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was born in Tinley Park, Illinois. She graduated cum laude with a BA in biology from Monmouth College in Monmouth, Illinois, and cum laude with a DPM from the Dr. William M. Scholl College of Podiatric Surgery in Chicago. She presented a poster, *High Risk Diabetics Select Shoes That May Increase Their Risk of Foot Complications* at the American College of Foot and Ankle Surgeons Expo earlier this year. Following graduation, Misty will enter private practice. Misty and her husband, Michael Patrick McNeill, have a new son, Chase Patrick, who was born in January.

HIGH RISK DIABETICS SELECT SHOES THAT MAY INCREASE THEIR RISK OF FOOT COMPLICATIONS

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INTRODUCTION

Over 54,000 amputations of the lower extremity occur in the diabetic patient population each year. Half involving the foot/toes and the other half are at below the knee or above the knee levels.[1] It has been documented that a triad of component causes including minor trauma, subsequent ulceration, and faulty wound healing can lead to over 70% of these amputations in the diabetic population.[2] Neuropathy affects up to 50% of patients with diabetes for more than 15 years and is associated with an 8 to 18 fold higher risk of ulceration. Foot ulcers affect up to 15% of all diabetic patients in their lifetime, and are commonly associated with bony deformities of the foot.[1] It is well known that ill-fitting shoe gear is a common cause of the trauma that causes diabetic foot ulcerations.

Recently a study by Reveal et al found that 30% of diabetic patients choose shoes that were too narrow and 81% of these patients were women.[4] A second study by Pinzur et al identified that 73% of diabetics had improper shoe wear. After just one evaluation with education on proper shoe gear the incidence decreased to 43%.[3]

PURPOSE

The purpose of this paper was to compare the size of the foot-bed in self-selected shoes and professionally fitted shoes in diabetic patient that were high-risk for foot complications.

MATERIALS AND METHODS

We evaluated 30 patients as part of a diabetic disease management program that fit a high-risk profile for foot complications. These patients had sensory neuropathy with loss of protective sensation and foot deformities and/or a history of previous foot complications. As part of the prevention program, these patients were fitted by a certified pedorthist for therapeutic shoes and/or accommodative insoles to protect their feet from repetitive trauma. As part of the foot evaluation the pedorthist used acetate to prepare three tracings: the insole from the shoes the patient chose, the bare foot standing, and the insole fitted by the pedorthist. The area of the three tracings was measured using an overlay of 0.25 cm squares. This method has previously been shown to be reproducible and reliable in evaluation of wounds.[5]

RESULTS

We used paired T-tests to compare the area, the maximum width (cm) and the maximum length (cm) of the self-selected vs. professionally fitted shoes. As expected, high-risk diabetics' self-selected shoes were significantly smaller than those fitted by a trained professional in total area, maximum width and maximum length

Area $t(55) = -4.66$, $f<.001$
Width $t(55) = -5.12$, $f<.001$
Length $t(55) = -3.09$, $f<.01$

It was found that patient selected shoe width was too

narrow in 82% of patients, too short in 75% of patients and the area was smaller in 80% of patients as compared with pedorthist selected shoes. On average patient selected shoes were 3.55mm too narrow and 5.17 mm too short than the pedorthist selected shoes.

CONCLUSION

There have been multiple studies in which shoe fit has been evaluated by subjective measures. It has been hypothesized many times that diabetic patients with and without sensory neuropathy often choose shoes that are an inappropriate fit, however this has never been proven. This study proves by objective measure of area, length and width that high-risk diabetic patients choose inappropriate shoe gear. Therefore, high-risk diabetics should have footwear fitted by a trained professional in order to eliminate ill-fitting shoes as a source of pathology.

