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Do radiological parameters affect quality of life in patients with untreated and symptomatic hallux valgus?

Türkan Turgay[1], Gökhan Bülent Sever[2]

[1]*Department of Physical Medicine and Rehabilitation, SANKO University, Faculty of Medicine, Gaziantep, Turkey*
[2]*Department of Physiotherapy and Rehabilitation, SANKO University, Faculty of Health Sciences, Gaziantep, Turkey*

ABSTRACT

Objectives: The aim of this study is to investigate the effect of the disease on quality of life (QoL) in patients with not operated symptomatic hallux valgus (HV) and the relationship between the degree of deformity classified by radiological parameters and QoL.

Methods: In this prospective study, 100 patients (33 males, 67 females; mean age 49.25 ± 15.20 years; range 18 to 75 years) who were admitted to our institution and diagnosed with HV between March 2019 and February 2020 were included. Hallux valgus angle (HVA) and intermetatarsal angle (IMA) were used to assess the degree of deformity. The Visual Analog Scale (VAS), the Foot Function Index (FFI), and the 36-Item Short-Form Health Survey (SF-36) instruments were used to evaluate patients.

Results: The severity of HVA associated with SF-36 scores for physical health, social functioning, bodily pain, general health, and mental health ($p < 0.05$). Differences were found between the degrees of IMA for social functioning, bodily pain, and general health scores in SF-36 ($p < 0.05$). A significant statistical correlation was observed between pain scores in VAS and severity of HVA and IMA. Higher scores in VAS and FFI were recorded from the participants with high degrees of HVA ($p < 0.05$). However, no relationship was found between the radiographic severity of the IMA and the FFI.

Conclusions: In this study, it was shown that the QoL decreased as the degree of deformity increased in HV patients. In addition, it was concluded that HVA is a more basic radiological predictor than IMA in the evaluation of HV patients.

Keywords: Hallux valgus, radiographic angles, quality of life

Hallux valgus (HV) is one of the chronic progressive foot deformities that can be seen in almost every age group, characterized by the lateral deviation (abduction) of the hallux and by the corresponding deviation (adduction) of the first metatarsal [1]. In a recent large-scale epidemiological study showed that the prevalence of hallux valgus was 23% in adults aged 18-65 and 35.7% in the elderly [2]. Although the etiology of hallux valgus is unclear, inappropriate footwear, the length of the first metatarsal, foot pronation, female sex and hereditary factors have been identified as risk factors [3]. Considering its high incidence in orthopedic foot surgery [4], the fact that it is becoming a major health problem such as osteoarthritis in women [5], and its association with disability [6], increased risk of falling [7], muscle weakness in the toe

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Address for correspondence: *Türkan Turgay, MD., SANKO University, Faculty of Medicine, Sani Konukoğlu Research and Practice Hospital, Department of Physical Medicine and Rehabilitation İncilipınar mah. Ali Fuat Cebesoy Blv. No: 45, Şehitkamil 27090, Gaziantep, Turkey. E-mail: turkanharunlar@hotmail.com, GSM: +90 536 680 71 34*

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[8], worse physical performance [9], balance and gait disturbances [10].

QoL is defined as an individual's perception of his/her position in life in relation to his/her goals, expectations, standards, and interests within the framework of the surrounding culture and value systems. The main purpose of the services provided in health systems is to provide a positive change in the health of the individual or society. It is important to measure the QoL, in order to manage health policies and conduct medical research.

The effects of diseases on QoL are variable. However, most of the time, the physician has no chance to thoroughly evaluate the patient to make a decision on the treatment of the disease in the outpatient clinic conditions. In such cases, radiological parameters gain importance in the treatment decision of HV disease. The accepted standard radiological measurements to reveal the severity of the disease are hallux valgus angle (HVA) and intermetatarsal angle (IMA) [11]. According to our literature review, studies investigating the correlation between these angles and the patients' QoL are limited.

The aim of our study was to investigate whether the disease really affects the quality of life using standard radiological measurements in symptomatic and non-surgical patients with varying degrees of HV deformities.

