

Orthotics Q&A: Comparing Lessons On Biomechanics And The Realities Of Clinical Experience

- [Guest Clinical Editor: Bruce Williams, DPM](#)

Although what one learned in podiatric medical school is invaluable in a podiatry career, sometimes podiatrists may encounter a different reality in clinical practice. These expert panelists weigh what they learned in school with their experience and the current research. They also detail which directions future orthotic research should take.

Q: What is the current research telling us about how the foot really functions as opposed to what many podiatrists were taught in school?

A: Much of the current research focuses on the importance of the midtarsal joint(s) and how they have a significant impact on foot function, according to Bruce Williams, DPM. He adds that recent research efforts also concentrate on the forces/kinetics of foot function. As Dr. Williams explains, although the rearfoot might continue pronating to the end range of motion, the orthotic device may still change pathologic forces.

However, Christopher Nester, BSc, PhD, believes the profession puts too much emphasis on the subtalar and midtarsal joints. As he notes, research says the ankle, cuneiform/navicular and metatarsocuneiform/cuboid joints are sites of considerable motion. "The podiatry model needs to include more joints and reflect the fact that they all make equally important contributions to what the foot does," asserts Dr. Nester.

Craig Payne, DPM, says the approach to biomechanics that he took in school 20 years ago was "somewhat dogmatic" but easier to understand. He notes that much more has been revealed in recent years, including research associated with the effects of joint axes variation on foot mechanics. In addition, Dr. Payne notes emerging knowledge on the role of the first metatarsophalangeal joint (MPJ) in rearfoot function and the fact that the windlass mechanism is assuming more importance. He says one cannot dismiss the current conflicting data. Most importantly, Dr. Payne says the profession has learned more about appropriate research methodology with foot orthoses and the understanding of foot mechanics is increasingly being subject to that kind of scrutiny.

Q: How might recent research in foot mechanics and/or foot orthoses affect how podiatrists use orthoses to alleviate foot pain?

A: Most current research shows that when one puts a foot orthoses in a shoe, patients get better, notes Dr. Payne. Yet he says clinical trials suggest the type of orthotic does not seem to matter. This does not necessarily coincide with what practitioners encounter clinically so Dr. Payne says clinicians and researchers have some questions to ask. For example, does it matter what type of foot orthoses one uses? If it does, in what population does it matter?

Dr. Williams notes that some studies are starting to show positive outcomes with foot orthoses in both rheumatologic patients and juvenile patients. While such outcomes may be a given for podiatrists, Dr. Williams says it is good to see positive outcomes research outside of the profession. The research ratifies Dr. Williams' experience in private practice in treating patients with chronic low back pain and other musculoskeletal pain disorders, which occurred as a result of lower extremity issues.

Dr. Nester believes clinical biomechanical research is becoming easier to

conduct. He attributes this to technology being faster and easier to use, and podiatrists having a better grasp of the meaning of the data. He says biomechanical data that explains the effects of orthotic prescription or data explaining what the foot and the rest of the limb are doing in individual clinical cases will affect how the profession assesses the biomechanical effects on each patient.



The podiatry profession places too much emphasis on the subtalar and midtarsal joints, according to Christopher Nester, BSc, PhD. (Photo courtesy of Arnold Ross, DPM)

Podiatrists are using prefabricated orthotics more these days, according to Dr. Payne. He says they work but not in all cases. Dr. Payne questions whether the profession can use research to determine which prefab devices do not work.

Q: What clinical revelations go completely against the grain of what you were taught about foot biomechanics or the use of foot orthoses in podiatry school?

A: In school, Dr. Williams says he learned of the existence of forefoot varus and its role as a primary cause of excessive foot pronation. However, he says recent research has actually shown that forefoot varus rarely occurs and one can usually cast it out

of the orthotic.

As far as rearfoot varus goes, Dr. Williams learned rearfoot varus posting will prevent pronation. In contrast, he says research is increasingly showing conclusive results that the rearfoot continues to pronate to the end range of motion despite the use of small to large rearfoot varus posted devices. He argues that the profession needs to “look elsewhere for the real cause of pronation related problems,” including the blockage of sagittal plane pivots in the forefoot and ankle.

Dr. Williams also disputes the conventional wisdom that only accommodative soft devices can effectively treat diabetic plantar ulcerations. If it were true, he says every podiatrist would have a perfect record of treating plantar foot ulcers. Dr. Williams says DPMs must realize that all diabetic patients have poor and asymmetrical foot function. If practitioners do not address this, especially in patients with diabetes, he argues that they will be fighting a “losing battle” to offload the ulcer and will not improve the overall foot function.

