

RESULTS OF KINESITHERAPY FOR HALUX VALGUS (BUNIONS): A CASE STUDY

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Abstract

Hallux valgus, or the so-called "bunions", is a common joint deformity that can seriously affect the foot's function. The current case study presents the influence of physiotherapy tools on a 43-year-old woman with bilateral hallux valgus. The diagnostic methods used are current status, functional tests, and measuring deformation angles and plantar indices on the simple footprint (plantogram). The therapy includes passive means (separation of the fingers, corrective Kinesio taping, stretching exercises) and active ones - specific, corrective and strength exercises. Conducted kinesitherapy leads to pain relief and partial correction of the deformity. The present case may serve as a basis for further, more in-depth studies.

Keywords: *Hallux Valgus correction, bunions prevention, kinesiotherapy*

INTRODUCTION

Hallux valgus (HV) is a typical first metatarsophalangeal joint (MTPJ) condition associated with medial deviation of the first metatarsal, lateral abduction of the big toe, and first metatarsophalangeal joint pronation (Nair et al., 2022). It was first described by the German surgeon Carl Heuter in 1871 (Cavalheiro et al., 2020). It usually becomes chronic and deepens with advancing age, and many studies have also established a hereditary nature (Okuda et al., 2014). In addition to the cosmetic problem and the difficulties it causes when choosing shoes, pain, limitation of the functional possibilities of the foot, and deterioration of the patient's quality of life may occur (Nair et al., 2022). In moderate and severe hallux valgus, plantar toe pressure and push-off strength were reduced (Hurn et al., 2015). The sufferer of a protruding "knuckle" of the thumb develops a reaction of fear of movement and falling, avoidance of certain activities, mostly related to walking, and the balance is disturbed (Mickle et al., 2011; Oztarsu & Oksuz, 2022). The positive correlation between the degree of deformation and the subluxation between the sesamoid and metatarsal bones was also established (Koller et al., 2014), as well as with the presence of pathological changes in the anatomy of the foot (Cavalheiro et al., 2020).

Radiographic studies are commonly used to evaluate the extent of physical deformity objectively. The most frequently used measurements include:

Intermetatarsal angle (the angle between the first and second metatarsal bones) – 9-11° (mild degree), 12-17° (moderate-severe degree) and $\geq 18^\circ$ (severe degree);

Hallux valgus angle (HVA) or metatarsophalangeal angle (MTFA) of the first beam (Manchester Scale grades) - below 15° is considered to be free of pathology. Above this value, a diagnosis of "hallux valgus" can be made, as a mild degree is considered deformation of 15-19°, medium degree – from 20° to 39° and from 40° upwards – severe degree (Estepa-Gallego et al., 2022; Okuda et al., 2014).

Manchester scale – a visual scheme for diagnosis through standardized images of the damage in the different stages (related to the determination of HVA), one of the most significant advantages being the minimization of X-ray radiation (Garrow et al., 2001).

According to various sources, sufferers of this deformity vary from 23% to 33% of all persons between the ages of 18 and 65, with women significantly more frequently affected (Ezzatvar et al., 2021; Nair et al., 2022; Nix et al., 2010). Okuda's team reported that 30% of female students with an average age of 18.7 years had mild to moderate HV unilaterally or bilaterally (Okuda et al., 2014). Extensive studies were conducted on hundreds of radiographs in the mid-20th century to determine the various types of structural disorders that affect the congruence, deviation, or subluxation of the first MTPS (Piggott, 1960).

The etiology of foot problems can be attributed to internal factors (such as gender and heredity) and external factors, including footwear. Frequent and prolonged wearing of shoes with a narrow compartment in the toe area and a high heel are considered risk factors for the development of the deformity (Cavalheiro et al.,

2020). It is to this that scientists attribute the female sex being affected 15 times more than the male in adulthood and old age, compared to a ratio of 2:1 (w:m) in childhood.

The degree of deformity as well as the presence/absence of comorbidity play a vital role in the prognosis and for the treatment strategy choice. Quite often, in severe cases of HV, surgical treatment is recommended. It usually gives excellent results regarding the alignment of bone segments (Nair et al., 2022; Natsaridis et al., 2021). With the accumulation of empirical experience, surgical intervention has become routine. Strict medication and analgesia protocols have been established for them preoperatively, during the surgical intervention and afterward (Korwin-Kochanowska et al., 2020).