METHODS

A total of 100 patients who were 18 to 75 years of age and were diagnosed with HV in the Physical Medicine and Rehabilitation and Orthopedics and Traumatology Clinics at SANKO University Sani Konukoglu Practice and Research Hospital between March 2019 and February 2020 were included in this study. The patients were randomly selected from those who have not undergone surgical treatment and botulinum toxin injections and used any HV orthotic devices (e.g, interdigital reel, night splint) throughout their lives. Patients who were over 75 years old, had rheumatic inflammatory diseases such as rheumatoid arthritis, psoriatic arthritis, and gout, history of foot surgery or trauma, and those with neurological diseases were not included in the study. The study protocol was approved by the SANKO University Clinical Research Ethics Committee (Decision No: 2019/02-04; Date: 04.03.2019). The study was conducted in accordance with the principles of the Declaration of Helsinki. A written informed consent was obtained from each participant. Demographic data of the individuals such as age, gender and body weight index (BMI = kg/m²) were recorded.

The degree of the deformity was evaluated with radiological parameters using the HVA and the IMA. Since the severity of hallux valgus may differ between feet in the same individual, we evaluated the most painful foot.

The measurements of the HVA and IMA angles on standing anterior-posterior foot radiographs were performed by two independent physicians. PACS (PACS Expertise, Marosis, South Korea) computer system in a conventional X-ray machine was used for radiographic evaluations. The HVA was categorized as normal (< 15°), mild (Stage 1) (15-20°), moderate (Stage 2) (20-40°), and severe (Stage 3) (≥ 40°); the IMA as normal (< 9°), mild (Stage 1) (9-11°), moderate (Stage 2) (11–16°), and severe (Stage 3) (≥ 16°) [12].

The Short Form-36 (SF-36) instrument was used to measure the overall QoL. In the SF-36 scale, eight dimensions of health, including physical function, social function, role limitations (due to physical and emotional reasons), mental health, vitality/energy, pain, and general perception of health are examined with 36 items. The scores range from 0 to 100, separately for each subscale. A high score is an indicator of good QoL [13]. Intensity of pain was evaluated using a visual analog scale (0-100) (VAS) [14]. The Foot Function Index (FFI) was used to evaluate foot pain and the functional status of the foot [15]. FFI consists of 23 items on 3 subscales with three subgroups. FFI is scored on a visual analog scale between numeric anchors representing extremes. In calculations, all scores are averaged. Higher scores indicate more pain, disability, and activity restriction.

Statistical Analysis

IBM SPSS Statistics v.23 package program was used for data analysis. In expressing the descriptive statistics, the mean and standard deviation or the median and minimum-maximum values were given for quantitative data, and the frequency and percentage values were given for qualitative data. The compliance

of the quantitative data with normal distribution was evaluated using the Kolmogorov-Smirnov test. In group comparisons of the quantitative data, the independent samples t-test (quality of life comparisons according to gender), one-way ANOVA (FFI) or Kruskal-Wallis variance analysis (quality of life comparisons according to severity of hallux valgus and intermetatarsal angles except FFI) were used according to the suitability of the data. When a significant difference was detected in the ANOVA results, Tukey's or Dunn's test was used to determine the difference. The relationship between two continuous data was evaluated using the Pearson correlation coefficient (correlations between quality of life and patient characteristics). In all evaluations, a p level <0.05 was considered statistically significant.

RESULTS

A total of 100 participants (mean age: 49.25 ± 15.20 years, range: 18 to 75 years) were enrolled in this study. Table 1 shows the characteristics of the patients such as age, education, affected foot, gender, BMI, HVA, IMA, FFI, SF-36, and foot pain levels in VAS. First, we stated that 67% of patients were women and in 57% of the cases the right foot was affected. Mean scores ± SD were significantly high in the assessment of foot pain, foot function, and BMI for all patients.

Regarding HVA, there were 23 cases classified as 'HV3/severe' (> 40°); 51 cases classified as 'HV2/moderate' (20-40°), and 26 cases classified as 'HV1/mild' (15-20°). The classification of the IMA revealed that 22 cases were categorized as 'IMA1/mild' (9-11°), 37 as 'IMA2/moderate' (11-16°), and 41 as 'IMA3/severe' cases (> 16°).

