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Can radiology reflect patient satisfaction after hallux valgus surgery?

Radyoloji, halluks valgus cerrahisi sonrası hasta memnuniyetini yansıtabilir mi?

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ABSTRACT

Objectives: This study aims to define the first web space length (FWSL) as a new radiologic parameter, which may reflect patients' subjective satisfaction and be associated with American Orthopedic Foot and Ankle Society (AOFAS) score as an objective parameter.

Patients and methods: One hundred and fourteen patients (11 males, 103 females; mean age 43.4±13.2 years; range, 18 to 70 years) who underwent distal osteotomy between April 2010 and January 2018 were retrospectively reviewed. Patients were radiographically evaluated with pre- and postoperative standing foot anteroposterior and lateral X-rays. Hallux valgus angles (HVAs), intermetatarsal angle (IMA), and FWSL were measured. AOFAS scores were used for clinical evaluation. Satisfaction scores were obtained using a visual analog scale at the final follow-up.

Results: The relationship between postoperative AOFAS score changes and postoperative HVA changes was statistically significant (p=0.001, p<0.1). The relationship between postoperative AOFAS values and postoperative FWSL changes was statistically significant (p<0.001, p<0.1). No statistically significant relationship was detected between postoperative AOFAS values and IMA changes (p=0.101, p>0.05). The relationship between AOFAS scores and satisfaction scale was statistically significant (r=0.695; p<0.001, p<0.01). The relationship between the satisfaction scale and FWSL was statistically significant (p=0.005, p<0.01).

Conclusion: The FWSL has an influence on patient satisfaction. It is correlated both with AOFAS scores and satisfaction scale. It can be used as a measurable parameter to detect patient satisfaction.

Keywords: Angle, hallux valgus, outcome scores, satisfaction.

ÖZ

Amaç: Bu çalışmada hastaların öznel memnuniyetini yansıtabilecek ve ayrıca objektif bir parametre olarak Amerikan Ortopedik Ayak-Ayak Bileği Derneği (AOFAS) skoruyla ilişkili olabilecek birinci web aralığı uzunluğu (FWSL) yeni bir radyolojik parametre olarak tanımlandı.

Hastalar ve yöntemler: Nisan 2010 ve Ocak 2018 tarihleri arasında distal osteotomi uygulanan 114 hasta (11 erkek, 103 kadın; ort. yaş 43.4±13.16 yıl; dağılım, 18-70 yıl) retrospektif olarak incelendi. Hastalar ameliyat öncesi ve sonrası ayakta ayak ön-arka ve yan grafileri ile radyografik olarak değerlendirildi. Halluks valgus açıları (HVA'lar), intermetatarsal açı (İMA) ve FWSL ölçüldü. Klinik değerlendirme için AOFAS skorları kullanıldı. Memnuniyet skorları görsel analog ölçeği kullanılarak son takipte elde edildi.

Bulgular: Ameliyat sonrası AOFAS skoru değişiklikleri ve ameliyat sonrası HVA değişiklikleri arasındaki ilişki istatistiksel olarak anlamlıydı (p=0.001, p<0.1). Ameliyat sonrası AOFAS değerleri ve ameliyat sonrası FWSL değişiklikleri arasındaki ilişki istatistiksel olarak anlamlıydı (p<0.001, p<0.1). Ameliyat sonrası AOFAS değerleri ve İMA değişiklikleri arasında istatistiksel olarak anlamlı bir ilişki bulunmadı (p=0.101, p>0.05). AOFAS skorları ve memnuniyet ölçeği arasındaki ilişki istatistiksel olarak anlamlıydı (r=0.695; p<0.001, p<0.01). Memnuniyet ölçeği ve FWSL arasındaki ilişki istatistiksel olarak anlamlıydı (p=0.005, p<0.01).

Sonuç: Birinci web aralığı uzunluğunun hasta memnuniyetine etkisi vardır. FWSL hem AOFAS skorları hem de memnuniyet ölçeği ile ilişkilidir. Hasta memnuniyetini saptamak için ölçülebilir bir parametre olarak kullanılabilir.

Anahtar sözcükler: Açı, halluks valgus, sonuç skorları, memnuniyet.

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Satisfaction scale in this study has been presented at 17th EFORT Congress, June 1-3, 2016, Geneva.
Early results about First Web Space Lenght has been presented at 18th EFORT Congress, May 31- June 02, 2017, Vienna.