According to some scientists, however, there is no firm evidence that surgical interventions improve the function of the forefoot from the point of view of biomechanics. Even the opposite - HV surgery may further exacerbate the deficit of plantar loading of the big toe in the push-off phase of walking (Wong et al., 2023). In addition, some sources warn of recurrences and complications in 10.6% to 73% of operative interventions, and most often, the

AIMS

This study aims to evaluate the impact of kinesiotherapy on a patient with bilateral hallux valgus.

The subject is a physically active (according to the criteria and recommendations for minimum weekly physical activity of the World Health Organization (World Health Organization, 2020)) 43-year-old clinically healthy woman.

METHODS

Diagnostic methods:

History taking - history of suffering and current complaints; view

Preparation of plantograms - making a footprint with massage oil while weight-bearing (standing on one leg) and tracing the outline;

Functional assessment: manual muscle testing (MMT) for mm. gastrocnemius et soleus, fingertips to floor distance test, pelvic position in sitting, feet and heel position in squatting.

Measurement of modified HV angle (mHVA) on plantograms and photographic material, using the medial foot tangent (from the most prominent medial point of the heel to the most prominent medial point of the MTPJ) and inner tangent of the big toe (from the most prominent medial point of the big toe to the most prominent medial point of the MTPJ). Of course, this method cannot give the accuracy of the HVA measurement with radiographic examination. This inaccuracy is because the inner tangent of the foot is more likely not to be parallel to the first metatarsal bone. Usually, the distal end of the first metatarsal bone

Therapeutic methods:

- Improving the joint mobility in the area of the ankle-foot joint complex - with an emphasis on the 1stMTPJ, the talocrural and

reasons are related to inadequate appointment or execution of the surgical intervention (Barg et al., 2018; Ezzatvar et al., 2021).

At the same time, efforts are being made to develop conservative treatment methods. Studies have shown that a combination of exercises, toe separators, night stretches, and acupuncture are the best choices for reducing HVA, with toe spacers (with or without exercise), acupuncture, and manual manipulation (with or without cryotherapy) having advantages in alleviating the patient's subjective pain sensations (Ying et al., 2021). Other authors also confirm the beneficial influence of orthoses (Kwan et al., 2021) or kinesio taping (Ahmed et al., 2021) for straightening the thumb. The literature sources also highlight the leading role of the specialist in kinesiotherapy in this process. The same exercise program gives a better result when carried out under professional supervision than when carried out by the patient at home without the intervention of a specialist (Oztarsu & Oksuz, 2022). There are reports regarding the positive impact on balance abilities - static and dynamic, and the improvement of dorsiflexion in the ankle joint (Estepa-Gallego et al., 2022).

From April to June 2023, were carried out 11 sessions, the first and last of which were mainly diagnostic and research.

The tasks to be solved in the present case are grouped in two directions: diagnostic and therapeutic.

is shifted in a lateral direction, so the mHVA is expected to be smaller than the HVA. However, this modified measurement method is preferred in the present study to trace the difference before - and after the kinesiotherapy intervention due to its inexpensive and sparing nature – no X-ray exposure for the patient is needed. Some scientists use a first phalanx adduction angle (1stPAA), which is measured while standing by a goniometer, with the fixed arm placed on the projection of the first metatarsal bone, its centre established in the middle of the MTPJ and the mobile arm on the axis of the first phalanx (Oztarsu & Oksuz, 2022). The present study assumes that the possible error in the measurement of the mHVA is lesser than 1stPAA, measured by the goniometer.

Measurements and calculations of three plantar indices: Chizhin's index - ChI (Zhelev, 2011), Staheli index - Staheli Plantar Index - SPI (Hernandez et al., 2007), and Chipaux-Smirak Plantar Arch Index - ChSPAI of Chipo-Smirak (Koirala et al., 2021; Pita-Fernández et al., 2017).

the subtalar ankle joints, pronation in the midfoot area, and intermetatarsal mobility.

- Stretching of shortened/contracted muscles that deepen the deformity;
- Analytical activation and strengthening of muscles relevant to deformity correction.
- Passive and active deformity correction.

Kinesitherapeutic tools included in the methodology:

- Corrective Kinesio-taping for HV, according to Eremiev (2013), with a modification to reduce dorsiflexion in the second MTPJ. The

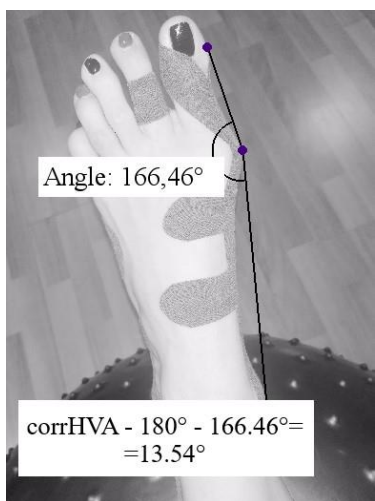


Figure 1a.: Corrective taping for hallux valgus with corrected (corr) HVA 13.54°

desired correction is not maximal, but the possible pain-free one that the patient can tolerate and carry out daily activities within up to two days (Fig. 1a and 1b).