In all patients there was a statistically significant correlation between scores of SF- role physical, SF-energy/fatigue, SF-social functioning and pain (VAS-foot) scores ($p < 0.05$). Additionally, a statistically significant positive correlation was found between FFI, HVA, IMA and VAS-foot pain ($p < 0.001$) (Table 2).

In gender-based comparisons, it was observed SF-energy fatigue, SF-emotional well-being, SF-general health, and SF-mental health scores were significantly lower in females than males ($p = 0.004$, $p = 0.045$, p

Table 1. Sociodemographic and clinical characteristic of patients (n = 100)

	Mean ± SD (Range)
Age (years)	49.25 ± 15.20 18-75
BMI (kg/m²)	25.35 ± 3.94 19.3-36.2
Education level, n (%)	
Untrained	12 (12)
Low	13 (13)
Middle	38 (38)
High	37 (37)
Affected foot, n (%)	
Right	57 (57)
Left	43 (43)
Gender, n (%)	
Female	67 (67)
Male	33 (33)
HVA	32.52 ± 8.07 16.2-53.4
IMA	14.53 ± 2.91 8.5-20.7
FFI	70.27 ± 10.01 31-88
VAS-foot pain	77.20 ± 10.47 60-100
SF-Physical functioning	54.90 ± 12.26 25-75
SF-Role physical	40.5 ± 17.86 25-75
SF-Role emotional	66.1 ± 22.22 33-100
SF-Energy/Fatigue	59.50±19.73 25-100
SF-Emotional well being	49.56 ± 16.63 28-72
SF-Social functioning	65.20 ± 19.74 25-88
SF-Pain	40.30 ± 11.36 25-63
SF-General health	61.30 ± 13.38 30-80
SF-Mental health	56.35 ± 15.56 25-80

BMI = Body Mass Index, HVA = Hallux Valgus Angle, IMA = Intermetatarsal Angle, FFI = Foot Function Index, VAS = Visual Analogue Scale, SF = Short Form, SD = Standart Deviation

Table 2. Correlations between quality of life and patient characteristics.

		Age (years)	BMI (kg/m^2)	VAS-foot pain	FFI	HVA	IMA
SF-Physical functioning	r	0.050	-0.081	-0.144	0.039	-0.101	-0.082
	p	0.624	0.422	0.154	0.701	0,317	0.416
SF-Role physical	r	-0.067	0.067	-0.401	-0.106	-0,429	-0.165
	p	0.507	0.508	**< 0.001**	0.293	**< 0.001**	0.102
SF-Role emotional	r	-0.241	0.093	-0.095	-0.341	-0.195	0.039
	p	0.016	0.360	0.347	**0.001**	0.052	0.702
SF-Energy/Fatigue	r	-0.111	0.100	-0.383	-0.322	-0.290	-0.044
	p	0.270	0.320	**< 0.001**	**0.001**	**0.003**	0.667
SF-Emotional well being	r	0.146	0.246	-0.004	-0.143	0.168	0.181
	p	0.148	0.013	0.971	0.154	0.096	0.071
SF-Social functioning	r	-0.026	0.166	-0,515	-0.413	-0.467	-0.249
	p	0.796	0.098	**< 0.001**	**< 0.001**	**< 0.001**	**0.013**
SF-Pain	r	0.101	-0.117	-0.133	0.092	-0.254	-0.232
	p	0.316	0.246	0.188	0.360	**0.011**	**0.020**
SF-General health	r	-0.386	-0.120	0.185	-0.143	0.240	0.334
	p	**< 0.001**	0.235	0.066	0.156	**0.016**	**0.001**
SF-Mental health	r	-0,483	-0.021	0.101	-0.276	0.265	0.302
	p	**< 0.001**	0.833	0.318	**0.005**	**0.008**	**0.002**

BMI = Body Mass Index, HVA = Hallux Valgus Angle, IMA = Intermetatarsal Angle, FFI = Foot Function Index, VAS = Visual Analogue Scale, SF = Short Form, r= Pearson correlation coefficient