In his clinical experience, Dr. Nester has learned “there is no such thing as podiatric biomechanics” and that schools should only teach Newton’s paradigm of foot function.

“We do not need multiple ill-considered attempts to explain what is seen clinically via ‘pseudomechanics.’ These ‘stories’ to explain what is seen clinically inevitably conflict with each other and fail to fully explain the foot,” argues Dr. Nester. “Our podiatry students just need to learn biomechanical principles and understand what happens when forces are applied to the structures of the foot.”

Dr. Nester also believes podiatrists do not need to overcomplicate the prescription of orthotics. If practitioners understand the biomechanics, he believes they can decide what force they should apply to the patient’s foot and accordingly decide which components to add to an orthotic device. Given all the variables involved, Dr. Nester says it is too easy to turn orthosis prescription into an unnecessarily complex science.

Podiatry school taught Dr. Nester that the foot controls the lower limb but he has found in his clinical experience that the rest of the limb controls the foot. Although the foot can influence the capabilities of the proximal limb structures, he believes that the foot is poorly positioned mechanically to be the primary influence over the knee and hip. As Dr. Nester sees it, the profession ascribes too much

importance to the foot in lower limb mechanics. Rather, Dr. Nester believes the foot "is just one of a number of interdependent structures we need to consider."

In his post-education clinical experience, Dr. Payne has learned that motion and foot position are not necessarily associated with pathology and that changes in foot posture and motion patterns with an orthotic are not necessarily associated with a positive outcome. In addition, he has discovered that the subtalar joint neutral position is not as important as one assumed for foot orthoses outcomes.

Q: What research are you pursuing now and how may it ultimately effect how DPMs look at podiatric biomechanics and the use of foot orthoses to treat foot pain?

A: Dr. Nester is studying how the bones of the midfoot and forefoot move during stance, and how podiatrists can best model this in experiments and in terms of clinical problems. He is also looking into the way the foot interacts with other joints and the importance of muscles in foot function.

Dr. Payne is researching what parameters orthotics change and which parameters are associated with positive outcomes. He is also studying the effects of orthotics on the windlass mechanism.

Although his private practice keeps him too busy to pursue research, Dr. Williams says he would like to work with "like-minded practitioners" and conduct simple studies that correlate his views of the function of the foot.

Q: What research needs to be done in the next five to 10 years to prove podiatric biomechanics and orthotics are successful and cost effective in improving patient outcomes?

A: Dr. Williams advocates more multiple site studies, perhaps at podiatric medical schools, to document cost effectiveness and positive outcomes with orthotics. He suggests that the American Podiatric Medical Association (APMA) could fund research from a group of private practitioners to study certain aspects of foot function and outcomes with prescription foot orthotics.

Since the podiatric profession has discovered that changing rearfoot motion patterns with orthotics are not necessarily associated with positive clinical outcomes, Dr. Payne says DPMs should determine what an orthotic needs to change in order to achieve a positive outcome. He speculates that perhaps different foot types and pathologies need to require different changes to achieve a positive outcome.

Dr. Payne says the profession must also institute randomized controlled trials to investigate if changing the right parameter is truly associated with better outcomes and if changing the parameters is cost effective. He says since motion and posture of the foot do not necessarily need to change, the parameters showing the most promise for investigation are those associated with changes in forces. Such changes in forces make intuitive sense, according to Dr. Payne, who says the forces do the damage to the tissues.

Dr. Nester foresees growth in the funding and completion of quality clinical trials that will either prove or disprove the efficacy of orthotics. He expects that such studies may also reveal new ways in which orthoses are beneficial, new ways in which one should evaluate the orthotics and new reasons for prescribing orthotics. Dr. Nester says such studies will be wide ranging as far as assessing outcome.

"Healthcare providers need to know whether orthoses do for patients what patients want and how orthoses impact on their service agenda and possibly reducing demands on other services," asserts Dr. Nester. "It is not enough to say the patient is satisfied."

Dr. Nester is a Senior Research Fellow at the Centre for Rehabilitation and

Human Performance Research at the University of Salford in the United Kingdom.

Dr. Payne is a Professor in the Department of Podiatry in the School of Human Biosciences at Latrobe University in Melbourne, Australia.

Dr. Williams is a Fellow of the American College of Foot and Ankle Surgeons, and is board certified by the American Board of Podiatric Surgery. He is a Fellow and the current Secretary/Treasurer of the American Academy of Podiatric Sports Medicine. Dr. Williams practices in Merrillville, Ind.

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