Rheumatoid Arthritis

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Key Messages

- Early diagnosis and treatment is vital to reducing disabling effects of rheumatoid arthritis.
- Recognition of signs and symptoms of possible rheumatic disease may speed appropriate diagnostic tests in previously undiagnosed individuals.
- There is strong evidence that foot orthoses and specific footwear reduce foot pain and improve functional ability.
- Orthotic efficacy may be as much a result of changes in muscle activation, proprioception, and motion facilitation as skeletal alignment and kinematic changes.
- Semi-rigid and rigid orthotics in combination with rocker toe footwear were the most effective in relieving forefoot pain where soft orthoses (plastazote, poron) were less effective.
- Footwear modifications are an effective treatment option for the rheumatoid foot.

Introduction

Rheumatoid arthritis (RA) is a chronic, progressive, autoimmune disease of unknown cause in which the body’s immune system attacks the joints and surrounding tissues leading to joint inflammation, pain, joint damage, and disability. It is a systemic disease that targets synovial joints but can have extra-articular ramifications in other organs. RA affects approximately 1% of Canadians (Health Canada, 2003) and is more than twice as likely to affect women as men. Rheumatoid arthritis can occur at any age but tends to begin between the ages of 25 and 60. Children can be affected by a distinct but closely related inflammatory arthritic condition called juvenile idiopathic arthritis, or juvenile rheumatoid arthritis. Rheumatoid arthritis affects all ethnic groups and is found worldwide (Thould & Thould, 1983).

Symptoms of initial onset of RA most commonly include insidious fatigue, morning stiffness lasting 30-60 minutes or more, joint pain and swelling involving the small distal joints including the wrist, metacarpophalangeal joints, proximal interphalangeal joints, metatarsophalangeal joints (Rheumatoid Arthritis, 2011; Tehlirian & Bاثon, 2008). Inflammation of the small joints of the hands and feet in a symmetrical pattern is specifically characteristic of RA (Robinson, 2008) and occurs early in the onset of the disease (Otter et al., 2010). Other joints that may be affected include elbows, shoulders, hips, knees, ankles, jaw, and neck. In addition to articular symptoms the early symptoms of RA can also include low grade fever, fatigue, loss of appetite, weight loss, swollen glands, weakness, malaise, myalgias, and anemia. Muscle weakness and atrophy is a common complaint and may be a result of pain from articular and/or periarticular inflammation.
Foot involvement in rheumatoid arthritis is a major contributing factor to disability causing changes to gait mechanics, difficulties walking and restrictions in activities of daily living (Clark, Rome, Plant, O’Hare, & Gray, 2006; Williams et al., 2011). Over 90% of patients report foot problems within the first 10 years of disease onset (Clark et al., 2006; Goksel Karatepe et al., 2010; Otter et al., 2010; Williams et al., 2011) and 57% report foot and ankle pain in the first year (Riskowski et al., 2011). Disease severity is not the only factor that affects disability. Other contributing factors may include socio-economic factors, depression, and access to appropriate medical care and supportive resources, which all contribute to the quality of patient care and patient compliance with recommended treatments (Jones, Halbert, Crotty, Shanahan & Batterham, 2003).

Growing evidence shows that early diagnosis and treatment offers the best chance of limiting the disabling effects of RA on joints and damage to organs (Breedveld & Combe, 2011; Rheumatoid Arthritis, 2011). For patients who are referred for pedorthic treatment complaining of bilateral joint pain in the metatarsophalangeal and/or interphalangeal joints but have not been diagnosed with rheumatoid arthritis, the clinician should look for the cardinal signs of articular inflammation. These signs include warmth, joint line tenderness, pain on motion particularly at end range, and intra-articular swelling or effusion. The history should also include questions regarding other joints in the body, mode of onset of pain, quality of pain and general health of the patient. Episodic swelling, stiffness, weakness, and more generalized symptoms are warning signs of a possible rheumatic condition. A thorough history and assessment of the painful joints may elicit responses that indicate a referral back to the physician is necessary. If the physician suspects RA an immediate referral to a rheumatologist will speed appropriate treatment. With respect to non-pharmacological treatment, research suggests that pedorthic treatment of the foot in RA using foot orthoses and specific shoe types that reduce planar pressures and redistribute forces may play a significant role in the treatment of the RA foot (Riskowski et al., 2011; Williams et al., 2011; Woodburn, Barker & Helliwell, 2002). Other health care professionals are integral to the team treating the RA patient and may include rheumatologist, physiotherapist, occupational therapist, dietician, alternative therapists, social worker, and other complementary professionals.

