Research Article

Türk Fen ve Sağlık Dergisi
Turkish Journal of Science and Health

Volume 3
Number 3
Year 2022
Pages 185-191

e-ISSN: 2717-7173 https://dergipark.org.tr/tr/pub/tfsd

Received: 20.04.2022 *Accepted:* 02.07.2022 https://doi.org/10.51972/tfsd.1106562

The Immediate Effects of Rigid Taping on Physical Performance in Women with Hallux Valgus Deformity

Ertuğrul Demirdel [1]*, **A. Ayşe Karaduman** [2]

[1]Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Ankara Yildirim Beyazit University, Ankara, Türkiye
[2]Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Lokman Hekim University, Ankara, Türkiye

ABSTRACT:
Purpose: The aim of this study was to investigate the immediate effects of taping on physical performance in women with flexible hallux valgus.
Material and Methods: The study included 40 women with hallux valgus. All the subjects performed timed activities barefoot. The 10-meter walk test was used to evaluate walking speed and 10-stair ascent time was recorded. Each measurement was repeated three times and the average of the three measurements was recorded. The timed-performance tests were applied before and after taping and the differences between the measurements were compared. The study subjects were separated into groups according to age and Body Mass Index, and the timed-performance test results were compared between the groups.
Results: After taping, the walking speed increased ($p<0.001$) and the 10-stair ascent time decreased ($p<0.01$) in all the subjects. Physical performance was better in both age groups after taping ($p<0.01$). There was no difference in walking speed pre- and post-taping between the age groups ($p>0.05$), but a significant difference was found in terms of stair ascent time ($p<0.01$). Physical performance was better after taping in different BMI groups ($p<0.01$). There was no difference in walking speed pre- and post-taping between BMI groups ($p>0.05$), but the stair ascent time was different between the groups ($p<0.05$).
Conclusion: It was found that individuals with hallux valgus deformity had lower physical performance in fulfilling foot functions, and the mechanical correction provided by taping significantly increased performance.
Keywords: *Hallux valgus, Rigid taping, Walking speed*

**Corresponding author: Ertuğrul Demirdel, email: edemirdel@aybu.edu.tr*

INTRODUCTION

Hallux valgus (HV) is a common foot deformity associated with the medial deviation of the first metatarsal, lateral deviation of the hallux at the metatarsophalangeal joint (MTPJ), and pronation of the hallux on the longitudinal axis (Nix et al., 2012). Angular deviation of the hallux bone to the 1st metatarsal bone by >15° is considered to be HV. It is a common forefoot deformity seen in 58% of women (Nguyen et al., 2010). Symptoms increase with increased angular values. Inflammation, capsule proliferations, pain and movement restrictions occur and joint degeneration develops (Bock et al., 2004). An increase in symptoms may lead to functional limitations and impairment of performance in everyday life depending on the severity of the deformity. Hallux valgus may cause pain, limitation of physical activity, balance and mobility problems (Joseph and Mroczek, 2007; Menz and Lord, 2001, 2005). It has been stated that orthoses, taping, night splints and different exercise approaches play an important role in the conservative treatment of HV, reducing both the pain and the HV angle (Bayar et al., 2011; Joseph and Mroczek, 2007; Tehraninasr et al.,

2008). However, studies evaluating the effect of rigid taping on functional performance are limited. The hypothesis of this study was that physical performance could improve by supporting foot mechanics with taping during functional use. The aim of this study was to examine the effect of rigid taping on functional performance in HV deformity.

MATERIAL and METHODS

Purpose and Type of the Study

The purpose of this cross-sectional study was to examine the effect of rigid taping on functional performance in HV deformity. A case series study design was used.

Sampling and Participants

This study was conducted on 40 women, aged 20-60 years, with bilateral and flexible HV deformity (HV angle 15˚-30˚). The subjects were selected from patients who presented at an outpatient physical therapy clinic and met the inclusion criteria. Subjects were excluded if they had a history of surgery on the lower extremity, had any orthopaedic or neurological disorders, had received any treatment for HV in the last 6 months, had skin lessions around the taping area or skin allergy for taping, or had rigid HV deformity.

Data Collection Tools

The demographic information of all the subjects was recorded. Body mass index (BMI) was calculated as body weight divided by height squared (BMI=body weight (kg)/height (m^2) (Frey and Zamora, 2007). BMI <25 kg/m^2 was classified as "normal weight", 25-30 kg/m^2 as "overweight" and >30 kg/m^2 as "obese" (Dufour et al., 2017). The study subjects were separated into 3 subgroups according to these BMI classifications and into 2 subgroups according to age as 21-40 years and 41-60 years. These groups were compared in respect of the timed performance test results.

