

The effects of taping and foot exercises on patients with hallux valgus: a preliminary study

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Aim: To determine the effects of taping and foot exercises on patients with hallux valgus.

Materials and methods: The study included 20 female patients. The subjects were divided into 2 groups, the study and control groups. The study group was treated with taping and foot exercises, and the control group was treated only with foot exercises. A goniometer was used to determine the angle of hallux valgus. Foot pain intensity was assessed by the visual analog scale (VAS), and walking ability was evaluated using the walking ability scale (WAS).

Results: At the end of the 8-week treatment period, a significant decrease was found in hallux valgus angle, resting pain, and walking pain in both groups ($P < 0.05$). Also, walking ability improved at least 1 grade in the study group. When the post-treatment results between the 2 groups were compared, the results were significantly different in favor of the study group with regard to decreased hallux valgus angle, resting and walking pain, and walking ability ($P < 0.05$).

Conclusion: Our results suggest that a combined treatment program consisting of both taping and exercise had more beneficial effects than exercise alone on hallux valgus angle, foot pain, and walking ability in patients with hallux valgus.

Key words: Hallux valgus, taping, pain, conservative treatment

Bantlama ve ayak egzersizlerinin halluks valguslu hastalar üzerine etkileri: Bir ön çalışma

Amaç: Bu çalışmanın amacı bantlama ve ayak egzersizlerinin halluks valgus tanılı hastalar üzerindeki etkilerini belirlemektir.

Yöntem ve gereç: Çalışmaya 20 kadın hasta dahil edilmiştir. Olgular çalışma ve kontrol grubu olmak üzere iki gruba ayrılmıştır. Çalışma grubu bantlama ve ayak egzersizleri, kontrol grubu ise sadece ayak egzersizleri almıştır. Halluks valgus açısını belirlemek için gonyometre kullanılmıştır. Ayak ağrı şiddetini değerlendirmek için Görsel Analog Skalası, yürüme yeteneğini değerlendirmek için Yürüme Yeteneği Skalası kullanılmıştır.

Bulgular: Sekiz haftalık tedavi süresi sonunda her iki grupta halluks valgus açısı, istirahat ağrısı ve yürüme ağrısında anlamlı bir azalma bulunmuştur ($P < 0,05$). Yürüme yeteneği çalışma grubunda en az bir seviye gelişmiştir. Tedavi sonrası değerler iki grup arasında karşılaştırıldığında halluks valgus açısındaki azalma, istirahat ve yürüme ağrısı, yürüme yeteneği açısından sonuçlar çalışma grubu lehine anlamlı bulunmuştur ($P < 0,05$).

Sonuç: Bizim sonuçlarımız halluks valguslu hastalarda bantlama ve egzersizden oluşan tedavi programının halluks valgus açısı, ayak ağrısı ve yürüme yeteneği üzerine daha yararlı etkiye sahip olduğunu göstermiştir.

Anahtar sözcükler: Halluks valgus, bantlama, ağrı, konservatif tedavi

Received: 18.12.2009 – Accepted: 04.08.2010

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Introduction

Hallux valgus is a complex progressive deformity manifesting with lateral deviation of the greater toe and medial deviation of the first metatarsal (1). The aetiology of hallux valgus is multifactorial (2). Although inappropriate or constricting footwear appears to be the primary extrinsic cause, intrinsic factors play a role as well (3). Mann and Coughlin reported that pes planus has some influence on bunion formation, while Inman suggested pronation of the hindfoot as a major cause of this condition (4,5). Metatarsus primus varus, which is characterized by an increased angle between the first and second metatarsals, is often associated with a hallux valgus deformity. Other intrinsic causes of hallux valgus include muscle imbalance in abductor and adductor muscles, contracture of the Achilles tendon, generalized joint laxity, hypermobility of the first metatarsocuneiform joint and neuromuscular diseases. Heredity is also thought to be a factor in the development of hallux valgus deformity (3,6).