Table 3. Quality of life comparisons according to gender

	Female Mean±SD (n = 67)	Male Mean±SD (n = 33)	*p* value
SF-Physical functioning	55.00 ± 12.43	54.70 ± 12.11	0.908
SF-Role physical	41.04 ±17.78	40.76 ± 18.29	0.940
SF-Role emotional	66.68 ± 21.72	64.65 ± 23.49	0.671
SF-Energy/Fatigue	55.75 ± 20.11	67.12 ± 16.77	**0.004**
SF-Emotional well being	47.22 ±16.30	54.30 ± 16.52	**0.045**
SF-Social functioning	64.10± 20.27	67.42 ± 18.73	0.432
SF-Pain	41.79 ± 10.85	37.27 ± 11.94	0.061
SF-General health	58.81 ± 13.08	66.36 ± 12.70	**0.007**
SF-Mental health	52.69 ± 14.25	63.79 ± 15.66	**0.001**
VAS	77.46 ± 10.74	76.67 ± 10.05	0.723
FFI	69.66 ± 10.35	71.52 ± 9.32	0.386

FFI = Foot Function Index, VAS = Visual Analogue Scale, SF = Short Form, SD = Standart Deviation.
Independent samples t-test.

= 0.007, and $p = 0.001$, respectively) (Table 3).

When the group with HVA3/severe deformity was compared with the mild and moderate groups, VAS-foot pain, SF-role limitations due to physical health, SF-social functioning, SF-bodily pain, SF-general health, and SF-mental health scores were found to be statistically significantly worse ($p < 0.001$, $p < 0.001$, $p < 0.001$, $p = 0.027$, $p = 0.005$, and $p = 0.017$, respectively) (Table 4).

In classification of the deformity based on the IMA, a significant difference was detected in the VAS-foot pain, SF-social functioning, SF-bodily pain, and SF-general health scores in comparison of the IMA3/severe group with the other groups ($p = 0.004$, $p = 0.016$, $p = 0.015$, and $p = 0.008$, respectively) (Table 4).

The FFI was worse in the HVA3/severe deformity group than the HVA1/mild group ($p = 0.042$). However, there was no difference in foot function according to the radiographic severity of the IMA ($p > 0.05$) (Table 4).

DISCUSSION

The results of this study showed that the increase in HVA and IMA decreased the quality of life in HV patients as expected, but the increase in radiological HVA in patients with HV was a more effective parameter than IMA in evaluating QoL and foot function.

HV is associated with diminished QoL [16], and patients often complain of difficulty in walking and standing [17], nail disorders [18], bunions [19], and calluses [20]. HV therapy aims to relieve pain and improve function. Conservative treatment options include padding, splinting, shoe modification, orthosis, and nonsteroidal anti-inflammatory drugs [21]. Botulinum toxin injection is a potentially effective method in reducing HV deformity and associated pain [22]. However, these methods provide short-term relief for the patient. Different qualitative and quantitative evaluations are available to define the severity of the deformity. HVA, IMA, metatarsophalangeal osteoarthritis, metatarsal rotation, and lateral round

Table 4. Quality of life comparisons according to severity of hallux valgus and intermetatarsal angles