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Hallux valgus is the static subluxation of the metatarsophalangeal joint with lateral deviation of the great toe and medial deviation of the first metatarsal bone.[1] More than 130 surgical techniques have been described for the treatment of hallux valgus.[2] The use of surgical procedures to correct the alignment of the great toe, however, has at times been rather uncritical, and the same technique has been applied for different forms of hallux valgus. For adequate treatment of hallux valgus, however, it is crucial to understand that not all deformities are equal.[3]

Correction of the radiographic alignment of the first ray is often used as a surrogate marker for successful hallux valgus surgery, and for this purpose, the intermetatarsal angle (IMA) and hallux valgus angle (HVA) are used.[4] Although these angles are used to measure successful results, it has been shown that the amount of preoperative hallux valgus and the intermetatarsal deformity has no effect on the change of any of the outcome scores or the American Orthopedic Foot and Ankle Society (AOFAS) score, and assessment of the magnitudes of change in the HVA and IMA revealed no significant differences between mild-to-moderate and severe deformities in the most improved angular changes for any of the outcome scores or AOFAS scores.[5]

In this study, we aimed to define the first web space length (FWSL) as a new radiologic parameter, which may reflect patients' subjective satisfaction and be associated with AOFAS score as an objective parameter.[6]

PATIENTS AND METHODS

One hundred and fourteen patients (11 males, 103 females; mean age 43.4±13.2 years; range, 18 to 70 years) who underwent distal chevron osteotomy between April 2010 and January 2018 at our clinic were retrospectively evaluated. All procedures were performed by a senior surgeon. Our inclusion criteria were: *(i)* patients with unilateral hallux valgus, *(ii)* primary cases, *(iii)* patients with pre- and postoperative standing foot anteroposterior (AP) and lateral X-rays, *(iv)* patients aged over 18 years, *(v)* patients with distal metatarsal osteotomy *(vi)* with at least one year of follow-up. Our exclusion criteria were: *(i)* revision cases, *(ii)* patients with additional foot and ankle problems, *(iii)* prior foot and ankle trauma, *(iv)* inflammatory arthritis. The study protocol was approved by the Bakırköy Dr. Sadi Konuk Training and Research Hospital Ethics Committee (2014/149). A written informed consent was obtained from each patient. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Patients were radiographically evaluated through pre- and postoperative standing foot AP and lateral X-rays. Hallux valgus angle, IMA, and FWSL were measured on these X-rays. All measurements were performed on final follow-up visit. First web space length is measured between the most prominent lateral point of the first metatarsal head, and the most prominent medial point of the second metatarsal head (Figure 1). Magnitudinal and percentage changes were calculated.

American Orthopedic Foot and Ankle Society score was obtained preoperatively and at the final follow-up visit for clinical evaluation. Satisfaction was assessed using a modified visual analog scale that reflects patients' subjective satisfaction. At the final follow-up, patients were asked to score their postoperative satisfaction between 1-10, as 1-2 for very unsatisfied, 3-4 for unsatisfied, 5-6 for neither unsatisfied nor satisfied, 7-8 for satisfied, and 9-10 for very satisfied.

The magnitudinal and percentage changes of HVA, IMA, and FWSL were compared with AOFAS score changes and the satisfaction scale. Also, AOFAS score changes were compared with the satisfaction scale.

Statistical analysis

The paired-samples test was used to compare descriptive statistical methods (mean, standard deviation, frequency, ratio, minimum, maximum), as

Figure 1. Measurement of first web space length pre- and postoperatively.

TABLE I
Distribution of satisfaction scores

	Points (n)	n	%	Mean±SD	Min-Max
Satisfaction score	3	2	1.8	8.6±1.3	3-10
	4	2	1.8		
	5	1	0.9		
	7	5	4.4		
	8	30	26.3		
	9	49	43.0		
	10	25	21.9		

SD: Standard deviation; Min: Minimum; Max: Maximum.

well as for in-group comparisons of variables that had normal distribution in the comparison of quantitative data. Pearson correlation analysis was used to evaluate the relationships between variables. Significance was evaluated at $p<0.01$ and $p<0.05$ levels.

RESULTS

Sixty-one patients (53.5%) underwent surgery on the right side, and 53 (46.5%) had surgery on the left side. Mean follow-up duration was 57.43 months (range, 12-103 months). The satisfaction scores of the participants were between 3 and 10 and the mean score was 8.64±1.32 (Table I). The mean decrease of 18.36° in the postoperative HVA measurement was statistically significant ($p<0.001$, $p<0.01$). The mean decrease in postoperative IMA measurement by 7.96° was statistically significant ($p<0.001$, $p<0.01$). The mean decrease in the postoperative FWSL measurement of 4.85 millimeters was statistically significant ($p<0.001$, $p<0.01$) (Table II).

The mean change in postoperative mean AOFAS score by 19.64 units was statistically significant ($p<0.001$, $p<0.01$). The relationship between postoperative AOFAS score change and pre- and postoperative HVA percentage change was statistically significant ($p=0.001$, $p<0.1$). According to the findings, this relationship was a positive relationship ($r=0.311$). Thus, as the final AOFAS measurement value increased, the percentage change of HVA significantly increased. There was no statistically significant relationship between postoperative AOFAS values and pre- and postoperative IMA percentage change ($p=0.101$, $p>0.05$). The relationship between postoperative AOFAS values and pre- and postoperative FWSL percentage changes was statistically significant ($p<0.001$, $p<0.1$). According to the findings, this relationship was a positive relationship ($r=0.403$). Accordingly, as the final AOFAS measurement value increased, the percentage change of FWSL significantly increased. A positive correlation was found between postoperative AOFAS scores and satisfaction scores ($r=0.695$; $p<0.001$, $p<0.01$). The relationship between the satisfaction scale and the pre- and postoperative FWSL percentage changes was statistically significant ($p=0.005$, $p<0.01$). According to the findings, this relationship was weakly positive ($r=0.261$) (Table III).