Hallux valgus can lead to painful motion of the joint or difficulty with footwear (7). Patients generally complain of pressure symptoms over the prominent pseudoexostosis, which together with the thickened bursa constitutes the bunion. Wearing shoes and finding suitable footwear to accommodate the deformity are the major problems. Many patients also complain of general forefoot pain, often as a result of bearing more weight laterally to avoid pressure on the bunion (8). Nonoperative management of hallux valgus can improve a patient's symptoms (2). A conservative approach should include evaluation of patients' footwear and patient education regarding appropriate footwear (9,10). Eliminating friction over the medial eminence can often relieve pain, blistering and bursal inflammation. Pes planus can be managed with insoles or foot orthoses. In order to decrease or control the hallux valgus angle, various orthoses pulling the hallux laterally and taping may be used (3,7,11,12). Also, foot exercises can be important in maintaining the mobility of the joint, stretching soft tissue around the joint and improving muscle strength (11,13,14).

Evidence for the effectiveness of conservative treatment approaches for patients with hallux valgus is very limited (11). Studies often focus on the surgical

treatment of hallux valgus and the comparison of various surgical methods and their results. The aim of this study was to investigate the effects of a combined treatment program consisting of both exercise and taping on hallux valgus angle, foot pain and walking ability in patients with hallux valgus.

Materials and methods

Twenty female subjects between the ages of 43 and 62 years with a diagnosis of hallux valgus were included in the study. Inclusion criteria were a hallux valgus angle of at least 15° and maintaining regular attendance for the follow-ups. Exclusion criteria were limitation in the abduction movement of the hallux, a diagnosis of rheumatoid arthritis, a history of previous foot surgery and previous use of foot orthoses. All subjects had bilateral flexible hallux valgus. The subjects were randomly divided into 2 groups each containing 10 subjects using the block randomization method. The subjects in the study group were treated with foot exercises and taping and the subjects in the control group were treated only with foot exercises.

The hallux valgus angle was measured using a toe goniometer. The fixed arm of the toe goniometer was placed on the longitudinal line of the first metatarsal bone, and the movable arm was placed on the longitudinal line of the great toe. The value of the hallux angle between these 2 lines was recorded (15).

The intensity of foot pain was evaluated using the visual analogue scale (VAS) with the far left and right ends anchored with the phrases "no pain" and "the worst pain imaginable", respectively. The subjects were asked to mark their pain at rest on a 10 cm straight line. The same process was repeated for pain in walking. Afterwards, the markings on those 2 lines were measured in centimeters and the results were recorded.

Walking ability was determined according to the walking ability scale (WAS), which is a subjective test graded between 1 and 4. Grade 1 indicates poor walking ability; the subject can walk for less than 10 min. Grade 2 indicates fair walking ability; the subject can walk for more than 10 min, but for less than 1 h. Grade 3 indicates good walking ability; the subject is able to walk well over 1 h. Grade 4 indicates

an excellent walking ability; the subject is able to walk normally (16).

Subjects were asked to describe the shoes that they most frequently wore during the daytime.

Following the initial evaluations, both groups were given information about appropriate shoe-wear and hallux valgus. The same foot exercises were given as a home program for both groups.

The subjects were asked to do the exercises 2 times a day with 10 repetitions and for 8 weeks. The exercises consisted of:

1. Passive abduction of the hallux with traction of the first metatarsophalangeal joint
2. Active abduction of the hallux

The study group was treated with taping in addition to the exercise program. For the taping, a non-allergenic and non-elastic white tape was used. First, an anchor strip 2 cm wide was attached around the distal toe at the base of the toenail, and a 3.8 cm wide strip was attached around the instep and arch of the foot. Then another strip 2 cm wide was attached parallel to the midline of the medial aspect of the foot, from the distal to the proximal anchor, sustaining the hallux in a midline position. The taping was completed with light circumferential strips covering the sites of the original anchors with 2 cm and 3.8 cm tape (Figures 1 and 2). Each subject was trained by a physiotherapist for the taping (17). The subjects in the study group were asked to do the

taping after the exercises in the morning and wear it for 10 h, and then take off the tape for the exercises.

All subjects were re-evaluated at the end of an 8-week period.

Statistical analysis

All analyses were conducted using SPSS for Windows Version 11.00. The results were reported as the arithmetic mean and standard deviation (quantitative variables) or as the number and percentage (qualitative variables). The Mann-Whitney U test was used to investigate the difference between the groups and Wilcoxon 2 paired samples test was used to determine the pre- and post-treatment difference in the groups. Statistical significance was set at $P < 0.05$.