Figure 1b.: Corrective taping for hallux valgus with corrected (corr) HVA 21.38°

- Exercises for self-massage with balls (size from 2.5 - 8cm) and stretching of the short muscles of the foot - "curling", incl. separation of the toes using a napkin (depending on how much the napkin is twisted, its thickness and the separation of the toes may vary), plantar and dorsiflexion for each toe separately in a (maximal painless) corrected position;
- Exercises to strengthen the plantar flexion, especially of the big toe, in a maximal pain-free corrected position - with manual guidance, resistance, and an elastic band. "Spreading" the fingers - active toes abduction.
- Exercises to improve the biomechanics of the foot (in the maximally corrected position) when lifting toes and squatting, moving from a supported squat to a supported kneeling position with feet on toes (in the pain-free range of motion).
All exercises are performed slowly, with correction of the MTPJ alignment to the maximum possible extent, without provoking pain.
An essential condition is that the patient's shoes respond to the requirements of the therapy, namely – to provide enough space for the correct position of the big toe.

RESULTS

History and current complaints

The HV deformity has been developing for many years. It started to get worse in the last two years, and for the previous half year, the pain has been much more acute.

At the beginning of the examination, the patient reports severe pain, especially after a long distance walking or running, in the area of the second interphalangeal joint of the left foot, which is

pushed medially and up by the big toe and pressed to the shoe. This pain limits the patient and leads to avoiding the mentioned activities and replacing them with other aerobic activities to remain physically active.

The patient also informs about difficulties in finding suitable shoes.

Observation

Thick and hard skin is found dorsally on the second and fourth proximal interphalangeal joints (PIFJ) of the left foot; in the area of the first phalanx – medio-plantar; 5th PIFJ – lateral-plantar; first and second MTPJ - plantar. Also, in the area of the right foot - fourth PIFJ, dorsal; first phalanx – medio-plantar; 5th PIFJ – lateral-plantar; second MTFJ - plantar side.

The big toes' MTPJs on both feet are medially prominent and seem irritated, more to the left.

The observation of the lower limbs in standing position (SP) from behind shows a neutral position of the heels and Achilles, with internal rotation of the hip joints and knee caps pointing medially.

Parallel inner feet edges are noticeable from the front view. The hallux valgus deformity is visible, significantly more for the left MTPJ.

A digital measurement of the mHVA of the images and the plantograms was made for comparison.

Functional studies

Manual muscle testing (MMT) for mm. gastrocnemius et soleus gave a maximum score of 25 and 23 toe-ups for each leg, respectively (a maximal MMT score - 5 for these muscles means that at least 20 repetitions of the testing movement can be performed correctly through a full range of motion). The patient performs very well but reports a sensation of more fatigue accumulating in the right calf.

The "Fingertips to floor distance" test shows hypermobility (+17cm). The neutral pelvic position while sitting is possible without

difficulties. Squatting is possible without lifting the heels off the floor or turning the toes outward.

Preparation of plantograms, measurement of mHVA and plantar indices

In calculating the results for mHVA at the beginning and end of the study, the measurements made on the plantograms were checked digitally using the program ICMMeasure 2.0.0.286 (Fig. 2).