Pain intensity

A 10 cm visual analog scale (VAS) was used to assess pain severity. The subjects marked the scale to reflect the pain felt at rest, during activity and at night, where 0= no pain and 10 = the most severe pain (Akaras et al., 2020; Bayar et al., 2011).

Hallux valgus angle

A universal goniometer was used to measure the HV angle. The angle between the longitudinal axis of the 1st metatarsal bone and the longitudinal axis of the 1st proximal phalanx was recorded as the HV angle. The measurement was made in the standing position by measuring from the dorsal aspect of the foot and recorded as degrees (Akaras et al., 2020; Bayar et al., 2011).

Timed Performance Tests

The timed performance activities were conducted barefoot before and immediately after taping. Each timed performance test was repeated 3 times and the average value was recorded.

The 10-meter walk test was used to evaluate walking speed. This test is used in the evaluation of walking speed in HV deformity (Nix et al., 2012). The subjects were instructed to walk along a 10-meter walkway at a self-selected speed and the time was recorded with a stopwatch (Graham et al., 2008). Stair climbing speed was evaluated using the 10-step climbing test. This test is used in functional performance evaluation in HV deformity (Nix et al., 2012). The time that the subject climbed 10 steps of 20 cm height was measured with a stopwatch and recorded.

Taping

A non-allergenic and rigid white tape (protape) was used for taping. Circular wrappings were made around the center of foot and the hallux with the subject in a relaxed long sitting position. Then, the tape was cut in an “I shape” and applied with a stretching force pulling the hallux to adduction on the medial side of the foot. A second “I-shaped” tape was applied to the upper third of the first, and another to the lower third. The taping was completed by making circular wrappings as initially applied (Albers and Agnone, 2003) (Figure 1).

Statistical Analysis

Data obtained in the study were analyzed statistically using SPSS for Windows ver. 20.0 software (IBM SPSS Inc., Armonk, NY, USA). Continuous variables were

expressed as mean and standard deviation values. The Shapiro–Wilk test was used to determine normal distribution of the numerical variables. The Wilcoxon test was used to determine the changes within the group. Differences between the age groups were examined with the Mann Whitney U test. The Kruskal Wallis Test was used to determine the differences between BMI groups and the Mann Whitney U test was used in pairwise comparisons. A 5% type-1 error level was used to infer statistical significance.

Ethical Approval

Ethics committee approval for this study was obtained from the Medical, Surgical and Pharmaceutical Research Ethics Board of Hacettepe University Faculty of Medicine (LUT 08/54-48). A signed informed consent form was provided by all the study subjects.

RESULTS

From eligibility screening of 68 women with HV, a total of 40 satisfied all the inclusion criteria and agreed to participate in the study. The analyses were made of the data of 40 patients. The flow chart is shown in Figure 2.

Figure 1. Rigid taping for hallux valgus.

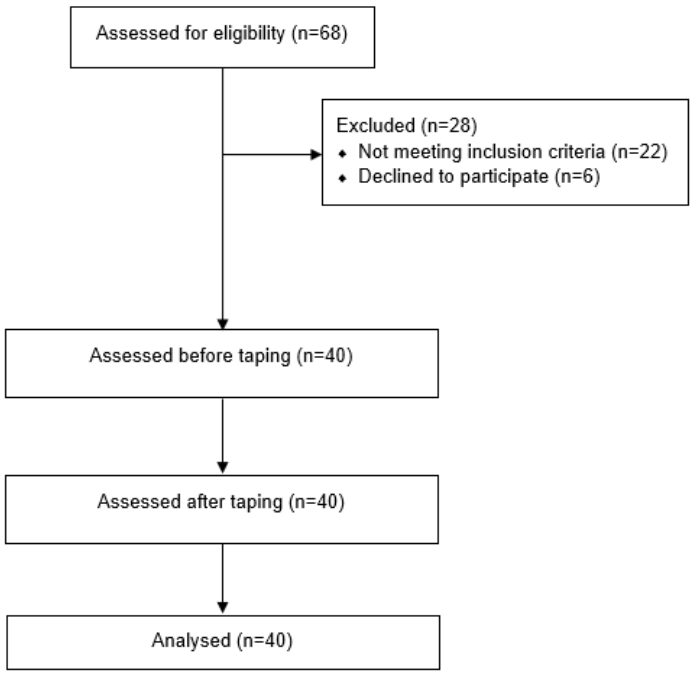

Figure 2. Study Flow Chart

Demographic characteristics, activity pain scores and HV angle of subjects were shown in Table 1. No subjects had pain at rest or at night. Activity pain was reported to be felt during lower extremity functions such as standing, going up and down stairs, and walking.