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FRANCIS JOHN ROTTIER, DPM,
was born in LaCrossse, Wisconsin. He received his BS in biology from Loyola University Chicago and his DPM from the Dr. William M. Scholl College of Podiatric Medicine in Chicago. He had a poster presentation at the 2003 American College of Foot and Ankle Surgeons Annual Meeting entitled, *Comparison of Hindfoot Contact Characteristics after Surgical Reconstruction of Pathologic Pes Plano Valgus Deformity.* When not working, Frank enjoys fishing, camping and the Chicago Cubs. He wishes to thank his wife, Karen, and his entire family for their ongoing support during his residency.

COMPARISON OF HINDFOOT CONTACT CHARACTERISTICS AFTER SURGICAL RECONSTRUCTION OF FLATFOOT DEFORMITY

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INTRODUCTION

Flatfoot deformity is a commonly encountered pathology in the podiatric surgeon's practice. Tibialis Posterior Tendon Dysfunction (TPD) is frequently responsible for this clinical entity. Patients recalcitrant to bracing and medicinal management often require surgical correction of their deformity. Numerous procedures have been described to address this deformity via soft tissue reconstruction, osteotomies or hindfoot arthrodesis. The Double Calcaneal Osteotomy (DCO)[1,2] is a commonly employed procedure to address flatfoot deformity (Figures 1&2). The procedure consists of a lateral column lengthening in conjunction with a medial displacement calcaneal osteotomy.

FIGURE 1

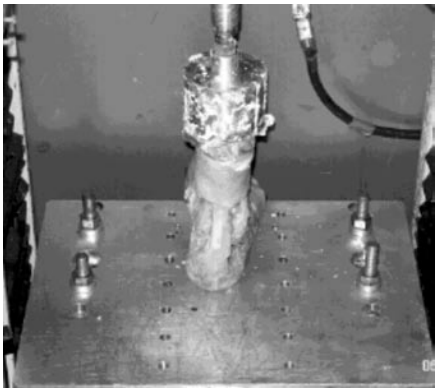

FIGURE 2

Recent literature has raised concern about the development of calcaneocuboid (CC) arthrosis following the Evan's lateral column lengthening procedure.[1] Deland et al described a new procedure to address this potential complication. Their procedure, known as Posterior Calcaneal Osteotomy with Wedge (PCOW),[1] consists of a posterior medial displacement calcaneal osteotomy with interposition of a tapered bone graft to functionally lengthen the lateral column (Figure 3&4).

MATERIALS AND METHODS

Five fresh-frozen, matched cadaveric foot and ankle specimens were obtained for this investigation. Specimens were screened for prior surgery and pathologic anomalies that would effect the planned surgical reconstructions. Soft tissue dissection was performed in a manner to isolate the talonavicular (TN), calcaneocuboid (CC), anteromedial subtalar (AMST), and posterior subtalar (PST) joints. The creation of a flatfoot model was performed as described by Thordarson et al.[1] Pressure sensitive film (Fuji Prescale, Superlow, Low, Fuji Film Company™, Tokyo, Japan) was used as a transducer for the measurement of intra-articular contact area and pressure in the hindfoot joints.

Templates of each articular surface were constructed prior to each trial by the lead investigator (FJR) to ensure that transducers anatomically represented the joint being tested. Access to the hindfoot joints and insertion of the transducers was carried out in the manner described by McCormack et al.[1] Prior to testing, a calibration strip was fabricated and a pressure-to-gray scale level was fit to a second order polynomial. The pressure film was imaged utilizing a JVC™ high-resolution camera and data were analyzed with ImagePro™ software on an IBM™ compatible computer. Specimens were axially loaded through the tibia and fibula after being potted in methylmethacralate in ankle joint neutral. A load of 700 Newtons was applied over five seconds and was maintained for five seconds using an Instron™ materials testing device (Figures 2 & 4). Measurements of intra-articular contact area and pressure were obtained after the creation of the flatfoot deformity and after each surgical reconstruction. Surgical reconstruction compared DCO to PCOW within the matched cadaveric pair. The limb chosen to perform each reconstruction was randomized.

