

Activity-Oriented Exercise Intervention For Hallux Valgus Deformity In Women

Kadınlarda Hallux Valgus Deformitesine Yönelik Aktivite Odaklı Egzersiz Müdahalesi

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Abstract

Background: The aim of the current study is to investigate the effects of activity-based exercise intervention for hallux valgus deformity.

Materials and Methods: Forty women with hallux valgus deformity were included in the study and the participants were divided into two groups as intervention and control (intervention group 37.8 ± 7.20 years, control group 37.3±2.61 years). Before and after the 8-week intervention programme hallux valgus angle, activity-specific balance scale, dynamic gait index and foot function index were measured.

Results: According to the results of the study in the intervention group, the hallux valgus angle decreased significantly in both the right and left feet after the treatment, and a significant improvement was obtained in the activity specific balance confidence scale, foot function index, pain, disability, activity limitation, and total score of foot function index ($p<0.001$). When the intervention and control groups were compared after the intervention, a significant difference was found in favor of the intervention group in the foot function index and pain, disability and total score parameters of the dynamic gait index ($p<0.001$).

Conclusions: The results of our research reveal that the exercise applied for hallux valgus is effective in terms of balance, walking and function. It has been demonstrated that activity-based exercise is a good option in the treatment of hallux valgus, which is a very common deformity that should be taken seriously.

Key Words: Hallux Valgus; Exercise, Activity

ÖZ.

Amaç: Bu çalışmanın amacı, halluks valgus deformitesi için aktiviteye dayalı egzersiz müdahalesinin etkilerini araştırmaktır.

Materyal ve Metod: Çalışmaya halluks valgus deformitesi olan 40 kadın dahil edildi ve katılımcılar müdahale ve kontrol olarak iki gruba ayrıldı (müdahale grubu 37.8 ± 7.20 yıl, kontrol grubu 37.3±2.61 yıl). Müdahale grubunda 8 haftalık egzersiz programı öncesi ve sonrasında halluks valgus açısı, aktiviteye özel denge skalası, dinamik yürüme indeksi ve ayak fonksiyon indeksi ölçüldü.

Bulgular: Müdahale grubunda egzersiz sonrasında hem sağ, hem de sol ayakta halluks valgus açısında azalma ve aktiviteye özgü denge güvenlik ölçeği, dinamik yürüme indeksi, ayak fonksiyon indeksinin, ağrı, yetersizlik, aktivite kısıtlılığı ve toplam skor parametrelerinde anlamlı gelişme bulundu ($p<0.001$).

Müdahale ve kontrol grupları karşılaştırıldığında, ayak fonksiyon indeksinin ağrı ile yetersizlik ve toplam skor parametrelerinde müdahale grubu lehine anlamlı fark bulundu ($p<0,001$).

Sonuç: Araştırmamızın sonuçları, halluks valgusa yönelik olarak uygulanan egzersizin denge, yürüme ve fonksiyon açısından etkili olduğunu ortaya koymaktadır. Toplumda özellikle kadınlarda sık karşılaşılan ve ciddiye alınması gereken bir deformite olan halluks valgus tedavisinde aktiviteye dayalı egzersizin iyi bir seçenek olduğu ortaya konmuştur.

Anahtar kelimeler: Halluks valgus, Egzersiz, Aktivite

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Received / Geliş tarihi: 28.02.2022

Accepted / Kabul tarihi: 12.04.2022

DOI: 10.35440/hutfd.1079912

Introduction

Hallux valgus (HV) is one of the most common structural foot deformities in adults and it is characterized by abnormal rotation and lateral deviation of the hallux at the first metatarsophalangeal joint. This angle is also called as the angle between the bisection line of the first metatarsal bone and the proximal phalanx (1). This angle is defined as normal if it is 15 ° and below, mild up to 20 °, moderate between 20 ° and 40 °, and severe when it is 40 ° and above. In this case, it can be mentioned that there is HV deformity at values above 15 degrees. This deformity has symptoms such as pain, inflammation, and reduced mobility of the thumb (2,3).

