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ORIGINAL ARTICLE

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Evaluation of quality of life and radiological parameters after hallux valgus correction

Avaliação da qualidade de vida e parâmetros radiológicos após a correção do hálux valgo

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ABSTRACT

Objective: To evaluate the quality of life of patients undergoing hallux valgus correction and maintenance of radiographic parameters over time.
Methods: The study included 38 patients who underwent hallux valgus correction surgery using different osteotomy techniques (Scarf, Chevron, Arciform, Proximal Chevron and Chevron-Akin) between January 2010 and December 2012. The patients were evaluated radiographically at 3 different periods (preoperatively and 1 year and 5 years postoperatively) and completed the SF-36 quality-of-life questionnaire. Statistical analysis was performed using Student's t-test and the nonparametric Wilcoxon and Friedman tests at a maximum significance level of 5%.
Results: Among the main results obtained for the SF-36 questionnaire, the domain patients felt better about emotional aspects, physical limitations and social aspects, with a final mean of 74.9. The metatarsophalangeal and intermetatarsal angles and medial eminence exhibited significant reductions in the postoperative period ($p<0.05$), and only 1 patient presented with the loss of joint congruence.
Conclusion: Different surgical osteotomy techniques used to correct moderate and severe hallux valgus provide improvements in the radiological parameters and quality of life of patients.
Level of Evidence IV; Therapeutic Studies; Case Series.

Keywords: Hallux valgus; Osteotomy; Quality of life.

RESUMO

Objetivo: Avaliar a qualidade de vida dos pacientes submetidos à correção do hálux valgo e a manutenção dos parâmetros radiográficos no longo do tempo.
Métodos: Foram selecionados 38 pacientes que fizeram cirurgia para correção do hálux valgo com diferentes técnicas de osteotomia (Scarf, Chevron, Arciforme, Chevron Proximal e Chevron associado com Akin), entre janeiro de 2010 e dezembro de 2012. Os pacientes foram avaliados radiograficamente em três momentos distintos (pré-operatório, um e cinco anos de pós-operatório) e responderam ao questionário de avaliação de qualidade de vida SF-36. A análise estatística foi realizada através do teste t de Student Pareado e pelos testes não paramétricos de Wilcoxon e Friedman, ao nível de significância máximo de 5%.
Resultados: Dentre os principais resultados obtidos do questionário SF-36, os domínios que os pacientes se sentem melhor foram referentes aos aspectos emocionais, limitação física e aspectos sociais, com média final de 74,9. Os ângulos metatarsofalangiano e intermetatarsal e a eminência medial apresentaram reduções significativas no pós-operatório ($p<0,05$), e somente um paciente apresentou perda da congruência articular.
Conclusão: Diferentes técnicas cirúrgicas por meio de osteotomias utilizadas para correção do hálux valgo moderado e severo proporcionam melhora nos parâmetros radiológicos e na qualidade de vida aos pacientes.
Nível de Evidência IV; Estudos Terapêuticos;* Série de *Casos.

Descritores: Hallux valgus; Osteotomia; Qualidade de Vida.

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INTRODUCTION

The term hallux valgus was originally described by Carl Heuter in 1871[1] as a progressive foot deformity, characterized by lateral deviation of the hallux with corresponding medial deviation of the first metatarsal, with or without medial expansion of the soft tissues in the first metatarsal head (*Bunion*)[2]. The prevalence of this deformity in adults ranges from 12% to 70% in the general population[3,4], with a high prevalence in women[3,5].

Hallux valgus, besides being an aesthetic deformity, can cause significant symptoms, especially pain. Approximately 80% of patients present with pain in the first metatarsophalangeal joint (1st MTP joint) that worsens with the use of ill-fitting footwear, metatarsalgia, and up to 30% of the cases have difficulty wearing footwear[6], leading to an important loss of the quality of life and functional limitation[7,8]. Some authors have already demonstrated the relationship between the increase in hallux valgus deformity and progressive reduction in quality of life[9-11].