	HVA1 Mean ± SD (range) (n = 26)	HVA2 Mean ± SD (range) (n = 51)	HVA3 Mean ± SD (range) (n = 23)	*p* value	IMA1 Mean ± SD (range) (n = 22)	IMA2 Mean ± SD (range) (n = 37)	IMA3 Mean ± SD (range) (n = 41)	*p* value
SF-Physical functioning*	60 (25-70)	60 (25-75)	50 (25-70)	0.532	62.5 (25-70)	55 (25-75)	50 (25-75)	0.500
SF-Role physical*	50 (25-75)	25 (25-75)	25 (25-70)	**< 0.001**	50 (25-75)	50 (25-75)	25 (25-75)	0.239
SF-Role emotional*	66.7 (33.3-100)	66.7 (33.3-100)	66.7 (33.3-100)	0.136	66.7 (33.3-100)	66.7 (33.3-100)	66,7 (33.3-100)	0.645
SF-Energy/Fatigue*	72.5 (40-100)	50 (30-95)	65 (25-85)	0.059	55 (25-85)	65 (30-100)	60 (30-95)	0.562
SF-Emotional well-being*	44 (28-72)	60 (28-72)	60 (28-72)	0.130	44 (28-72)	48 (28-72)	60 (28-72)	0.369
SF-Social functioning*	87.5 (37.5-87.5)	62.5 (25-87.5)	62.5 (25-87.5)	**< 0.001**	81.25 (25-87.5)	75 (25-87.5)	62.5 (25-87.5)	**0.016**
SF-Pain*	50 (25-62.5)	45 (25-55)	32.5 (25-50)	**0.027**	50 (25-62.5)	45 (25-55)	32.5 (25-55)	**0.015**
SF-General health*	50 (30-80)	60 (30-80)	70 (30-80)	**0.005**	55 (30-80)	66 (30-80)	70 (40-80)	**0.008**
SF-Mental health*	50 (25-80)	50 (25-80)	60 (25-80)	**0.017**	50 (25-75)	50 (25-80)	60 (25-80)	0.052
VAS*	70 (60-85)	80 (60-95)	85 (60-100)	**< 0.001**	70 (60-100)	80 (60-100)	80 (60-100)	**0.004**
FFI**	68.19 ± 9.64 (53-88)	69.29 ± 9.92 (31-86)	74.78 ± 9.65 (58-88)	**0.042**	68.95 ± 9.48 (54-88)	69.70 ± 8.95 (53-86)	71.49 ± 11.22 (31-88)	0.580

HVA = Hallux Valgus Angle, IMA = Intermetatarsal Angle, FFI = Foot Function Index, VAS = Visual Analogue Scale, SF = Short Form, SD = Standart Deviation.

*Kruskal-Wallis variance analysis. **One-way ANOVA.

sign of first metatarsal present are among these evaluations. Besides radiographic measurements, clinical evaluation methods such as quality of life can guide the definition and optimal treatment of HV deformity [23].

Our study aimed to objectively evaluate the daily lives of symptomatic and untreated HV patients, depending on the radiological angles of varying degrees. Each domain (physical, mental and social) included in these scales is related to QoL and these domains are closely related to each other. In our study, when the SF-36 values of all patients were examined, it was found that there was a statistically significant impairment in SF-role limitations due to physical health, SF-energy/fatigue, SF-social functioning, and foot pain (VAS) scores ($p < 0.05$). However, a statistically significant positive correlation was found between foot pain (VAS) and the FFI, and radiologically measured deformity degrees in all patients ($p < 0.05$).

Hallux valgus angle is defined as the angle between the shaft axis of the first metatarsal and the proximal phalanx of the hallux. Values of HVA greater than 15° are considered to be pathological. IMA is the angle between the shaft axis of the first and second metatarsal. Values above 9° are generally interpreted as pathological. In general, the appearance of the deformity and the degree of HVA/IMA determine the treatment strategies.

In our study, the SF-36 scores in the SF-role limitations due to physical health, SF-social functioning, SF-bodily pain, SF-general health, and SF-mental health subgroups were significantly different between the HVA3/severe group and the HVA1/mild and HVA1/moderate HVA groups ($p < 0.05$). However, in our study, the SF-social functioning, SF-bodily pain, and SF-general health domains had a significant difference in comparison of the IMA3/severe group with the IMA1/mild and IMA3/moderate groups. There is no consensus in the literature regarding the radiographic parameters. Lazarides et al. [24] found that "The severity of HVA is significantly affected the general health and the severity of IMA affected the SF-role physical, SF-role emotional, and SF-mental health". Another study reporting the emergence of a worse health scenario as deformity increases showed that all SF-36 subscale scores demonstrated a significant decreasing trend as the severity of hallux valgus increased [6].

Hallux valgus deformity is not a disorder that only affects women. In our study, approximately 70% of the patients with HV were females. Anxiety and depression are common disorders reported to be more common in women [25]. Moreover, patients with anxiety and/or depression, and those with a higher percentage of severe deformities than those who are not affected by these mental disorders have lower scores in the mental health domain in QoL assessments [26]. In our study, it was observed that the impairment in SF-energy fatigue, SF-emotional well-being, SF-general health, and SF-mental health scores was more significant in females compared to males. However, although the HV prevalence is higher in women, the predictive effect of HV treatment does not appear to be associated with the gender of the patients. A study involving only female patients showed that there was no clear relationship between the effect of varying degrees of HVA and foot deformity and QoL [27]. Another study showed that the increasing severity of HVA with a progressive decrease in general health and foot health was higher in elderly individuals with HV, regardless of gender [28].