The physical performance of all the study subjects increased in both the 10 m walk test and the 10-stair ascent test after taping ($p<0.01$) (Table 2).

Physical performance was better in both age groups after taping ($p<0.01$). There was no difference in walking speed pre- and post-taping between the age groups ($p>0.05$), but a significant difference was found in terms of stair ascent speed ($p<0.01$) (Table 3).

Table 1. Demographic characteristics, pain scores and HV angle of subjects

n=40	Mean±SD
Age (years)	41.60±12.64
BMI (kg/m²)	26.31±4.59
Activity pain (cm)	4.68 ± 1.60
HV angle (°)	
Right	23.48±4.52
Left	23.00±4.38

SD: Standard Deviation, BMI: Body Mass Index, kg:kilogram, m:meter, HV: Hallux Valgus

Table 2. Comparison of walking speed and 10 stairs ascent test results

Timed Performance Tests (n=40)	Before taping Mean±SD	After taping Mean±SD	p*
Walking speed (m/sec)	1.14±0.198	1.23±0.205	**<0.001**
10 step climbing test (sec)	4.77±0.90	4.21±0.81	**<0.001**

SD: Standard Deviation, m: meter, sec: seconds, *Wilcoxon Test

Table 3. Comparison of walking speed and 10 stairs ascent test results within and between age groups

Timed Performance Tests	Age Groups (years)	N	Before taping Mean±SD	After taping Mean±SD	p*
Walking speed (m/sec)	21-40	17	1.20±0.17	1.31±0.17	**0.001**
	41-60	23	1.09±0.21	1.21±0.22	**<0.001**
p**			0.06	0.09	
10 step climbing test (sec)	21-40	17	4.20±0.27	3.76±0.27	**<0.001**
	41-60	23	5.19±0.98	4.54±0.92	**<0.001**
p**			**0.001**	**0.006**	

SD: Standard Deviation, m:meter, sec: seconds, *Wilcoxon Test, **Mann Whitney U Test

Table 4. Comparison of walking speed and 10 stairs ascent test results within and between BMI groups

Timed Performance Tests	BMI Groups	N	Before taping Mean±SD	After taping Mean±SD	p*
Walking speed (m/sec)	Normal	19	1.18±0.19	1.29±0.17	**<0.001**
	Overweight	13	1.16±0.19	1.27±0.21	**0.001**
	Obese	8	1.02±0.22	1.12±0.25	**0.01**
p**			0.09	0.08	
10 stairs ascent test (sec)	Normal	19	4.32±0.39[a]	3.84±0.38	**<0.001**
	Overweight	13	4.68±0.91	4.25±0.94	**0.001**
	Obese	8	6±0.66	5.02±0.81	**0.012**
p**			**<0.001**[¥]	**0.004**[¥]	

(BMI: Body Mass Index, SD: Standard Deviation, m:meter, sec: seconds,*Wilcoxon Test, **Kruskal Wallis Test, [¥]The results of the corresponding measurement significantly higher in "obese" group compared to the other groups according to Mann Whitney U Test.

Physical performance was better after taping in different BMI groups ($p<0.01$). There was no difference in walking speed pre- and post-taping between the BMI groups ($p>0.05$). Stair ascent speed was different between the BMI groups ($p<0.05$). The stair ascent speed was similar in the normal and overweight BMI groups ($p<0.05$), and the speed of the obese group was lower both before and after taping compared to the other two groups ($p<0.001$) (Table 4).

DISCUSSION

The results of this study showed that rigid taping improved physical performance in women with HV. A difference was found between the age groups and BMI groups in the stair ascent time both before and after taping. It was also determined that taping increased physical performance in all age and BMI groups.

