Lower Extremity RA: Can Orthoses Have An Impact?

There is no other disease that so profoundly deforms the human foot as rheumatoid arthritis (RA). The pain symptoms from RA foot deformities limit mobility significantly in patients from adolescents to seniors. Although diabetes affects a greater number of people in the United States, the morbidity from RA is more severe.

A podiatrist’s expertise in the mechanical treatment of the rheumatoid foot is not only a professional obligation but also a guarantee of continued referrals from the rheumatology professions. Intimate knowledge of orthotic control provides a unique opportunity to demonstrate our ability to reduce pain and increase mobility through custom functional foot orthoses (CFOs).

What You Should Know About The Pathology Of RA

Rheumatoid arthritis affects 2.1 million Americans with the disease affecting 2.5 times more women than men. The onset predominantly occurs during middle age but one may see RA in children and senior adults as well. Rheumatoid arthritis accounts for 22 percent of all deaths from arthritis and irreversible damage occurs early, often during the first two years of the disease.

Rheumatoid arthritis is an inflammatory arthropathy with an etiology that is not entirely understood. Some researchers believe genetic factors play a major role but preliminary results from twin studies do not support this concept. The pathology has been described as two interrelated processes. The first process is the malfunctioning of the body’s immune system triggered by viral/bacterial infection or environmental toxins like caffeine and nicotine. The second process is chronic inflammation of joints leading to destruction of cartilage and subchondral bone.

According to the Arthritis Foundation, the pathology begins when the body’s immune systems mounts an attack on joint tissue, particularly the synovium, producing destructive inflammatory cells and new blood vessel growth (angiogenesis) in the joint space. Certain types of T cells behave abnormally in this response and researchers are accordingly testing agents that block these particular T cells by inhibiting their receptors.

A Primer On Systemic Treatment Options

Systemic treatment of RA falls into several categories, which are all designed to reduce joint pain and swelling, relieve stiffness and prevent further joint damage. Traditionally, the first line of attack is nonsteroidal antiinflammatory drugs (NSAIDs).

Low-dose corticosteroids are traditionally the second level of therapy for progressive symptoms and inflammation. This therapy has the obvious disadvantages of further immune suppression and adrenal suppression. Accordingly, this therapy is only utilized for short-term therapy.

Recently, disease-modifying antirheumatic drugs (DMARDs) have demonstrated a curious success and have now stimulated several large clinical trials of methotrexate and leflunomide. These drugs control
rapidly growing cells, hopefully the ones producing the inflammation, and the joint destruction. Antibiotic and anti-malarial drugs also seem to have a profound effect in some individuals yet have no effect in others. Investigations into biologic response modifiers (BRMs), drugs that inhibit certain cytokines that cause the actual joint destruction, have produced some optimism for future therapies. These new therapies as well as the emerging research are available at www.arthritis-research.com.

What The Research Reveals About Orthotic Efficacy

Given that most podiatrists do not initiate drug therapy for RA patients, our predominant role involves monitoring the patient’s progress, consulting with rheumatologists and providing mechanical and surgical care for the foot and ankle pathology. Recent significant research has been published about the value of mechanical control with custom foot orthoses. Understanding this recent research is vital for improved clinical outcomes and is also of interest to the rheumatologist who refers RA patients. A 1999 study examined RA patients with second MPJ plantar pain. Comparing prefabricated and custom functional orthoses, the authors of the study assessed the effectiveness of CFOs in reducing plantar pressure via a metatarsal pad in comparison to a metatarsal bar. They discovered that a CFO with a metatarsal pad was the most effective in reducing second metatarsal plantar pressures as compared to prefabricated orthoses. Adding a metatarsal pad to the CFO improved the pressure reduction significantly. 5

A 2000 study compared the foot pressures and loading forces of in-shoe foot orthoses in reducing both high pressure and shear forces. 12 The study evaluated female RA patients who experienced foot pain while walking and matched these patients by age to eight healthy women. Both groups wore CFOs. The results showed that “foot orthoses created greater pressure and force relief in rheumatoid arthritis patients than in normal subjects.”6

Another 2000 paper compared the effect of soft accommodating orthotics versus semi-rigid functional orthoses in treating metatarsalgia in patients with RA. 7 The study on 24 RA patients demonstrated that “the semi-rigid orthoses had a highly significant effect on pain. Soft orthoses did not show a significant effect on pain.” Supportive shoes alone did not have a significant effect. The conclusion of the study was that semi-rigid orthoses were an effective treatment for metatarsalgia. 7