The results of our study also revealed a relationship between the varying degrees of HVA and foot function parameter scores. The increase in the HVA led to higher scores in the FFI, which evaluates pain, difficulty, and disability during different activities, while the increase in IMA did not affect this result. It has been shown that the presence of HV significantly reduces QoL by causing foot pain, disability, and functional restrictions [29].

Pain that cannot be managed by conservative treatment methods is the most important indication for surgery. VAS has been shown to be an approved and reliable method in the evaluation of QoL in patients with HV [30]. In our study, a statistically significant positive correlation was detected between the FFI, HVA, IMA and VAS scores ($p < 0.05$). We also observed that as the deformity of the HVA and IMA increased, the pain scores that affect the QoL of the individuals also increased.

Limitations

Although our study is compatible in terms of the number of patients with other studies, it had some limitations such as the sample size. Social differences, including the genetic and structural foot differences of

the patients and the choice of shoes in women, can be listed among the factors that limited our study.

CONCLUSION

The results of this study showed that radiological HVA is a more effective parameter than IMA on quality of life, pain, and disability in patients with non-surgical HV, and it may be more eligible to use HVA as a reference when assessing foot function. In making a surgical decision, not only the severity of HVA but also the effect of this angle on the patient's quality of life should be considered.

Authors' Contribution

Study Conception: TT, GBS; Study Design: TT; Supervision: TT, GBS; Funding: TT, GBS; Materials: TT, GBS; Data Collection and/or Processing: TT; Statistical Analysis and/or Data Interpretation: TT, GBS; Literature Review: TT; Manuscript Preparation: TT and Critical Review: TT, GBS.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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REFERENCES