Several biomechanical alterations such as deformity of the distal metatarsal articular angle, axial rotation and inclination of the first metatarsal occur simultaneously, and the different surgical techniques described aim to correct this complex deformity[11]. There are different surgeries described in the literature to correct hallux valgus, including balancing soft tissues around the metatarsophalangeal joint, osteotomies and arthrodeses[7]. Many articles published in the literature have compared techniques and reported recurrence rates, but few have evaluated the quality of life of the operated patients[12].

In fact, several tools have been used to measure the results of foot and ankle surgeries[13]. However, none of these scales demonstrated adequate validity, responsiveness and reliability when applied in patients with different foot pathologies[14]. Evaluation of the outcome of hallux valgus correction surgery is usually based on the parameters of interest to the surgeon; thus, the outcomes considered important by the patients may differ from those of the physicians[15]. The most important factors cited by patients include limited walking ability, constant and activity-related pain, difficulty standing for long periods, and inability to perform work tasks and practice sports. On the other hand, surgeons are especially interested in evaluating pain, range of motion of the metatarsophalangeal (MTP) joint and removal of the bunion[15,16], in addition to radiological criteria[17-19]. While the most commonly used scales only partially evaluate patients' expectations, the psychometric properties of the quality of life scores such as SF-36 allow a better analysis of postoperative results[15,16].

The aim of this study was to evaluate the quality of life of patients who underwent surgical correction of hallux valgus and analyze the improvement in the radiographic parameters postoperatively.

METHODS

This study was approved by the Research Ethics Committee with registration in the Brazil Platform under CAAE number: 81221517.4.0000.5273.

This is a retrospective study that evaluated patients undergoing valgus hallux correction surgery, from January 2010 to December 2012, after approval by the research ethics committee of the institution. The study met all human rights requirements.

The study included all skeletally mature patients with moderate and severe hallux valgus[20], consecutively treated, with a minimum postoperative follow-up period of 5 years, after signing an informed consent form.

All patients were treated conservatively, with instructions to change their footwear, oral analgesics and physiotherapy for a period of 3 to 6 months, without improvement of symptoms, before the indication for surgical treatment. The patients underwent correction of the foot deformity using the *Scarf, Chevron*, Arciform, proximal *Chevron* and *Chevron-Akin* osteotomy techniques. Surgeries were performed by different specialists of the institution's Foot and Ankle surgery group. All patients followed the same postoperative protocol using an orthopedic sandal for 8 weeks associated with *McBride* dressings and received instructions not to wear high-heeled sandals or shoes with narrow toe box chambers for 6 months after the operation.

The patients excluded were those who did not have the necessary imaging tests to evaluate the radiographic parameters of interest and those with mild deformities undergoing soft-tissue rebalancing surgery (*McBride* Technique) or other techniques that did not include first metatarsal osteotomies, such as arthrodesis of the 1st MFA or tarsus-metatarsal joint or those undergoing revision surgeries. Finally, all the patients who did not agree to participate in the study were also excluded.

After 5 years of follow up, all the patients selected to participate in the study were recruited and evaluated by the principal investigator, who did not participate in the surgery of any of the participants, using the *Medical Outcomes Study 36 - Item Short-Form* (SF-36) questionnaire adapted to the Portuguese language and validated by Ciconelli et al.[21] This tool proved to be reliable in evaluating the results of hallux valgus correction surgery[9,22]. It is a questionnaire

comprising 36 items, encompassing the following 8 scales or domains: functional capacity, physical aspects, pain, general health, vitality, social aspects, emotional aspects and mental health. Its final score ranges from 0 (zero) to 100 (obtained by calculating the *Raw Scale*), in which *zero* corresponds to the worst general health status and 100 corresponds to the best health status. The results of the surgeries were also evaluated radiographically.

Radiographic analysis

Foot radiographs were performed before surgery and at 1 and 5 years postoperatively on anteroposterior (AP) and orthostatic and oblique views. In the AP examinations, the metatarsophalangeal (hallux valgus angle), intermetatarsal and interphalangeal angles were measured, as well as medial eminence, joint congruence and sesamoid position (Figure 1).