In previous studies, it has been reported that foot deformities and HV cause a decrease in walking speed by causing mechanical instability (Menz and Lord, 2001, 2005). Nishimura et al. also found that moderate-to-severe HV caused a decrease in walking speed (Nishimura et al., 2018). In some studies, it has been found that the walking speed of people with HV is not different from healthy people (Deschamps et al., 2010; Hurn et al., 2015; Nix et al., 2012). The normal walking speed of healthy adults has been reported to be 1.37 ± 0.18 m/s (Amatachaya et al., 2020). The results of the current study showed that women with HV had lower walking speed both with and without taping than healthy adults in general. Gür et al. found that the walking speed did not change after taping (Gur et al., 2017), whereas Akaras et al found that rigid taping increased the stride length (Akaras et al., 2020). Bayar et al. showed that walking ability increased after 8 weeks of taping and an exercise program (Bayar et al., 2011). Xiang et al. also reported that the non-operative treatments achieved good gait correct effects (Xiang et al., 2022). In the current study, walking speed was determined to increase after taping in all subjects with HV. The improvement in walking speed after taping showed that the mechanical correction effect of rigid taping has a positive effect on gait.

Especially changes in loading patterns affect the timing of foot function and balance in subjects with HV (Menz and Lord, 2005). In some studies, it has been reported that the stair ascent time for people with HV is not different from that of healthy people (Hurn et al., 2015; Nix et al., 2012). Nix et al. reported that the time to ascend 10 stairs in healthy adults was 3.77 s. In the current study, the 10-stair ascent time of subjects with HV deformity was determined to be longer than that of healthy adults. Especially in women of an older age and with higher BMI, the stair ascent time was longer, which demonstrated that age and increasing BMI affect stair ascent performance in women with HV. The mechanical correction provided by the taping improved the stair ascent performance. The changes in loading patterns have a reducing effect on lower extremity performance as well as affect the timing, balance and walking patterns, thus the mechanical support provided by taping makes a positive contribution to performance. The decrease in stair ascent time after taping in age groups and BMI groups showed that taping has similar healing effects in women of different ages and BMI.

The timed performance test results were found to be lower in subjects with HV deformity in the 41-60 years age group than in the 21-40 years age group. In studies investigating the risk of falls and functional changes with increasing age, decreased flexibility of the foot, decreased plantar pressure sensation and foot deformities (particularly severe HV deformity) have been shown to increase the risk of falls and significantly reduce functionality (Menz and Lord, 2001, 2005). According to this information, the reduction in the performance of subjects in the 41-60 years age group can be said to be associated with HV deformity together with different age-related changes. The mechanical support provided by taping can be considered to make a positive contribution to the performance of subjects in this age group and to decrease the risk of falls and prevent serious health problems.

Obesity negatively affects bone and soft tissues biomechanically by causing overload in weight-bearing joints (Chen et al., 2015). However, being overweight or obese has not been found to increase the risk of developing HV (Dufour et al., 2017; Frey

and Zamora, 2007). The increase in BMI reveals the negative impact on the foot functions and foot health (Nix et al., 2012). Chen et al. showed that obese people have a higher risk of recurrence of HV surgery due to complications (Chen et al., 2015). No study could be found in literature which has examined the effect of BMI on the results of conservative treatment of HV. The current study results showed that taping had a positive effect on physical performance in different BMI groups.

This study has shown that taping increases physical performance in women with HV of different ages and BMI. Nevertheless, there is a need for further studies to examine the long-term effects of taping on physical performance.

CONCLUSION

Hallux valgus is a common foot deformity that causes pain and dysfunction. Rigid taping is an easy and inexpensive method to apply. The positive effect of rigid taping on functional performance has shown that it is an option that may be used in HV treatment.

Limitations of Study

A limitation of the study was that there was no examination of the long-term effects of taping on physical performance.

Conflict of Interest

There are no conflicts of interest for any author.

REFERENCES

Akaras, E., Guzel, N. A., Kafa, N. et al. (2020). The acute effects of two different rigid taping methods in patients with hallux valgus deformity. Journal of Back and Musculoskeletal Rehabilitation (Preprint), 1-8. https://doi.org/10.3233/BMR-181150

Albers, D., & Agnone, M. (2003). Rehabilitation and taping techniques in the athlete: hallux and first ray problems. Techniques in Foot & Ankle Surgery, 2(1), 61-72. https://doi.org/10.1097/00132587-200303000-00010

Amatachaya, S., Kwanmongkolthong, M., Thongjumroon, A. et al. (2020). Influence of timing protocols and distance covered on the outcomes of the 10-meter walk test. Physiotherapy Theory and Practice, 36(12), 1348-1353. https://doi.org/10.1080/09593985.2019.1570577