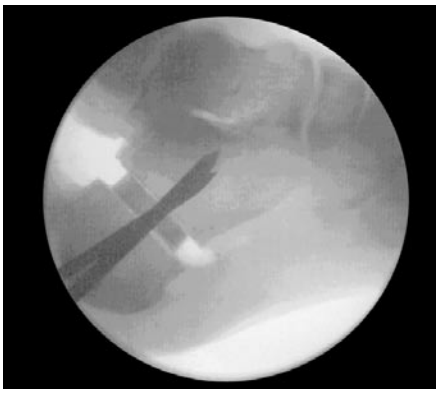

FIGURE 3

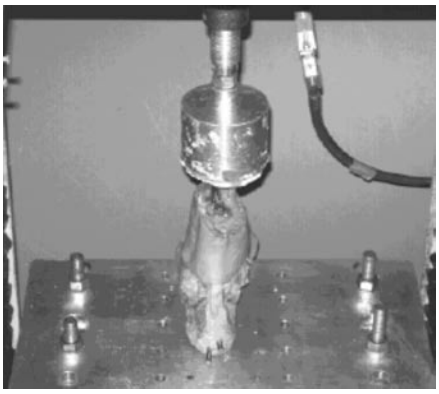

FIGURE 4

RESULTS

Data were analyzed using a paired t-test with a p-value of 0.05. A significant decrease in pressure was noted to the PSTJ in the DCO group ($p>0.029$) (Figure 5). There was no significant difference found when comparing the CC joint contact area and pressure in the DCO or PCOW group.

DISCUSSION

This study attempts to quantify in vitro contact characteristics of the hindfoot after the performance of two reconstructive techniques for flatfoot deformity. To the authors' knowledge, this study is unique in that it compares two procedures that incorporate medial calcaneal displacement osteotomy and lateral column lengthening without sacrificing the CC joint. Previous studies have shown that articular cartilage degradation can be attributed to high contact pressure. Increased stress concentration in a smaller contact area has also been shown to result in articular cartilage failure.[1] The authors believe that the decrease in pressure of the PSTJ after DCO illustrates a favorable biomechanical outcome. Previous authors have raised concern about increasing intra-articular pressures in the CC joint and the potential for arthrosis.

Our study did not find a significant difference in the contact area or pressure when comparing the DCO and PCOW reconstructions to the flatfoot model. Although insignificant, there was a trend that indicated increased contact area and decreased intra-articular pressure in the TN joint after the DCO reconstruction. An inverse finding was noted in the TN joint after the PCOW reconstruction. These findings warrant further investigation of the effects on the TN joint after reconstructive surgery that preserves the joints of the hindfoot complex. This study has a number of limitations: 1) Measurements reflect a static load during the midstance phase of gait only, 2) the contribution of various muscle groups that may potentially affect hindfoot contact characteristics was not studied in this investigation, and, 3) data collected by means of pressure sensitive film has inherent error that has been well documented in the literature.[6]

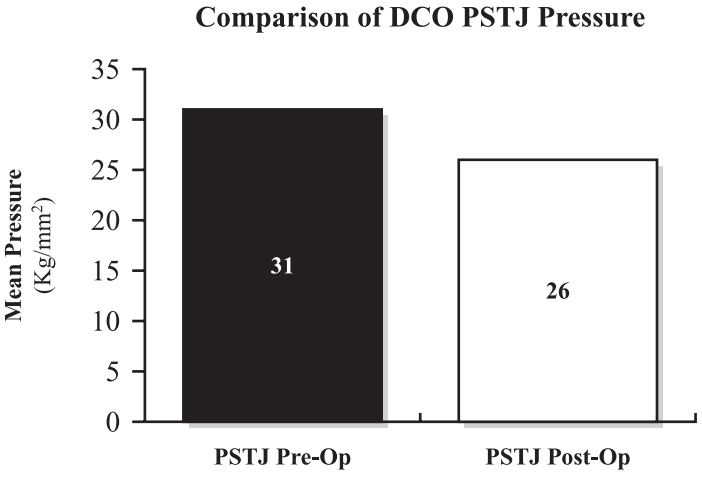

FIGURE 5

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