Results

The demographic characteristics of the subjects including age, height, and weight are shown in Table 1.

At the end of the 8-week treatment program there was a significant difference between the pre- and post-treatment hallux valgus angles, indicating a decrease in angle for both groups ($P < 0.05$) (Table 2). Although there was no difference in the post-treatment hallux valgus angle ($p > 0.05$) (Table 3), the difference in post- and pre-treatment values were significantly higher in the study group when the 2 groups were compared ($P < 0.05$) (Table 4).



Figure 1. Medial view of taping.



Figure 2. Taping of the hallux.

Table 1. The physical characteristics of patients with hallux valgus.

	Study group (n = 10) X ± SD	Control group (n = 10) X ± SD
Age (year)	52.4 ± 4.62	53.0 ± 5.92
Height (cm)	157.7 ± 4.42	159.4 ± 5.27
Weight (kg)	58.7 ± 10.88	60.4 ± 8.41

There was a significant difference between pre- and post-treatment VAS scores evaluating resting and walking pain in both groups, showing a decrease in both groups ($P < 0.05$) (Table 2). When the post-treatment resting and walking VAS scores of the 2 groups were compared, the pain levels were found to be significantly lower in the study group ($P < 0.05$) (Table 3).

Table 2. Pre-treatment and post-treatment assessment scores.

	Pre-treatment X ± SD	Post-treatment X ± SD	Z	P
Study group				
HVA right	22.8 ± 4.16	17.4 ± 3.81	-2.84	0.004*
HVA left	23.6 ± 2.84	17.8 ± 2.86	-2.81	0.005*
Resting pain	34.6 ± 14.56	19.7 ± 10.94	-2.81	0.005*
Walking pain	67.0 ± 21.13	33.3 ± 20.40	-2.81	0.005*
Walking ability	1.9 ± 0.74	3.1 ± 0.57	-2.97	0.003*
Control group				
HVA right	19.1 ± 1.91	17.5 ± 2.01	-2.41	0.016*
HVA left	21.2 ± 4.05	19.0 ± 4.03	-2.68	0.007*
Resting pain	49.6 ± 13.04	38.5 ± 15.57	-2.80	0.005*
Walking pain	67.0 ± 16.56	59.2 ± 16.23	-2.81	0.005*
Walking ability	2.1 ± 0.57	2.4 ± 0.52	-1.73	0.083

HVA: Hallux valgus angle

* $P < 0.05$

Table 3. Comparison of post-treatment scores between groups.

	Study group X ± SD	Control group X ± SD	Z	P
HVA right	17.4 ± 3.81	17.5 ± 2.01	-0.30	0.761
HVA left	17.8 ± 2.86	19.0 ± 4.03	-0.46	0.647
Resting pain	19.7 ± 10.94	38.5 ± 15.57	-2.61	0.009*
Walking pain	33.3 ± 20.40	59.2 ± 16.23	-2.72	0.006*
Walking ability	3.1 ± 0.57	2.4 ± 0.52	-2.46	0.014*

HVA: Hallux valgus angle

* $P < 0.05$

When the pre-treatment WAS results of the 2 groups were compared with the post-treatment results, walking ability was found to have increased only in the study group ($P < 0.05$) (Table 2). Also the comparison of the post-treatment results showed better WAS results in the study group compared to the control group ($P < 0.05$) (Table 4).

The type of the shoes most frequently worn by the subjects was at normal heel height but with narrow toe boxes.

Discussion

Conservative treatment is generally proposed for patients with a mild hallux valgus angle (18). Many patients may find permanent or temporary relief with nonsurgical measures (16,19). Despite nonoperative measures, some patients eventually need operative management (3). The main purpose of a conservative method of treatment should be to decrease the hallux valgus angle or to prevent the deformity from becoming worse. Conservative treatment includes the use of night splints to balance the pull of the surrounding ligaments, foot exercises to increase the muscle strength and orthotic applications like inserts to correct the foot biomechanics (11,16,20). In recent years there has been an increasing trend for the use of taping techniques in the conservative management of hallux valgus (12). Although there are several studies involving taping techniques for knee and ankle problems, the number of studies about taping for hallux valgus is limited.