Bayar, B., Erel, S., Şimşek, İ. E. et al. (2011). The effects of taping and foot exercises on patients with hallux valgus: a preliminary study. Turkish Journal of Medical Sciences, 41(3), 403-409. https://doi.org/10.3906/sag-0912-499

Bock, P., Kristen, K.-H., Kröner, A. et al. (2004). Hallux valgus and cartilage degeneration in the first metatarsophalangeal joint. The Journal of Bone and Joint Surgery, British Volume, 86(5), 669-673. https://doi.org/10.1302/0301-620X.86B5.14766

Chen, J. Y., Lee, M. J. H., Rikhraj, K. et al. (2015). Effect of obesity on outcome of hallux valgus surgery. Foot & Ankle International, 36(9), 1078-1083. https://doi.org/10.1177/1071100715581449

Deschamps, K., Birch, I., Desloovere, K. et al. (2010). The impact of hallux valgus on foot kinematics: a cross-sectional, comparative study. Gait & Posture, 32(1), 102-106. https://doi.org/10.1016/j.gaitpost.2010.03.017

Dufour, A. B., Losina, E., Menz, H. B., et al. (2017). Obesity, foot pain and foot disorders in older men and women. Obesity Research & Clinical Practice, 11(4), 445-453. https://doi.org/10.1016/j.orcp.2016.11.001

Frey, C., & Zamora, J. (2007). The effects of obesity on orthopaedic foot and ankle pathology. Foot & Ankle International, 28(9), 996-999. https://doi.org/10.3113/FAI.2007.0996

Graham, J. E., Ostir, G. V., Fisher, S. R. et al. (2008). Assessing walking speed in clinical research: a systematic review. Journal of Evaluation in Clinical Practice, 14(4), 552-562. https://doi.org/10.1111/j.1365-2753.2007.00917.x

Gur, G., Ozkal, O., Dilek, B. et al. (2017). Effects of corrective taping on balance and gait in patients with hallux valgus. Foot & Ankle International, 38(5), 532-540. https://doi.org/10.1177/1071100716683347

Hurn, S. E., Vicenzino, B., & Smith, M. D. (2015). Functional impairments characterizing mild, moderate, and severe hallux valgus. Arthritis Care & Research, 67(1), 80-88. https://doi.org/10.1002/acr.22380

Joseph, T. N., & Mroczek, K. J. (2007). Decision making in the treatment of hallux valgus. Bulletin-Hospital for Joint diseases New York, 65(1), 19. PMID: 17539757.

Menz, H. B., & Lord, S. R. (2001). The contribution of foot problems to mobility impairment and falls in community-dwelling older people. Journal of the American Geriatrics Society, 49(12), 1651-1656. PMID: 11843999

Menz, H. B., & Lord, S. R. (2005). Gait instability in older people with hallux valgus. Foot & Ankle International, 26(6), 483-489. https://doi.org/10.1177/107110070502600610

Nguyen, U.-S., Hillstrom, H. J., Li, W. et al. (2010). Factors associated with hallux valgus in a population-based study of older women and men: the MOBILIZE Boston Study. Osteoarthritis and Cartilage, 18(1), 41-46. https://doi.org/10.1016/j.joca.2009.07.008

Nishimura, A., Ito, N., Nakazora, S. et al. (2018). Does hallux valgus impair physical function? BMC Musculoskeletal Disorders, 19(1), 174. https://doi.org/10.1186/s12891-018-2100-0

Nix, S. E., Vicenzino, B. T., & Smith, M. D. (2012). Foot pain

and functional limitation in healthy adults with hallux valgus: a cross-sectional study. BMC Musculoskeletal Disorders, 13(1), 197. https://doi.org/10.1186/1471-2474-13-197

Tehraninasr, A., Saeedi, H., Forogh, B. et al. (2008). Effects of insole with toe-separator and night splint on patients with painful hallux valgus: a comparative study. Prosthetics and Orthotics International, 32(1), 79-83. https://doi.org/10.1080/03093640701669074

Xiang, L., Mei, Q., Wang, A., et al. (2022). Gait biomechanics evaluation of the treatment effects for hallux valgus patients: A systematic review and meta-analysis. Gait & Posture, 94, 67-78. https://doi.org/10.1016/j.gaitpost.2022.02.026