HV formation and progression is a multifactorial event. Internal factors that cause deformity can be listed as the presence of pes planus, abductor and adductor muscle imbalance, obesity, joint laxity, genetic factors, race, advanced age, gender and external factors such as long-term use of high-heeled shoes with narrow toe boxes (2,4,5).

HV is more common especially among women and in older ages. Although the exact etiology of hallux valgus is not understood, its prevalence is highest in females with symptoms of deformity exacerbated by fashion-shoe wear (6,7).

By changing the foot posture and biomechanics, hallux valgus negatively affects the sensory inputs taken from the foot, thus causing gait and balance disorders (8). Other structural deformities in the foot may also be associated with hallux valgus like pes planus. These problems affecting the foot biomechanics can cause more serious loss of functions with advanced ages and negatively affect daily life activities. It is also known that structural foot problems increase the risk of falling in advanced ages (4,9).

Common rehabilitation practices for hallux valgus can be listed as exercise, shoe advice and orthotic modifications. Implementation of exercises through activity is an approach that has not been tried before for this disease group according to our best knowledge (10-12).

It is aimed to activate the foot muscles which have different functional importance with the exercise intervention. The tendons and muscles that move the big toe are arranged around the metatarsophalangeal joint in four groups: the long and short extensors, the short flexors, and the two tendons of the abductor and adductor hallucis (13,14).

The aim of this study is to examine the effects of activity-based activity intervention for hallux valgus deformity on deformity angle, pain and balance parameters.

Materials and Methods

Participants

Considering the average values of the hallux valgus angle of the treatment and control groups in the reference ar-

ticle according to the results of the power analysis made with the Gpower program to determine the number of participants to be included in the study, 40 people were eligible to participate in the study with a total $p < 0.05$ significance level and 95% power (11).

This research consists of an intervention program for HV deformity designed with an activity-oriented exercise perspective. At the beginning of the study, a total of 50 individuals with hallux valgus deformity were contacted. 42 of these individuals volunteered to participate in the study. After the research started, 2 people dropped out of the study. As a result, 40 women with hallux valgus deformity were included in the study (intervention group 37.8 ± 7.20 years, control group 37.3 ± 2.61 years).

Patients who have painful flexible hallux valgus deformity with the degrees 15 and above included to the study.

Patients who met the following criteria were excluded: previous hallux valgus or foot surgery, patients with rigid deformity and who participated previous rehabilitation intervention for hallux valgus before.

Ethical Statement

Ethics committee approval was received from Biruni University Ethics Committee, dated 25/09/2018, number 2018/20-03.

Assessment Procedure

Various measurements were applied to the patients before and after the intervention in the occupational therapy unit (Foot function index (FFI), dynamic gait index (DGI), activities specific balance confidence scale (ABC scale)).

Goniometric HV angle measurement

This angle was measured in standing position while transferring weight on bare feet. The center of rotation of the goniometer was placed on the metatarsophalangeal joint space. One arm of the goniometer was placed parallel to the first metatarsal and the other parallel to the proximal phalanx of the hallux. The average was calculated by taking three measurements (3).

Foot Function Index

Foot function index (FFI) measures the foot pain and the difficulties in foot-related activities experienced by the patient in the last week. The FFI is a self-administered questionnaire consisting of 3 subscales: pain (9 items), disability (9 items), and activity limitation (5 items), containing 23 items for assessing patients with foot diseases. The pain subscale (PS) evaluates the level of foot pain in various situations. The disability subscale (DS) investigates difficulty in performing various activities due to foot problems. The activity limitation subscale (ALS) shows activity limitations due to foot problems. The patient has to

score each question on a scale from 0 (no pain or difficulty) to 10 (worst pain imaginable or so difficult it requires help), that best describes their foot over the past week (15).

Dynamic Gait Index

Dynamic gait index (DGI) is a scale that evaluates the effects of postural changes during walking in daily life on walking and balance. It evaluates not only usual steady-state walking, but also walking during more challenging tasks. It assesses the individuals ability to modify balance while walking in presence of external demands. During the test, 8 functional walking tests are performed by the subject and marked out of three according to the lowest category which applies. 24 is the total individual score possible. Scores of 19 or less have been related to increase incidence of falls (16).