- Medial Eminence was measured by drawing a line along the medial diaphyseal border of the first metatarsal and a line perpendicular to the largest extension of the medial eminence. The size was calculated in millimeters[17].
- Joint congruence was determined by the inspection of the relationship of the articular surface of the base of the proximal phalanx with the articular surface of the head of the first metatarsal. Individual points were placed on the articular surface of the proximal phalanx to mark the most medial and lateral extension of the articular surface of the phalanx. A second set of points was then placed on the articular surface of the head of the first metatarsal to mark the most medial and lateral extension of the distal metatarsal articular surface. With a deformity of subluxated hallux valgus, the corresponding points on the proximal phalanx move laterally relative to the corresponding points on the first metatarsal head[18].
- Position of the sesamoids was used to determine the relationship between the position of the lateral sesamoid and lateral cortical surface of the head of the first metatarsal bone and position of the lateral sesamoid[19].

Each angle was measured 3 times by the same examiner, with a 1-week interval between the evaluations, and was calculated in degrees using the angle measuring tool of the mDicom Viewer *software*, version 3.0.0®, in the AP view with load.

Statistical analysis

The significance of the evolution of a categorical variable, when possible, was assessed by the McNemar test. In the inferential analysis of a quantitative variable, the assumption of a normal distribution was tested by the Kolmogorov-Smirnov (KS) test and Shapiro-Wilk (SW) test. When repeated measures of the same variable were normally distributed, 2 were compared using the paired Student's t-test, and 3 measures were compared using repeated measures analysis of variance. When the variables did not follow a normal distribution, 2 measures were compared by the Wilcoxon nonparametric test and 3 repeated measures were compared by the Friedman test. The variability of the distribution of a quantitative variable was evaluated by the coefficient of variation (CV), which was considered low if CV<0.20, moderate if 0.20≤CV<0.40, and high if CV≥0.40. All analyses considered a maximum significance level of 5% and were carried out using IBM SPSS (*Statistical Package for the Social Sciences*), version 22.0.

RESULTS

The sample consisted of 38 patients (38 operated feet), 35 women (92%) and 3 men, with a mean age of 59.1 years (39-81 years) and a mean follow-up of 60 months. Twenty-three patients (60.5%) were operated on their right foot, and 15 patients were operated on their left foot. Among all patients, 32% did not present with any comorbidity, and 47% reported hypertension; 1 patient had rheumatoid arthritis. Among the surgical techniques, 31 (81.5%) patients underwent Scarf osteotomy, and 4 (10.5%) patients underwent Chevron osteotomy. The Arciform, proximal Chevron and Chevron-Akin osteotomies were performed on 1 patient each[20].

Table 1 shows the main statistics of the variables of the SF-36 questionnaire, which presented an overall mean of 74.9 and a median of 78.6. The domains that reached the highest values were emotional aspects, physical limitations and social aspects. The mean scores of each domain and the overall score can be seen in ascending order in figure 2.

The hallux valgus angle decreased on average 20.3° after surgery; and the reduction observed 5 years later was, on average, 16.3°. These reductions were significant (P<0.05 in the Wilcoxon test comparing 2 repeated measures at the 2 periods analyzed (Figure 3); when 3 repeated measures were compared by the Friedman test, the P-value was also lower than 0.001).

The intermetatarsal angle decreased on average 7.1° immediately after surgery, and the reduction observed 5 years later was, on average, 5.8°. These reductions were significant (P<0.05) in the 2 analyzed periods (Figure 4), when 2 measures were compared and when the 3 measures were compared by the Friedman test (P<0.001).

Figure 1. Radiographs from the pre- and postoperative periods at 1 and 5 years.
Source: Author's personal archive.

