Has the Paradigm Shifted in Correction of Hallux Valgus?

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INTRODUCTION

For the reconstructive foot surgeon, correction of hallux valgus (bunion correction) can become both routine and rudimentary. Everyone does it, and everyone has their "way" of doing it. The decision or choice of procedure is often predicated on several factors including clinical and radiographic features of the hallux valgus condition. Historical teaching left us with the following dogma: bunions are either mild, moderate, or severe, and should be corrected based on their radiographic findings of such. Mild bunions, with intermetatarsal angles 8-12 degrees are best corrected with distal soft tissue procedures or distal first metatarsal osteotomies; moderate bunions with intermetatarsal angles 12-15 degrees are best corrected with mid-shaft osteotomies of the first metatarsal; and finally, severe bunions with high intermetatarsal angles, greater than 15 degrees are best corrected with proximal first metatarsal osteotomies or fusion of the first tarsal metatarsal joint.

More recently, the concept of hypermobility, or more accurately instability of the first ray became better understood as a major factor leading to bunion deformity. A series of articles on the biomechanics of the first ray thoroughly outlined this through cadaveric models (1-5). They were able to illustrate the effects of the peroneus longus, metatarsus primus varus, and equinus on the stability of the medial column. Additionally, they were able to illustrate the positive effect the Lapidus arthrodesis had on these various structures and in stabilizing the medial column.

We have now come to a place where we are looking at the bunion deformity critically in all 3 planes. We have always addressed the transverse and, at times, sagittal plane components of the deformity, but now with more extensive research performed by Dayton and others, the frontal plane valgus rotation of the first metatarsal is gaining more attention. In his articles, Dayton observed that the perceived increased tibial sesamoid position on the anterior-posterior projection radiograph may be due more to a valgus or pronated first metatarsal than to a medially deviated metatarsal off of the sesamoid apparatus (6). This is critical because if a distal metatarsal osteotomy is the procedure of choice to correct a bunion deformity, then the valgus rotation of the metatarsal could not be adequately addressed (7). It was found that 81% of patients undergoing modified Lapidus arthrodesis demonstrated valgus rotation of the first metatarsal on sesamoid axial radiographs (6). This was very intriguing to this author because, if this is true more broadly, it should follow that at least 80% of bunion deformities should be addressed surgically via Lapidus arthrodeis with triplane correction of the deformity. One could argue that most bunion deformities (maybe close to 80%) are corrected with distal metatarsal osteotomies, which may not have a long term effect on the valgus rotation of the first metatarsal.

MATERIALS AND METHODS

We undertook a prospective, single center radiographic study of 20 consecutive feet with pathologic bunion deformities in an attempt to validate the theory that there is a significant population of patients with bunion deformity that have valgus rotation of the first metatarsal. All patients presented to Coastal Podiatry, Mount Pleasant, SC with report of a painful bunion deformity and were seeking potential surgical intervention. Standard weight-bearing anterior posterior, lateral, and sesamoid axial radiographs were obtained on each symptomatic foot. We measured 1-2 intermetatarsal angles (IM), tibial sesamoid position (TSP), and degree of valgus rotation, if any on the sesamoid axial views. We described the metatarsal as either pronated, medially deviated, or a combination of pronation and medially deviated.

RESULTS

A total of 13 consecutive patients (20 feet) presented with symptomatic bunions and were included in this study. One patient had undergone a Silver-type bunionectomy and proximal phalanx osteotomy over 10 years ago. The average preoperative 1-2 intermetatarsal angle was 10.78. The average preoperative TSP was 4. Five of the 20 bunion deformities (25%) exhibited no valgus rotation of the metatarsal. Fifteen of the bunions (75%) had some valgus rotation of the metatarsal, and of those 6 (40%) had a combination medial displacement and valgus rotation of the metatarsal head. Individual measurements can be found in Table 1.

DISCUSSION

Three patterns on the sesamoid axial radiographs were identified that correlated to either true or perceived increased tibial sesamoid position on the anterior posterior radiographs. The first pattern was a true valgus or pronation of the first metatarsal 9 of 20 deformities, an example of

Patient	Intermetatarsal Angle	Tibial Seasamoid Po- sition	Degree of Pronation
1	9.1	2	0
2	13.4	7	28
3	9.8	1	0 - Medial Displacement
4	7.8	4	19
5	16.3	7	43
6	10.8	3	16 + Medial Displace- ment
7*	12.4	4	19
8*	10.9	5	15
9	9.0	5	28 + Medial Displace- ment
10	9.5	4	19 + Medial Displace- ment
11	14.2	6	29 + Medial Displace- ment
12	12.3	5	17.4 - Medial Displace- ment
13	11.9	5	10.8 - Medial Displace- ment
14	12.2	6	10.5
15	10.4	4	28.7
16	10.7	2	0 - Medial Displacement
17	8.5	2	0 - Medial Displacement
18	11.6	4	28.9
19	7.7	3	15.5
20	7	1	0 - Medial Displacement

Table 1. Individual measurements of patients

*Patient had previous bunion surgery

which is shown in Figure 1. One will notice that both sesamoids remain in their grooves medial and lateral to the crista as the metatarsal rotates in a valgus fashion. Figure 2 represents the second pattern of true medial displacement of the metatarsal head from the sesamoid apparatus. In this pattern the metatarsal crista sits atop the tibial sesmoid and there is no valgus rotation of the metatarsal head. The third pattern represents a combination of the 2 previous patterns, and this is a combination of both valgus rotation of the metatarsal head from the sesamoid apparatus (Figure 3).