A 2002 study described a project in which researchers randomized 98 RA patients and gave half of the patients custom rigid foot orthoses. Then they evaluated these patients for foot pain, disability, activity tolerance and adverse reactions. The half who received rigid CFOs did significantly better than those who received a placebo. The authors of the study concluded that “custom manufactured rigid foot orthoses are a clinically effective treatment for RA patients with early correctable deformity of the rearfoot.” 8

In 2002, a study examined the relationship between RA patients with flatfoot and forefoot deformities in order to understand the progression of foot pathologies. The researchers compared RA patients with flat feet and dorsiflexed first rays to RA patients with neck pain and no foot deformity. Researchers observed and took X-rays of the patients over a three- to four-year period. Patients with flatfoot and no orthotic support had a significantly higher incidence of severe stages of disability than those without a foot deformity. The authors of the study recommended that “RA patients with mechanical factors leading to flatfoot and forefoot deformity must receive early mechanical treatment to avoid disability.” 9

A 2003 study evaluated the efficacy of custom foot orthoses for the management of painful rearfoot valgus in patients with RA. The study authors monitored two groups of patients over 30 months. One
group received a rigid, graphite CFO while the other patients received no device. Although both RA
groups "demonstrated excessive subtalar joint eversion through the stance phase of gait … custom
orthoses significantly reduced eversion and re-established equilibrium of motion relative to neutral joint
position." The authors concluded that "continuous use of custom orthoses can correct deformity and
optimize function in RA patients with early painful deformity of the rearfoot."10 A 2005 study describes a clinical trial of 36 RA patients with foot pain. The patients received CFOs and
researchers evaluated their pain over the following six months. The study results state that "foot
orthoses were effective (adjunctively) in the management of the rheumatoid foot by significantly
reducing pain disability and activity limitations with minor adverse effects."11 Another recent study examines orthotics in children with RA. A 2005 article in the Journal of
Rheumatology by researchers at Children's Hospital in San Diego examined the efficacy of custom
semi-rigid orthoses in a randomized study of 40 children. The authors of the study noted that the custom
orthoses facilitated “significant improvement in overall pain, speed of walking and decreased disability”
as well as an improved quality of life. Researchers observed no significant effects in the group that
received an off-the-shelf orthosis.1

The most recent article in 2006 reviewed all previously written evidence based articles that were
available in English language journals in order to evaluate the effectiveness of various modalities used
to treat RA foot pathology. Although the authors of the study review found no consensus on the
preferred type of foot orthoses, they concluded “there is strong evidence that foot orthoses do reduce
pain and improve functional ability.”13 This is an article every podiatrist should have available when
rheumatologists ask why all their patients should receive foot orthoses.

Assessing The Goals Of Orthotic Therapy For Patients With RA
What should be the objectives of a custom foot orthosis that one prescribes for RA patients who have
foot pain and limitation of activity? What practical knowledge have we gained from these articles and
research projects?

Custom orthoses should be rigid enough to limit the heel eversion.7,8,10 They should contain either a
metatarsal bar or metatarsal pad to decrease the time ground reactive force acts upon the second
metatarsal.5 They should have a minimal arch fill to transfer weight from the metatarsals heads to the
arch of the foot.9 One should customize the orthoses to accommodate the unusual deformities of the RA
foot.11 The forefoot extension should reduce pressure peaks.12 Lastly, for children diagnosed with RA,
one should dispense custom orthoses as soon as possible following the diagnosis of the disease.12

Based upon the review of evidence-based information on this topic, we could design orthoses that would
be pathology specific for the rheumatoid foot. The key characteristics of the orthoses would be as
follows:

**Type:** custom functional
**Material:** semi-rigid polypropylene or semi-rigid graphite
**Heel cup depth:** deep (18 mm)
**Cast fill:** minimum
**Distal end width:** wide
**Cast correction:** 4 mm heel skive
**Additions:** metatarsal pad
**Topcover:** EVA with poron
**Forefoot extension:** 1/8 poron with accommodation for prominent metatarsal heads
Case Study: When A RA Patient Has Pain After Prolonged Ambulation Or Standing

The patient is a 49-year-old female grocery clerk who was diagnosed with RA at the age of 40. The patient suffered with joint pain and muscle spasm for 18 months before the diagnosis was confirmed. Her general health is excellent but she presents with foot and leg pain following one hour of ambulation or three hours of standing. The foot pain predominantly occurs under the metatarsal heads.