Table 1. Activity-Based Exercises

1. Stretching the toe by rolling the ball under the foot.
2. Active toe abduction
3. Active toe extension
4. Passive stretching of the thumb towards the neutral position in the direction of abduction. After waiting for 10 seconds in this position and it is repeated for 10 times.
5. Carrying 10 lego pieces between the thumb and 2nd finger into a bucket
6. Building a tower with 10 Lego pieces.
7. Attaching the rubber buckles to a bar.
8. Putting objects of different shapes and sizes into the box.
9. Heel-toe stretching (the heel is positioned between the toes for 10 seconds and this is repeated for 10 times).

Activity Specific Balance Confidence Scale (ABC)

This scale contains 16 tasks related to indoor and outdoor daily living activities, to measure balance confidence in elderly people who have various levels of functioning. Scores range from 0 (no confidence) to 100 (complete confidence) for each question item. Higher scores indicate gre

ater confidence. At the end of the evaluation, the balance security level is determined as a percentage by dividing the sum of the answers given by the patients by 16 (17).

Randomization

After the baseline assessments, patients were randomly assigned to intervention group or control group using a computer-generated table of randomized numbers created before the start of data collection.

Exercise programme

Following the evaluation process, an activity-oriented exercise program was applied to the patients in the intervention group for 8 weeks. In the beginning, the activities that should be practiced on a daily basis were taught to the patients one by one (Table 1). The activities we performed within the scope of our research strengthened especially the tibialis posterior, fibularis longus, abductor and adductor hallucis flexor digitorum longus and brevis, lumbricales and flexor hallucis longus muscles.

Results

According to the results of the evaluation made before and after the 8-week intervention program, IBM SPSS 22.0 for windows statistical package program was used for statistical analysis of research data. The Wilcoxon signed-rank test was applied for intra-group comparisons before and after the intervention period. In the intervention group, the hallux valgus angle decreased significantly in both the right and left feet after the treatment, and a significant improvement was obtained in the activity specific balance confidence scale, dynamic walking index, pain, disability, activity limitation and total score of foot function index ($p < 0.001$). There was no significant difference in the control group ($p > 0.001$) (Table 2).

According to the Mann Whitney U test results, when the intervention and control groups were compared after the intervention process, a significant difference was found in favor of the intervention group in the foot function index and dynamic gait index parameters ($p < 0.001$) (Table 3).

In the current study, activity-oriented exercise intervention was applied to female cases with hallux valgus deformity and evaluations were made before and after the exercise period. Considering the results of the evaluations, it was determined that exercise intervention was effective in terms of hallux valgus angle, balance, gait and foot function in these population. Although there was no significant difference in the hallux valgus angle before and after the intervention in the experimental and control groups, a significant improvement was observed in the balance, gait and foot function parameters in the experimental group.

Table 2. Hallux valgus angle, balance, dynamic gait and foot function index scores before and after the intervention period

Intervention group	Median	Min.	Max.	Mean	sd	z	p
HVA before intervention (right)	19	15	27	19	3.49		
HVA after intervention (right)	16.25	11	25	16.45	3.42	-3.946	0.000*
HVA before intervention (left)	20.50	16	29	21.07	3.72		
HVA after intervention (left)	18	12	26	17.80	3.27	-3.929	0.000*
ABC before intervention	73.74	52.5	92.5	73.95	9.96		
ABC after intervention	86.33	72.40	99.80	86.63	9.06	-3.920	0.000*
DGI before intervention	17.50	12	22	17.10	2.75		
DGI after intervention	20	15	23	19.55	2.54	-4.008	0.000*
FFI before intervention	66	32	97	64.20	17.45		
FFI after intervention	33.50	23	74	36.50	14.49	-3.921	0.000*
Control group	Median	Minimum	Maximum	Mean	sd	z	p
HVA before intervention (right)	18	16	21	18	1.48		
HVA after intervention (right)	18	16	21	18.17	1.45	-1.380	0.168
HVA before intervention (left)	18	15	22	18.30	1.84		
HVA after intervention (left)	18	15	21	18.50	1.53	-1.182	0.237
ABC before intervention	75	62.60	92.50	76.51	7.59		
ABC after intervention	75.10	58.40	94.50	75.69	8.11	-1.531	0.126
DGI before intervention	16.5	11	21	16.10	2.75		
DGI after intervention	16.5	10	20	16.05	2.56	-0.180	0.857
FFI before intervention	60.50	39	101	63.10	16.53		
FFI after intervention	58.50	44	98	63.60	14.70	-0.715	0.475