Table 1. SF-36 variables

Variable	Minimum	Maximum	Mean	Median	Standard deviation	Coefficient of variation
Functional capacity	20	100	75.3	80	19.9	0.26
Physical limitation	0	100	84.2	100	30.4	0.36
Pain	0	100	60.9	67	30.7	0.50
General health status	25	97	73.2	77	18.0	0.25
Vitality	15	90	59.2	60	19.4	0.33
Social aspects	0	100	81.6	93.5	26.6	0.33
Emotional Aspects	33	100	94.4	100	15.5	0.16
Mental health	24	88	67.5	72	18.9	0.28
Mean	33.4	91.0	74.9	78.6	14.9	0.20

Source: Prepared by the author based on the study results.

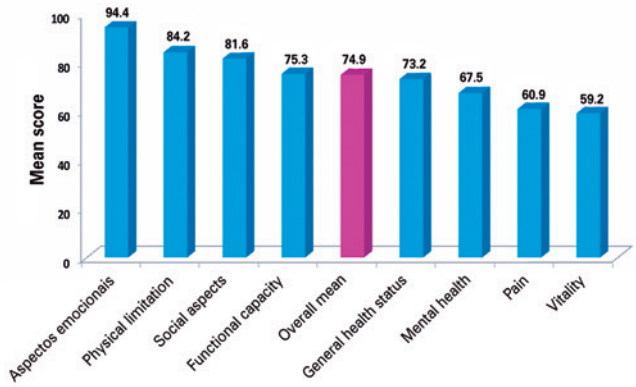

Figure 2. Mean domain scores and overall score for patient quality of life.
Source: Prepared by the author based on the study results.

There were reductions in the interphalangeal angle of, on average, 0.42° immediately after surgery and 0.37° after 5 years. However, such changes were not significant (P>0.05 in the comparison of 2 measures and also in the Friedman test comparing the 3 measures). The medial eminence showed a mean decrease of 3.2 mm and 2.8 mm, immediately after surgery and after 5 years, respectively, both showing significance (P<0.05).

The intermetatarsal angle decreased on average 7.1° immediately after surgery, and the reduction observed 5 years later was, on average, 5.8°. These reductions were significant (P<0.05) in the 2 analyzed periods (Figure 4).

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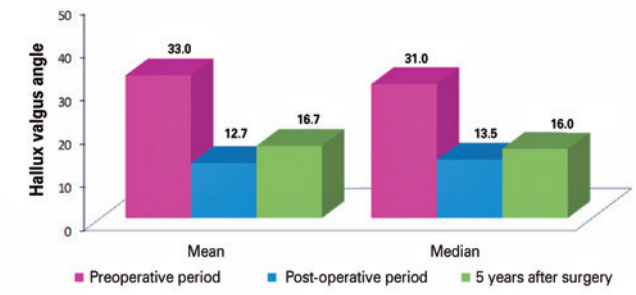

Figure 3. Means and medians of the measurements of the hallux valgus angle in the preoperative period, postoperative period and 5 years after surgery.
Source: Prepared by the author based on the study results.

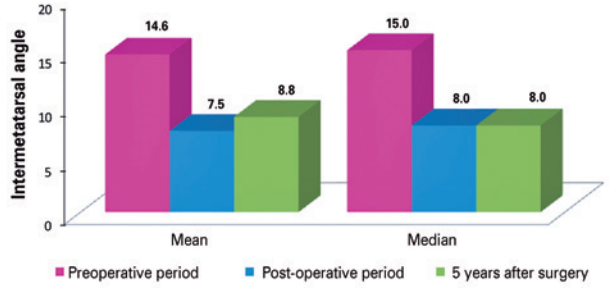

Figure 4. Means and medians of the measurements of the intermetatarsal angles in the preoperative period, postoperative period and 5 years after surgery.
Source: Prepared by the author based on the study results.

after 5 years; however, these changes were not significant (P>0.05). The medial eminence had a decrease of 3.2 mm and 2.8 mm, immediately after surgery and after 5 years, respectively, both showing significance (P<0.05).

In the preoperative period, 29 patients (76.3%) had no joint congruence. However, after surgery, 100% of the patients exhibited joint congruence. After 5 years, there was 1 case of the loss of congruence. In the preoperative period, 18 patients (47.4%) had lateral sesamoid exposure lower than 49%. After surgery, 100% of the patients had sesamoid exposure less than 49%, and none showed recurrence of the deformity regarding this parameter after 5 years.