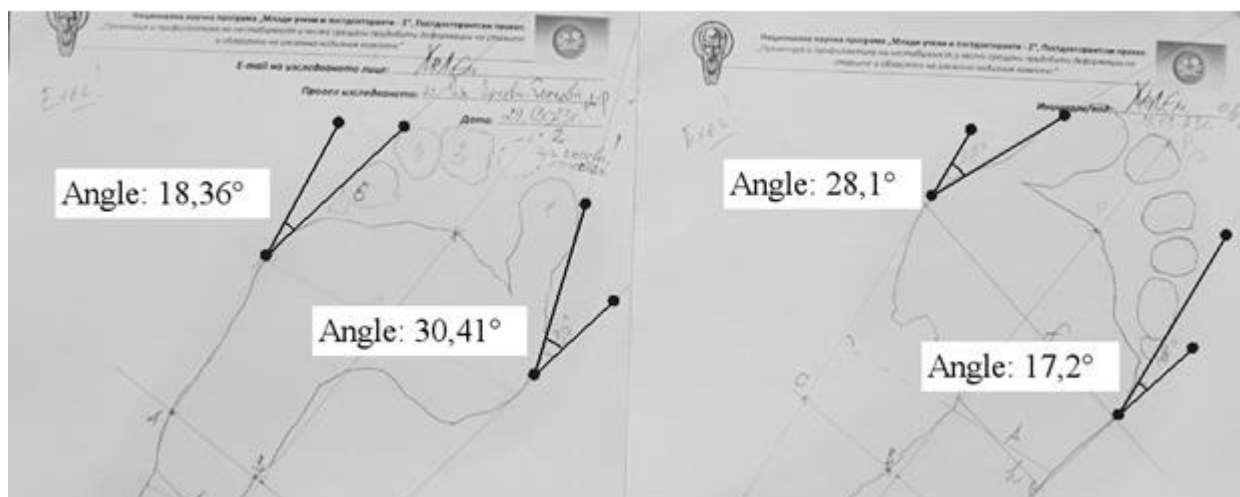


Figure 2.: Measurement of the mHVA at the beginning of the study on the plantograms, checked digitally using the ICMMeasure 2.0.0.286 application: left – 30.41° and right – 28.1°

It is important to note that in the plantogram of the left foot, the second toe did not leave a mark, and its presumed location is marked with a dashed curve to enable the calculation of the plantar

indices. However, in the final testing (Fig. 3), the second finger leaves a mark on the sheet, which means it is in contact with the surface, i.e., a correction has been achieved.

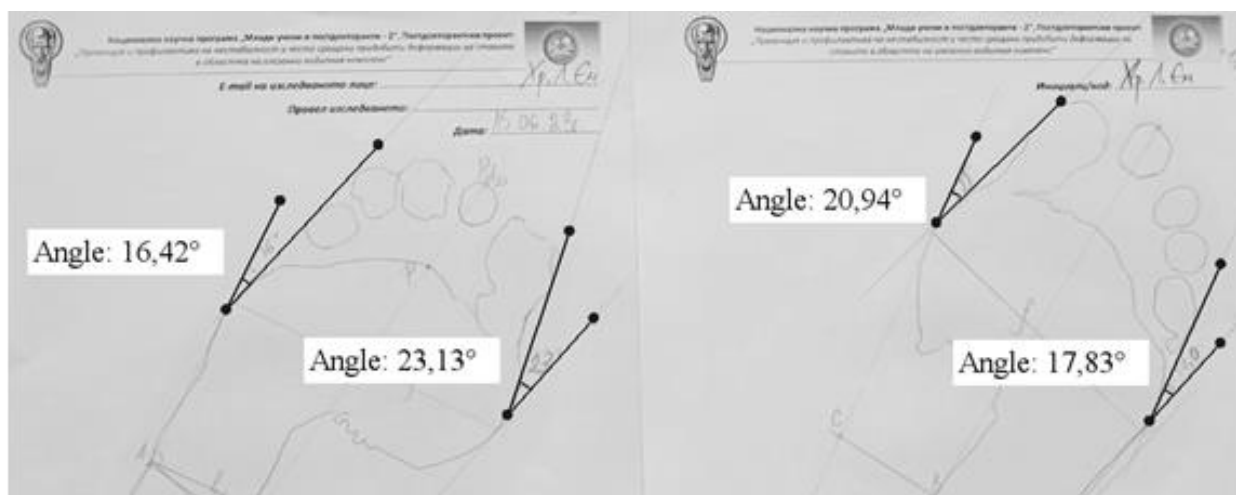


Figure 3.: Measurement of the mHVA at the end of the study on the plantograms, checked digitally using the ICMeasure 2.0.0.286: left – 23.13° and right – 20.94°

The results of the mHVA measurements at the beginning and end of the study showed an improvement in the patient's 1st

MTPJ alignment by 7.28° for the left foot and 7.16° for the right foot (Table 1.).

