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Pre And Postoperative Use of Force Platform in Hallux Valgus Surgery-Case Report

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Abstract

We tried to analyze the importance of information's obtained using a force platform in objective functional assessment of Scarf osteotomy in hallux valgus surgery. The aim was to obtain a normal architecture of the foot by restoring the normal relations of the first ray and the mobility in the first metatarso-phalangeal articulation. We used the AMTI Accu Gate force platform to analyze pre and postoperative force reaction of the foot succeeding Scarf osteotomy of the first metatarsal. Using the Scarf technique, we were able to restore the normal alignment of the forefoot. Data from the force platform revealed modifications of force reaction components of both leg in contrast with the pedobarographic studies. So, it is important that the technique chosen for correction should reestablish the normal parameters in all 3 space planes.

Keywords: Force platform; Scarf; Hallux valgus

Introduction

Medical literature considering surgery of the important static deformities of the foot present pressure distribution analysis on foot-ground interface [1-3]. We tried to analyze the importance of informations obtained using a force platform in objective functional assessment of Scarf osteotomy in hallux valgus surgery.

Case Report

We present the case of a 57- years old male patient presenting left hallux valgus grade II and second hammer toe. Clinical exam revealed pain at first metatarso-phalangeal articulation, presence of exostosis on the medial aspect, first phalange of the hallux in valgus and pronated, the distal phalange under the second toe, presence of dorsal dislocation of the metatarso-phalangeal articulation of the second toe, limited mobility of the first toe (flexion 5°, extension 10°).

To correct the deformity, we used the Scarf technique consisting in exostosectomy, lateral arthrolyse, Z osteotomy of the first metatarsal and osteosynthesis with two screws. The aim was to obtain a normal architecture of the foot by restoring the normal relations of the first ray and the mobility in the first metatarso-phalangeal articulation (flexion 20°, extension 40°).

We used the AMTI AccuGate force platform to analyze pre and postoperative force reaction of the foot succeeding Scarf osteotomy of the first metatarsal. The technique consisted in 2 session of measuring the ground reaction force: vertical (Fz), medio-lateral (Fy) and sagittal (Fx); the first session was done 5 weeks before surgery and the second session at 6 weeks postoperative. Every session consisted in 2 phases of 10 valid successive walking on the force platform with the same leg and the same direction of walking.

Results

Using the Scarf technique, we were able to restore the normal alignment of the forefoot: metatarso-phalangeal angle of 10°, Varus of the first metatarsal of 10°, distal articular angle of the first metatarsal of 0° and the attack angle of the first metatarsal of 20°. The osteotomy was consolidated at 6 weeks.

We eliminated the aberrant values using the Romanovski test. Testing of the values normality was done using Kolmogorov-Smirnov test; the null hypothesis ″distribution is not normal″ was rejected for all data series. The analysis revealed significant postoperative lengthening of center of pressure trajectory for both the left and the right foot. Significant differences (Paired-Samples T Tests, $p<0,05$) were obtained for the left foot (Fz-p=0,047; duration of stance phase-p=0,000) and the right foot (Fz-p=0,011; Fx-p=0,030; Fy-p=0,023; duration of stance phase-p=0,000) Table 1. Data from the force platform revealed modifications of force reaction components of both leg in contrast with the pedobarographic studies.

Table 1: Results of force reactions using the force platform.

Foot	Condition	Fx Value (%)	Fy Value (%)	Fz Value (%)
Left	Preoperative	13,6	6,12	102,25
	Postoperative	12,52	5,87	98,14
	Difference	1,08 (-7,9%)	0,25 (-4,09%)	4,11 (-4%)
Right	Preoperative	13,36	8,06	100,33
	Postoperative	11,14	3,98	104,55
	Difference	12,22 (-16,6%)	4,08 (-50,6%)	4,22 (+4,2%)

Discussion

Although in the past walking was considered symmetric for both feet, in the present Viel [4] showed that there is an asymmetry in the parameters of the 2 feet, corresponding to the ″propulsion foot″ (the dominant one) and ″amortization foot″. Gagey and Weber [5] established the value of the normal parameters of the feet on studies for the variation of center of pressure in time, but the data bases are incomplete for this time, so more studies are needed. In our case we have succeeded to restore the normal position of this center. Our data suggest that in hallux valgus there are modifications of kinematic parameters of the foot not only on the vertical plane (Fz), but also in antero-posterior (Fx) and lateral planes (Fy). So, it is important that the technique chosen for correction should reestablish the normal parameters in all 3 planes. In our case the correction obtained with Scarf technique was appropriate.

The purpose of the surgical treatment is to obtain a Greek foot and the metatarsal should be lined up according to Maestro [6] criteria. But it is mandatory to reestablish the normal trajectory of the center of pressure, as showed in our study using the force platform. So, we think that in the future orthopaedic surgeons should use data obtained from these platforms to increase their skills and to realize a better correction of forefoot deformities.

Conflict of Interest

The authors declare no financial interest or any conflict of interest.

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