DISCUSSION

Health outcome measures are tools that capture the health status of a patient throughout an episode of care for treatment of an injury, condition, or health maintenance. These measures can generally be divided into clinical outcomes (as assessed by a physician), laboratory outcomes (as seen with objective findings such as laboratory tests and radiographs), and patient-reported outcome scores (or health status as perceived by patients).[7] According to this knowledge, we used the AOFAS scoring system for patient-reported outcome scores; of the latter-day validated scoring systems, the AOFAS system was the most commonly used outcome metric between 1994 and 2016 in the literature,[7] and our evaluation started from 2010.

TABLE II
Pre- and postoperative mean measurements

	Preoperative	Postoperative
	Mean±SD	Mean±SD
Hallux valgus angle	31.6±6.8	13.3±6.4
Intermetatarsal angle	13.9±3.6	5.9±2.6
First web space length	10.7±4.0	5.9±2.3
AOFAS score	71.1±8.0	90.8±8.9

AOFAS: American Orthopedic Foot and Ankle Society;

TABLE III

Evaluation of relationship between American Orthopedic Foot and Ankle Society score changes and hallux valgus angle, intermetatarsal angle, first web space length and satisfaction scale

	AOFAS score postoperative change	
	r	*p*
Hallux valgus angle alteration (%)	0.311	0.001**
Intermetatarsal angle alteration (%)	0.154	0.101
First web space length alteration (%)	0.403	<0.001**
Satisfaction scale	0.695	<0.001**
	Satisfaction scale	
First web space length alteration (%)	0.261	0.005**

AOFAS: American Orthopedic Foot and Ankle Society; FWSL: First web space length; HVA: Hallux valgus angle; IMA: Intermetatarsal angle.

For the radiographic assessment, HVA and IMA angles were chosen. Many surgeons believe HVA to be the most essential element in hallux valgus repair.[8] In addition, there are publications in the literature making decisions based on the IMAs, without using HVAs.[3] However, the current literature has shown that patient-reported outcome scores are not correlated with radiologic parameters.[5,8,9]

In the present study, a third parameter was described to evaluate hallux valgus, the FWSL. Thordarson et al.[5] compared AOFAS scores, short form-36 health survey results, and American Academy of Orthopedic Surgeons lower extremity scores using radiologic and clinical outcomes, and patient satisfaction. They stated that the changes within these scoring systems were not influenced by the pre- or postoperative HVAs or IMAs, the magnitude of change of these angles, the residual deformity, or the type of surgery. In 2015, Chong et al.[9] reported a similar study using a validated scoring system, the Manchester-Oxford Foot Questionnaire (MOXFQ). The investigators reported that there was no association between the severity of hallux valgus radiologically and the degree of correction and the MOXFQ scores. In a recent study, Matthews et al.[8] used the Foot and Ankle Outcome Scores and continued the search for a correlation between outcomes and radiologic parameters. They concluded that there was no correlation between the change in HVA (initial or overall change), change in IMA (initial or overall change), and magnitude of preoperative HVA or IMA ($p>0.05$ for all). According to the outcomes of the present study, the noncorrelation between IMA and AOFAS scoring is consistent with the literature. However, what is different from the literature is the HVA and FWSL. The change of HVA showed a weak correlation with AOFAS scores (r=0.311), while the FWSL showed a moderate correlation with AOFAS scores (r=0.403). In the current literature, there are no radiologic parameters that moderately correlate with outcome scoring systems. Thus, FWSL can be used to evaluate patient satisfaction radiographically, and can possibly be used in the decision-making process for surgery.

The satisfaction scale was strongly correlated with the AOFAS scoring system (r=0.695). As a subjective scale being correlated with an objective scoring system, we believe that this satisfaction scale can be a useful tool to evaluate postoperative patient satisfaction in hallux valgus.

This study has some limitations. We included patients with at least one year of follow-up. We did not choose a longer follow-up period because studies have shown that after hallux valgus surgery, the greatest improvement was already found at six months and remained unchanged for up to 24 months postoperatively,[10] and the role-emotional score showed a statistically significant change between 6 and 12 months.[11]

In conclusion, changes in FWSL have an influence on patient satisfaction. First web space length is correlated both with AOFAS scores and a subjective satisfaction scale. It can be used as a measurable parameter to investigate patient satisfaction. The satisfaction scale is correlated with the AOFAS scoring system and can be used to evaluate patient's subjective satisfaction.

Declaration of conflicting interests

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