1. Mortka K, Lisinski P. Hallux valgus-a case for a physiotherapist or only for a surgeon? Literature review. J Phys Ther Sci 2015;27:3303-7.
2. Nix S, Smith M, Vicenzino B. Prevalence of hallux valgus in the general population: a systematic review and meta-analysis. J Foot Ankle Res 2010;3:21.
3. Nguyen US, Hillstrom HJ, Li W, Dufour AB, Kiel DP, Procter-Gray E, et al. Factors associated with hallux valgus in a population-based study of older women and men: the MOBILIZE Boston Study. Osteoarthritis Cartilage 2010;18:41-46.
4. Bascarević ZL, Vukasinović ZS, Bascarević VD, Stevanović VB, Spasovski DV, Janicić RR. Hallux valgus. Acta Chir Iugosl 2011;58:107-11.
5. D'Arcangelo P, Landorf K, Munteanu S, Zammit G, Menz H. Radiographic correlates of hallux valgus severity in older people. J Foot Ankle Res 2010;3:20.
6. Menz HB, Roddy E, Thomas E, Croft PR. Impact of hallux valgus severity on general and foot-specific health-related quality of life. Arthritis Care Res (Hoboken) 2011;63:396-404.
7. Menz HB, Lord SR. Foot pain impairs balance and functional ability in community dwelling older people. J Am Podiatr Med Assoc 2001;91:222-9.
8. Rao S, Song J, Kraszewski A, Backus S, Ellis SJ, Deland JT, et al. The effect of foot structure on first metatarsophalangeal joint flexibility and hallucal loading. Gait Posture 2011;34:131-137.
9. Gilheany MF, Landorf KB, Robinson P. Hallux valgus and hallux rigidus: a comparison of impact on health-related quality of life in patients presenting to foot surgeons in Australia. J Foot Ankle Res 2008;1:14-20.
10. Menz HB, Lord SR. The contribution of foot problems to mobility impairment and falls in community-dwelling older people. J Am Geriatr Soc 2001;49:1651-6.
11. Cho NH, Kim S, Kwon DJ, Kim HA. The prevalence of hallux valgus and its association with foot pain and function in a rural Korean community. J Bone Joint Surg Br 2009;91:494-8.
12. McKean RM, Bergin PF, Watson G, Mehta SK, Tarquinio TA. Radiographic evaluation of intermetatarsal angle correction following first MTP joint arthrodesis for severe hallux valgus. Foot Ankle Int 2016;37:1183-6.
13. Bennett PJ, Patterson C, Dunne MP. Health-related quality of life following podiatric surgery. J Am Podiatr Med Assoc 2001;91:164-73.
14. Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain. Arthritis Care Res (Hoboken) 2011;63:240-52.
15. Yalıman A, Şen EI, Eskiyurt N, Budiman-Mak E. Turkish translation and adaptation of foot function index in patients with plantar fasciitis. Turk J Phys Med Rehab 2014;60: 212-22.
16. Nix SE, Vicenzino BT, Smith MD. Foot pain and functional limitation in healthy adults with hallux valgus: a cross-sectional study. BMC Musculoskelet Disord 2012;16:197.
17. Steinberg N, Finestone A, Noff M, Zeev A, Dar G. Relationship between lower extremity alignment and hallux valgus in women. Foot Ankle Int 2013;34:824-31.
18. Martínez-Nova A, Sánchez-Rodríguez R, Pérez-Soriano P, Llana-Belloch S, Leal-Muro A, Pedrera-Zamorano JD. Plantar pressures determinants in mild hallux valgus. Gait Posture 2010;32:425-7.
19. Coughlin MJ, Shurnas PS. Hallux rigidus: demographics, etiology, and radiographic assessment. Foot Ankle Int 2003;24:731-43.
20. Roan LY, Tanaka Y, Taniguchi A, Tomiwa K, Kumai T, Cheng YM. Why do lesser toes deviate laterally in hallux valgus? A radiographic study. Foot Ankle Int 2015;36:664-72.
21. Chadchavalpanichaya N, Prakotmongkol V, Polhan N, Rayothee P, Seng-Iad S. Effectiveness of the custom-mold room temperature vulcanizing silicone toe separator on hallux valgus: A prospective, randomized single-blinded controlled trial. Prosthet Orthot Int 2018;42:163-70.
22. Radovic PA. Nonsurgical treatment for hallux abducto valgus with botulinum toxin type A. J Am Podiatr Med Assoc 2020;110:Article_6.
23. Heineman N, Liu G, Pacicco T, Dessouky R, Wukich DK,

Chhabra A. Clinical and imaging assessment and treatment of hallux valgus. Acta Radiologica 2020;61:56-66.
24. Lazarides SP, Hildreth A, Prassanna V, Talkhani I. Association amongst angular deformities in hallux valgus and impact of the deformity in health-related quality of life. Foot Ankle Surg 2005;11:193-6.
25. Shakked R, McDonald E, Sutton R, Lynch MK, Nicholson K, Raikin SM. Influence of depressive symptoms on hallux valgus surgical outcomes. Foot Ankle Int 2018;39:795-800.
26. Cody EA, Do HT, Koltsov JCB, Mancuso CA, Ellis SJ. Influence of diagnosis and other factors on patients' expectations of foot and ankle surgery. Foot Ankle Int 2018;39:641-8.
27. López DL, Callejo González L, Losa Iglesias ME, Canosa JL, Sanz DR, Lobo CC, et al. Quality of life impact related to foot health in a sample of older people with hallux valgus. Aging Dis 2016;7:45-52.
28. Palomo-López P, Becerro-de-Bengoa-Vallejo R, Losa-Iglesias ME, Rodríguez-Sanz D, Calvo-Lobo C, López-López D. Impact of hallux valgus related of quality of life in women. Int Wound J 2017;14:782-5.
29. González-Martín C, Alonso-Tajes F, Pérez-García S, Seoane-Pillado MT, Pértega-Díaz S, Couceiro-Sánchez E, et al. Hallux valgus in a random population in Spain and its impact on quality of life and functionality. Rheumatol Int 2017;37:1899-1907.
30. Schrier JC, Palmen LN, Verheyen CC, Jansen J, Koëter S. Patient-reported outcome measures in hallux valgus surgery. A review of literature. Foot Ankle Surg 2015;21:11-5.

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