In this small sample population, it was found that 75% of symptomatic bunion deformities had some degree of valgus rotation of the first metatarsal. This is less than, but not significantly different than the 81% that Dayton et al found in their studies owing for similar sample sizes. It should be noted that they looked retrospectively at patients who had undergone triplane bunion correction via Lapidus arthrodesis and we chose a consecutive series of 20 painful bunion deformities to measure regardless of future planned procedure. Nevertheless, the near agreement, percentagewise, in amount of bunion deformities that have valgus



Figure 1A. Anterior-posterior radiograph showing tibial sesamoid position of 7.



Figure 2. Sesamoid axial view showing example of valgus rotation and medial shift of the metatarsal off of the sesamoid apparatus. Notice the crista sits atop the tibial sesamoid.



Figure 3B. Corresponding sesamoid axial radiograph showing medial displacement of the metatarsal from the sesamoid apparatus without valgus rotation of the first metatarsal. Notice the overlap of the tibial sesamoid and metatarsal crista



Figure 1B. Corresponding sesamoid axial radiograph showing significant valgus rotation of the first metatarsal with sesamoids remaining in their grooves



Figure 3A. Anterior-posterior radiograph showing tibial sesamoid position of 5.

rotation begs the question as to whether the paradigm is, or should shift in the way we as foot and ankle surgeons approach correction of the bunion deformity.

This author has long been an advocate for pushing the limits of the distal chevron osteotomy for correction of the bunion deformity. We have been able to show that with modest sequential lateral release and a healthy lateral shift of the capital fragment, large IM angles with perceived medial column instability could be reliably corrected when compared with the Lapidus arthrodesis (8). However, when looking critically at patients that had recurrence of the deformity and comparing them to those that did not, I could find no vast differences in patient choice, technique, or postoperative course, so the revelation of the illusion of medial displacement of the metatarsal from the sesamoid apparatus was particularly interesting. Admittedly, the sesamoid axial radiograph was not taken routinely as a part of the radiographic evaluation of the bunion deformity. Therefore it was not readily apparent that a pronated metatarsal would lead to a relatively under-corrected deformity despite positive findings on conventional radiographs taken immediately postoperatively. This is not to say that when a distal osteotomy is performed and a recurrence occurs, it is due to an unrecognized pronated metatarsal. However, with a 75-80% occurrence of valgus rotation, the frontal plane position of the first metatarsal should be evaluated when considering correction of a bunion deformity.

Additionally, the findings in this study further elucidate the unreliability of the IM angle in the evaluation of the bunion deformity. The average IM angle in this study was 10.78. This falls well within the range that would be considered a "mild" bunion, however when looking at the complete deformity utilizing other views we see that optimal correction of the deformity may require a procedure traditionally reserved for more "severe" deformity.

Painful hallux abducto valgus is one of the most common presenting complaints of patients seeking care from a foot and ankle specialist. Correction of the bunion deformity has become routine, and every foot and ankle surgeon should be proficient in that regard. Because it is so routine, the complexity of the deformity should not be taken for granted. It is becoming more and more apparent that each bunion deformity will have a different personality and should be treated as such. When surgery is considered, complete correction of the entire deformity should be the goal.

In order to adequately address the entire deformity, the standard preoperative radiographs should include semi-weight-bearing sesamoid axial views along with standard anterior-posterior and lateral views. Based on the radiographic findings and clinical examination the proper procedure can be undertaken. The distal chevron osteotomy is a highly versatile procedure, however, it is limited in its ability to adequately address any pronation of the metatarsal if present. Currently, the most reliable way to address the bunion deformity in all 3 planes is with a first tarsal metatarsal arthrodesis. There are obvious concerns with this because of the technically challenging nature of this procedure, potential complications, and more challenging postoperative course. There have been advancements to the procedure that addresses these issues, however there are some surgeons that hesitate to perform this procedure.

Given the findings of this study, the frontal plane valgus rotation of the first metatarsal is a critical component of the bunion deformity, and should be addressed when considering surgical correction. We may be at a point in the evolution of bunion surgery that the Lapidus arthrodesis has become the standard of care for the majority of bunion correction.

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