A rheumatologist, who is controlling the acute flares with methotrexate, refers the patient. The patient had been previously treated with NSAIDs and occasional short-term high dose cortisone. However, the rheumatologist ceased using these medications for this patient two years ago due to gastrointestinal bleeding.

Previous foot and ankle treatment included extra-depth shoes to accommodate the foot deformities and soft accommodative orthoses to reduce pressure on the forefoot. These devices produced minimal relief of leg symptoms and did not extend her ability to walk or stand.

The physical exam is limited to the musculoskeletal exam as her neurosensory, vascular and dermatologic findings are essentially consistent with her age and disease. There are no plantar lesions. Her ankle joint dorsiflexion motion is limited by 10 degrees and painful at the end of the range of motion. Her subtalar joints are non-mobile and appeared to be fixed in the direction of pronation. The patient’s midtarsal joint is painful during inversion and eversion of the forefoot on the rearfoot. The patient’s lesser metatarsophalangeal joints are dorsally dislocated with prominent second and third metatarsal heads plantarly. An X-ray reveals that the patient has a significant hallux abducto valgus deformity with transverse plane subluxation.

The patient’s barefoot gait consists of short strides with diminished contact phase and non-existent propulsive phase. The heels are everted at least 10 degrees bilaterally and forefoot contact is obviously antalgic.

Lower extremity extrinsic muscle strength appears to be only slightly diminished upon non-weightbearing examination. The peroneus brevis is contracted, painful to palpation, in spasm and limiting subtalar motion.

The patient is wearing extra-depth shoes with traditional outer soles and heels. The patient’s orthoses are plastazote/poron accommodative with deep impressions under the second and third metatarsal heads.

After assessing these foot symptoms, it was clear the patient had rheumatoid metatarsalgia, peroneal spastic flatfoot secondary to posterior facet degeneration, and ankle equinus secondary to anterior talocrural joint erosion.

A Closer Look At The Rationale Behind Using Orthotics For This Patient

In regard to this patient’s orthotic therapy, there are several goals to achieve with this treatment. This patient received a custom semi-rigid polypropylene device since we know from the previously cited literature that this type of device reduces symptoms of pain better than soft flexible accommodative devices.

The first goal was to decrease the ground reactive force under the metatarsal heads during gait. It required the orthotic prescription to have a minimum fill positive cast. This made the arch of the orthoses tighter against the arch area of the foot. For every bit of ground reactive force that transferred to the arch, an equal amount decreased from the forefoot at the midstance period of gait.

I also ordered a poron metatarsal bar “on the device” and a “no skive distal edge.” These two techniques tend to “float” the metatarsal heads by adding more pressure to the shafts of the metatarsal and slightly...
reduce the dorsal dislocation of the metatarsophalangeal joint slightly.
The second goal is to reposition the heel under the foot and eliminate the overuse of the peroneal brevis muscle. I ordered a deep heel cup with a flat rearfoot post. The deeper heel cup allows more contact and control of the foot than shallow or soft orthoses. I also ordered a 4-mm medial (Kirby) skive. This technique produces a great supination moment (more pressure) to invert the calcaneus while limiting subtalar motion. The flat rearfoot post stabilizes the orthoses in the shoe.
In regard to the third goal of limiting ankle joint motion and moving the resting position away from the end of the range of motion, I added a 3-mm heel lift, which plantarflexed the talus in the ankle joint. Before dispensing the orthosis, I altered the patient’s shoe by adding a 60/40 rocker sole. This allowed sagittal plane motion to occur at the shoe/floor interface rather than within the painfully deteriorating ankle joint.
Several weeks after wearing the orthosis, the patient presented with significantly longer stance period, greater mobility, no lower leg pain, less pain in the forefoot and a longer stride length. The patient interpreted these results as positive progress in her treatment.

In Conclusion
A schematic of the Arthritis Foundation demonstrates that although the etiology of RA is unknown, inflammation in foot joints causes pain, the pain causes muscle splinting and spasm, the spasm causes deformity and the deformity in turn can exacerbate the inflammation. Functional orthotic control can break this cycle by interrupting the process. Holding the joints in a more stable position prevents the body’s need to produce spasm. This is probably why orthotic therapy works to reduce symptoms in the rheumatoid patient.
Few practitioners are aware that the literature overwhelmingly recommends custom foot orthoses for every RA patient with pain or limitation of activity. Indeed, the appropriate and specific application of what we have learned about orthoses could have a significant impact on the well-being and mobility of patients with RA.

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References:
4. www.arthritis.org/research


