On Dynamic Motion Control in Orthotic Therapy

The author discusses a new type of orthotic that acts as a "living hinge."

BY JAY SEGEL, D.P.M.

As podiatrists, you are very familiar with the challenging work that the foot has to do in order to prevent injury to itself and the rest of the muscular skeletal system. Providing shock absorption and a stable lever for propulsion faster than the blink of an eye is very difficult. Because of the foot's reliance on skeletal change to function optimally, orthotics need to provide a measure of both shock attenuation and positional support. The prescription foot orthotic needs to function in seemingly opposite ways during the stance phase of gait.

We began to see the concepts of dynamic control come into play with the advent of the semi rigid orthotic shell. These orthotics are still made to be an adapter between the three dimensional foot and the two dimensional flooring, by now adding a moldable resiliently flexible shell to provide mitigation of ground reaction forces and structural support to the foot and ankle.

As a place to start, let's begin looking at foot mechanics from the single support swing phase of gait. Feet need to be supinated as our leg passes under the body in order to prevent tripping over our own big toes. And so in most cases, the calcaneus hits the ground in a supinated position. The optimal foot then begins pronating to manage ground reaction forces and mitigating the corresponding shock before these forces can multiply and cause damage to the larger joints up the kinetic chain.

While I have had great success for almost thirty years in my practice with "traditional" posted foot orthotics, I have had consistently better results with dynamic rearfoot posting.

Engineered materials such as carbon graphite, polypropylene and their derivatives are used to fashion semi-rigid orthotic shells and are now bringing posting into the 21st century with designs aimed at controlling rear foot motion in a measured and ele-

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New Concepts and Studies

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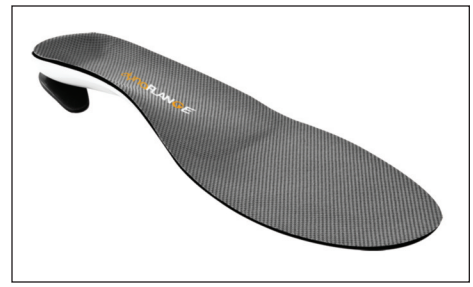
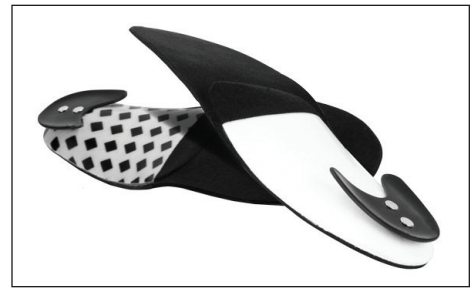
gant manner like Langer's new DynaFlange™ system.

Placing a rigid shell, or firm posts to curb excessive pronation is like putting a brick wall in front of a runaway truck—it may stop the motion, but at what cost, and what risk. The current solution on roadways is to make use of inclines and a series of water filled barrels of loose sand to retard motion. As the truck climbs and engages the barrels or soft undersurface, its motion is managed similarly to the way dynamic control works on foot motion. The molded semi-rigid orthotic has seen great success and has improved patient compliance as observed over the past many years in my practice as evidenced by patient comments, wear patterns and reorders.



Dynaflange orthotics



Dynaflange orthotics in both composite and polyethylene

These are dynamic solutions to dynamic problems, deforming only as much as is needed in response to ground reaction forces. The medial arm of the DynaFlange™ (a rigid plastic spring) is in a plantarflexed position and engages the ground before the foot so it can decelerate pronation by deforming while providing the necessary shock absorption. The combination of unique design and engineered materials allows for dynamic shock attenuation that is consistent with the functional needs of each individual patient. As the dynamic post deforms it stores the energy created by loading the "spring". This stored energy is released at heel raise and efficiently and effectively resupinates the foot as it readies for propulsion.

DynaFlange™ adapts to the unyielding surfaces we walk on and deforms so your foot doesn't have to, behaving like a living hinge. The medial portion of the Dynaflange rearfoot post in essence shortens the pronatory moment arm, described as the supinated heel strike to the full expression of rear foot pronation. The stored energy is released upon heel raise and actively resupinates the foot, providing an increase in stability without an increase in motion or fatigue. I've noticed that patients who often presented with subluxed cuboids show improved alignment in the lateral column. Through the years, patients fit with dynamically controlling orthotics seem to report fewer break-in issues and report a stable yet springy gait.

While I have had great success for almost thirty years in my practice with "traditional" posted foot orthotics, I have had consistently better results with dynamic rearfoot posting. I have had a number of patients who were previously unable to tolerate foot orthotics, who assimilated seamlessly to Dynaflange devices. In addition, many patients who have worn foot orthotics in the past have commented that the new designs are demonstrably more comfortable. I am certain that other innovations will be forthcoming that will create efficacious new tools for controlling dynamic gait-related problems. Matching innovative designs and materials to the unique requirements created by abnormal gait will help all podiatrists improve patient outcomes. **PM**

Disclosure:
Jay Segel, DPM is the inventor of the Dynaflange.

Dr. Jay Segel graduated from the Ohio College of Podiatric Medicine in 1983. He completed his surgical residency at Cambridge City Hospital, a Harvard Teaching Affiliate. After residency, he moved to Martha's Vineyard, where he still practices. He is a member of the American Academy of Sports Medicine, frequent author/contributor to Podiatry Management Magazine, Podiatric Advisor to Langer Biomechanics and lecturer on Podiatric Physical Therapy, Biomechanics, Tarsal Manipulation and Rehabilitative Medicine. He has been an advisor to shoe companies and holds several utilities patents on footwear.