A study by Jeon et al. investigated the effects of taping in the treatment of patients with hallux valgus. Fifteen patients were taped 15 times in a period of 4 weeks, and the results showed that the hallux valgus

angles were decreased from 21.95 to 18.75 and the pain scores were decreased from 4.73 to 3.45 (12).

In our study, 20 patients were randomly divided into 2 groups in which the study group was treated with exercise and taping and the control group was treated only with exercise. Muscle imbalance in abductor and adductor muscles is cited as a major factor in the production of hallux valgus (6). Thus, in order to increase muscle strength and attain joint mobility, all subjects were given passive and active abduction exercises to perform. The aim of hallux taping was to reduce the stress on the big toe by pulling the toe outwards and correct the position of the hallux. After the 8-week treatment program the average decrease in hallux valgus angles in the study and control groups were $5.4^\circ \pm 2.50^\circ$ and $1.6^\circ \pm 1.35^\circ$, respectively, for the right foot and $5.8 \pm 2.86^\circ$ and $2.2 \pm 1.32^\circ$, respectively, for the left foot. When the groups were compared it was noted that the additional taping application in the study group had increased the effectiveness of the treatment program.

The use of an ill-fitting shoe is agreed to be the main factor in most forefoot deformities, especially in women (2,3,7,18). Because of societal pressures and fashion trends, some women wear shoes that are narrower than their feet and have narrow toe boxes. High heels shift the forefoot forward into the toe box, causing crowding of the toes (10). With this in mind, we investigated the type of shoes most frequently used by the subjects and found that in the study group 70% of the subjects wore shoes of normal heel height with a narrow toe box, 20% wore shoes with a high heel height and a narrow toe box, and 10% wore shoes with a wide round toe box; in the control group, 60% wore shoes of normal heel height with a narrow toe box, 10% wore shoes with a high heel height and

Table 4. Comparison of post- and pre-treatment hallux valgus angle differences between groups.

	Study group X \pm SD	Control group X \pm SD	Z	P
HVAD right	5.4 \pm 2.50	1.6 \pm 1.35	-3.36	0.001*
HVAD left	5.8 \pm 2.86	2.2 \pm 1.32	-2.98	0.003*

HVAD: Hallux valgus angle differences

* $P < 0.05$

a narrow toe box, and 30% wore shoes with a wide round toe box. Later the subjects were informed about hallux valgus, foot health, and suitable shoe wear, and they were asked to wear shoes with a wide round toe box and normal heel height (1-1.5 inch).

All the subjects were evaluated for pre-and post-treatment hallux valgus angle, resting and walking pain, and walking ability. At the end of the treatment, we found a decrease in hallux valgus angles as well as resting and walking pain in both groups. Increased walking ability was observed only in the study group. However, when the post-treatment values between groups were compared, we found a significant difference in favor of the study group in resting and walking pain, and walking ability. In addition, although there was no difference in the post-treatment hallux valgus angle, the post- and pre-treatment angle changes between the groups were significantly different in favor of the study group.

These results indicate that combined (exercise and taping) approaches introduced for facilitating the correct positioning of hallux, stretching the soft tissues, and strengthening the abductor hallucis muscle are more effective than exercise alone. Thus,

we think that the greater improvement in the study group may be related to taping, which enhances the correct alignment of the hallux and also prolongs this position during ambulation. Furthermore, the subjects in the study group mentioned that they had walked pain-free and comfortably for a longer period of time at the end of the treatment.

The limitations of the study are thought to be the short follow-up period, the small number of subjects included in the study, and the absence of a third group receiving only taping and the blinding of the examiners. In future studies, we will focus on intrinsic factors such as pronation of the hindfoot, forefoot varus, and comparing different protocols with longer follow-up periods intended for the conservative management of hallux valgus.

Conclusions

Simultaneous utilization of exercise with taping may result in decreased hallux valgus angle and pain, and increased walking ability. This approach may be considered an effective conservative approach for patients with hallux valgus.

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