$p < 0.001$

ABC: Activity specific balance confidence scale

DGI: Dynamic gait index

FFI: Foot function index

HVA: Hallux valgus angle

Table 3. The comparison of intervention and control groups

		Median	Min.	Max.	Mean rank	p
Right	intervention	16.25	11	25	15.60	0.008
HVA	control	18	16	21	25.40	
Left HVA	intervention	18	12	26	18.80	0.353
	control	18	15	21	22.20	
ABC	intervention	86.33	72.40	99.80	26.85	0.001
	control	75.10	58.40	94.50	14.15	
DGI	intervention	20	15	23	26.98	0.000*
	control	16.5	10	20	14.03	
FFI	intervention	33.50	23	74	12.30	0.000*
	control	58.50	44	98	28.70	

* $p < 0.001$

Discussion

As a result of our research, significant improvements were obtained in terms of hallux valgus angle, balance, gait and foot function index after activity-based exercise intervention. Hallux valgus is a deformity that affects walking and wearing shoes, especially in women. For this reason, interventions that provide functional recovery such as exercise are very valuable with their corrective effect.

The original dimension of this research is to carry out the exercise on an activity-based basis in order to construct it in a more enjoyable and sustainable way.

In cases with hallux valgus deformity, it is known that strengthening of the tibialis posterior, fibularis longus, abductor and adductor hallucis, flexor digitorum longus and brevis, lumbricales and flexor hallucis longus muscles has positive effects on balance and walking activities (8,18). By activating these muscle groups with the intervention, we achieved gains both correcting the deformity and increasing the function.

In Abdalbary's study, 36 sessions of exercise, mobilization and finger separator were applied to 28 women with moderate hallux valgus deformity for 3 months. Significant improvement was observed in pain, muscle strength and angle parameters in the intervention group (11). In our study, we obtained significant results in pain and angle parameters over a 2-month period.

Although exercise and activity approaches can not completely normalize the deformity, they increase the mobility of patients by reducing pain and improving walking and balance performance¹.

Considering the complications caused by hallux valgus surgical methods and the inactivity process after surgery, it would be appropriate to prefer a conservative treatment approach such as exercise. However, it is not an easy situation to gain the habit of exercising. The purpose of the activity-oriented exercise approach is to ensure that patients enjoy exercise and most importantly, its continuity. It is also an approach where visual inputs and focus are of great importance and this increases its effect. However, despite these, when the literature is examined, there is no activity-oriented intervention study for hallux valgus deformity according to our best knowledge.

Conclusion

The results of the current research revealed the importance of the activity-oriented exercise therapy perspective in correcting the HV deformity angle. Results provided significant improvements in balance, gait and foot function parameters of activity-based exercise intervention for hallux valgus deformity. It has been demonstrated that activity-based exercise is a good option in the treatment of hallux valgus, which is a very common deformity that should be taken seriously.

Ethical Approval: Ethics committee approval was received from Biruni University Ethics Committee, dated 25/09/2018, number 2018/20-03.

Author Contributions:

Concept: B.Ö.

Literature Review: B.Ö.

Design : B.Ö., Y.Ç.

Data acquisition: B.Ö.

Analysis and interpretation: B.Ö., Y.Ç.

Writing manuscript: B.Ö., Y.Ç.

Critical revision of manuscript: . B.Ö., Y.Ç.

Conflict of Interest: None

Financial Disclosure: None

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