DISCUSSION

Hallux valgus is a common deformity of the forefoot and often causes symptoms that limit patients' functions and promote significant worsening of quality of life[9,10]. Yamamoto et al.[23] found that values for all the SF-36 subscales were significantly lower than those for the general population (P=.015 for general health, P=009 for mental health, and P<0.001 for all other parameters) when evaluating patients with untreated symptomatic hallux valgus.

Surgical correction of hallux valgus can be performed using several different techniques, but there is no ideal procedure for all cases[20,24]. In 81.6% of this sample, Scarf osteotomy was performed, with a high rate of deformity correction and a low rate of recurrence. Additionally, except for the interphalangeal angle parameter, all other radiographic measurements showed significant improvement (P<0.05) in the immediate and late postoperative periods. The patients had a high quality of life, with a mean SF-36 after 5 years of 74.9. The domains in which patients felt better were those related to emotional aspects (mean 94.4), physical limitation (mean 84.2) and social aspects (81.6).

We observed that, regardless of the technique used, an improvement was obtained both in radiographic parameters, in the short and medium term, and in quality of life, as described by other authors[24-28]. Choi et al.[25] evaluated 53 feet operated on using the Scarf technique, and after a mean follow-up of 24 months, all radiographic changes showed a statistically significant improvement, and the physical component of the SF-36 increased from 46 in the preoperative period to 52. Desmarchelier et al. al.[27] compared 65 patients, with a mean follow-up of 66.6 months, who underwent hallux valgus correction with Scarf osteotomy or with 1st MTP arthrodesis and found SF-36 values of 70.9 and 62.3, respectively.

Thordarson et al.[12] observed that of 10 SF-36 scores, 4 had an increase of more than 5 points after 6 postoperative months (physical function, functional capacity, pain, emotional role), and 3 parameters had persistent improvement after 12 months (physical function, functional capacity) in patients who underwent different procedures (distal metatarsal osteotomy, proximal metatarsal osteotomy with distal soft tissue realignment, and Lapidus arthrodesis).

In the Brazilian literature, there are a limited number of researchers who have evaluated the quality of life in patients with hallux valgus. Stéfani et al.[29] evaluated 20 patients (34 feet) operated on with the Chevron technique, with a mean follow-up of 23.3 months, through the SF-36, with mean values for each of the domains of the questionnaire of 84.5 (functional capacity), 82.5 (physical limitation), 61.5 (pain), 79.7 (general health), 59.7 (vitality), 76.2 (social aspects), 66.7 (emotional limitation) and 64.5 (mental health). Other authors[30] retrospectively analyzed 11 patients who

underwent different hallux valgus correction techniques; however, the SF-36 had lower values than in the present study for all domains, especially functional capacity (60.45 vs 75.3), physical aspects (43.2 vs 84.2), social aspects (62.8 vs 81.6) and emotional aspects (60.45 vs 94.4). We believe that these differences may be related to the postoperative time at which the score was applied; the author evaluated the patients after 1 year, while our patients had a minimum follow-up of 60 months.

Although we did not statistically analyze the correlation between the SF-36 score values and the radiographic parameters in the operated patients, we believe that the improvement in quality of life observed is also related to the correction and maintenance of these angles in the medium term.

One of the limitations of our study was the size of the sample, but the size was comparable with most studies in the literature, caused by the limitation of the surgical techniques performed and the postoperative follow-up of at least 5 years[25-28]. The limited number of patients, especially those operated on with techniques other than Scarf Osteotomy, did not allow us to perform an analysis of the results comparing the techniques. As the preoperative SF-36 score was not evaluated, it was also not possible to evaluate the progression of quality of life, and therefore, we did not quantify the degree of postoperative improvement. In addition, no scale was used to evaluate the function of the operated feet because the main objective of the study was to quantify patient quality of life.

CONCLUSION

Different surgical techniques used to correct moderate and severe hallux valgus offer significant improvement in patient quality of life and in radiographic parameters.

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