAS and FFI scores of the patients, it is evident that the pain and physical appearance of hallux recovered after the 10-day treatment and this effect lasted for a month. In addition, function and quality of life improved by this treatment. The conservative treatment of hallux valgus has 3 objectives: to prevent progression of the deformity, to accommodate the deformity when it is rigid, and to dissipate the pressure in the region of the lesion. The orthotics used for hallux valgus is either ineffective, too cumbersome to be worn in shoes, or is used mostly at night, whereas the corrective stretch applied by kinesiotape is effective all the time.

LIMITATIONS

In this study, only acute and initial prolonged effects of taping method were observed. This period was only a month; thus, long-term effects are unknown. However, our study has a statistical and clinical power to show the improvement of hallux pain and adduction angle in 1-month time. This is a very short-term study showing the initial effects on pain and adduction angle and needs further support. Further studies should be planned to see the longer effects with follow-ups and also to compare kinesiotaping with other conservative treatments.

The American Orthopaedic Foot and Ankle Society and FFI were not able to reflect the initial effect of taping treatment because these tools were not responsive enough to see the acute effects. In a study by Button et al,³⁸ 49

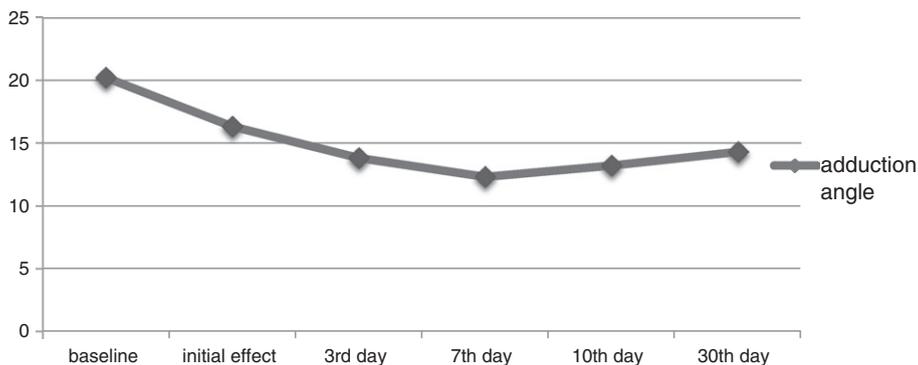


Fig 5. Change of metatarsophalangeal joint adduction angle during treatment.

Table 3. Radiographic Results of Adduction Angle in Patients

Abduction angle (°)	n	Min	Max	X ± SD
Before treatment	35	15	32	22.6 ± 5.0
A month after the treatment	31	10	30	19.3 ± 5.9

SD, standard deviation.

different scales were identified, although none of them was found reliable, validated, and responsive enough in patients with a variety of foot and ankle conditions.⁷ No tools were found sensitive enough to assess the acute effects of taping on hallux valgus deformity by researchers.

It may be considered as a limitation that the observer who has assessed the patients was also the person who performed the treatment, but in this study, the assessment of radiographic method was performed by a blinded assessor, which may have enhanced the reliability of the results. This study shows 3.5° of reduction in the hallux valgus adduction angle with 80% power.

The heterogeneity of deformity durations of the patients was another problem detected in the study. The variations in deformity durations were extended from 1 month to 10 years. Although this study shows 3.5° of improvement in the deformity with 80% statistical power, in a more homogeneous patient group with similar deformity duration, this improvement may be enhanced. Although this study shows initial results, well-designed future studies might be able to show the effectiveness for longer periods in larger samples.

CONCLUSION

This study found that kinesiotaping of hallux can diminish pain and adduction angle deformity in hallux valgus, but this effect was measured only for 1 month. Kinesiotaping may provide a short-term conservative treatment option for improving function and relieving pain, for patients who prefer not to undergo surgery if the hallux valgus is not too severe.

FUNDING SOURCES AND POTENTIAL CONFLICTS OF INTEREST

No funding sources or conflicts of interest were reported for this study.

CONTRIBUTORSHIP INFORMATION

Concept development (provided idea for the research): N.B.

Design (planned the methods to generate the results): N.B.

Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): G.O.K.

Data collection/processing (responsible for experiments, patient management, organization, or reporting data): G.O.K., U.T.

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Literature search (performed the literature search): G.O.K., N.B.

Writing (responsible for writing a substantive part of the manuscript): N.B., G.O.K.

Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): N.B., G.O.K.

Practical Applications

- This study showed that kinesiotaping may reduce the adduction angle of the hallux and pain intensity in 1-month follow-up.
- The subjects showed functional status and quality of life improvements.

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