Table 1.: Results of the measurements carried out at the beginning and end of the study, respectively, for the left (-l) and right (-r) foot

	<i>mHVA^a - l</i>	<i>mHVA - r</i>	<i>CHI^b - l</i>	<i>CHI - r</i>	<i>SPI^c-l</i>	<i>SPI-r</i>	<i>ChSPA^d- l</i>	<i>ChSPA - r</i>
Начало	30,41	28,1	0,88	1,14	0,59	0,74	31,18	43,16
Край	23,13	20,94	0,83	1,26	0,57	0,69	37,63	34,7
Разлика	7,28	7,16	0,05	-0,12	0,02	0,05	-6,45	8,46

^a - modified HV angle; ^b – Chizhin's index; ^c - Staheli Plantar Index; ^d - Chipaux-Smirak Plantar Arch Index;

Measurements of the three plantar indices are also presented in Table 1., with the left foot showing a slight improvement in two plantar indices (Chijin and Stahely index). The Chipo-Smirak index increases at the final examination, possibly due to a change in the foot's proportion and clearance during the opening of the hallux valgus angle.

Two indexes show an increase in the score for the right foot. The change in the Staheli index is insignificant - 0.05. However, the Chipo-Smirak index increase is significant because it

indicates a transition from a 3rd-degree to a 2nd-degree normal foot arch according to the author's reference values set. The Chijin index result at the end slightly contradicts the previous one as it has risen, indicating a minor fall in the medial foot arch.

A follow-up of the case (by interview with the patient four months after the therapy sessions) showed that there were still no complaints of pain, and the contact of the left foot's second toe kept touching the other toe stepping surface.

DISCUSSION

Surgery techniques, such as an alternative median Chevron osteotomy with a modified McBride capsuloplasty, resulted in an average improvement of 24.4° in HVA (Natsaridis et al., 2021). In various studies, the choice of minimally invasive techniques led to an 18.4° to 19.5° reduction in HVA, while percutaneous techniques (with open access) showed a 15.5° to 19.8° reduction in LVH (Kaufmann et al., 2019; Nair et al., 2022). Bulgarian authors reported an improvement in the HVA using different surgical techniques of an average of 14.4° (32 children, 47 feet), 19.35° (34 women and one man, 38 operated feet) and about 1.19° with epiphysiodesis (12 surgery-treated feet in nine children) (Gerchev et al., 2022; Gerchev & Tserovski, 2022; Zagorov, 2008).

Conservative treatment leads to modest achievements. In the literature, results for a reduction in the adduction angle of 7.63° for the right foot and 7.48° for the left foot in patients performing the exercises under the supervision of a physiotherapist and significantly lower in independent work were reported (Oztarsu & Oksuz, 2022). The results obtained in the present study are comparable to those reported by Oztarsu's team, being lower by 0.47° for the right foot and 0.2° for the left foot. It should be mentioned, however, that in the cited study, subjects had therapy sessions four times a week for eight weeks (a total of 32 sessions). In contrast, in the present case study, the patient had nine full

therapy sessions and two partial sessions (in which the tests were conducted) within two months.

Results of conservative treatment (passive one) with only insoles and orthoses (toe spacers) in children by a Bulgarian author

CONCLUSIONS AND RECOMMENDATIONS

The conclusions that emerge from the present study are as follows:

Kinesitherapeutic means and techniques make it possible to influence the pain symptoms in the presence of hallux valgus;

Hallux valgus angle correction can be achieved through kinesitherapy means and techniques, and the average value of the deformity reduction within two months (carrying out 10 to 30 procedures) can reach about 7.5°;

A good therapy effect may be obtained by integrating passive (orthoses, separators, kinesio taping) and active (stretching, corrective and strength exercises) means and techniques.

Recommendations are related to:

Use of standardized tests and measurements to allow comparison of results in different studies;

To conduct longer hallux valgus therapeutic courses, with patients' training for completing therapeutic exercise programs and taking independent measures to prevent complications.

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have an insignificant effect - an average improvement in HVA of 0.68° (Gerchev, 2020), which is an expected result in the context of other studies, that consider poor outcome for this therapy strategies (Bek & Kürklü, 2002).

Long-term follow-up of hallux valgus therapy (maintenance therapy) impact on plantar arches;

Contributions of the study:

Implementation of a new, gentle way to measure the hallux valgus deformity - modified hallux valgus angle (mHV);

Application of a modified corrective Kinesio taping technique for hallux valgus with additional correction for the second toe.

In conclusion, the examined case of a woman with hallux valgus is indicative of the possibilities that kinesitherapy provides to overcome this progressive, debilitating deformity. The disadvantages of this conservative approach are related to the effect being more modest than that reported with the operative one. It also requires much more time, effort and activity from the patient (and the therapist). In this process, however, indisputable advantages are the improvement of the overall kinematics of the foot due to the complex motor activities and the absence of severe relapses due to its non-invasive nature.

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