Pathology

In rheumatoid arthritis, the immune system attacks the synovium in particular, a thin layer of tissue that lines the joints. People with RA experience “flares” or intermittent active phases of the disease where joints may become hot, red, inflamed, and painful. The initial trigger for the autoimmune reaction that leads to rheumatoid arthritis is unknown but viral infection, bacterial infection, stress, hormones, environmental factors, and smoking have all been suggested as possible triggers (Carty, Snowden & Silman, 2003; Söderl, Bergsten & Svensson, 2011). As a result of the immune response that attacks the synovium, a host of inflammatory cells infiltrate the joint flooding it with inflammatory chemicals that damage cartilage, subchondral bone, articular capsule, and ligaments. Synovial fluid builds up within the joint leading to swelling and pain in the joint. The synovium thickens and develops into a granular tissue called a pannus, which releases inflammatory mediators, eroding the cartilage particularly but also the bone underneath. Once a pannus has formed, scar tissue can develop which can eventually ankylose, fusing the bone ends together. Not all cases of RA progress to the ankylosis stage, but joint erosion, subluxation and subsequent deformity are common in RA (Marieb & Hoehn, 2010). The pattern of joints affected can help in differentiating rheumatoid arthritis from other conditions. Symmetrical involvement of the small joints of the hands and feet is a hallmark of RA. RA can on occasion begin as a sudden onset polyarthritis, or a transient episode of single joint or polyarthritis lasting only a few days or weeks, but this is not the standard presentation (Tehlirian & Bathon, 2008). RA tends to affect joints symmetrically in the body as opposed to other arthritic diseases such as osteoarthritis which may act asymmetrically, targeting one or more individual joints. The progression of RA is highly variable among individuals with the disease. There are certain biological markers and clinical indicators that can identify individuals who are at high risk of rapid disease progression.

The complications of RA are many. In long-standing disease, extra-articular symptoms occur in approximately 40% of RA patients and may include the formation of firm, fibrous rheumatoid nodules on elbows, Achilles tendon, metatarsal heads and fingers; shortness of breath or chest pain due to pulmonary fibrosis, pleural effusion; pain and redness around the eyes due to scleritis; dry eyes and dry mouth; congestive heart failure as a result of pericarditis; bleeding stomach ulcers; and skin ulcers and infections due to rheumatic vasculitis (Tehlirian & Bathon, 2008). A viña-Zubieta et al., in a review of cardiovascular mortality in RA patients, reported most studies found a 30–50% increase in mortality rates due to cardiovascular disease in RA patients as compared to the general population. However, more recent studies indicate improvements to mortality rates from cardiovascular disease for RA patients and the authors suggest that earlier diagnosis and the use of more aggressive and newer antirheumatic treatment regimens have improved survival rates (Aviña-Zubieta et al., 2008). The key to achieving long-term disease control is to reduce inflammation promptly and effectively therefore early therapeutic intervention with appropriate medications reduces long-term disability and joint and organ damage (Breedveld & Combe, 2011; Rheumatoid Arthritis, 2011; Winston, 2011).

Common Testing and Differential Diagnosis

There is no single test for RA, rather it is a diagnosis reached after combining the results of a thorough patient history, physical examination, blood tests, and diagnostic imaging. A careful examination of musculoskeletal complaints by a physician will determine the direction of the clinical exam and the appropriate lab tests and diagnostic imaging that is...
required. Polyarthritis of the hands and feet is also a common feature of other rheumatic diseases as are the constitutional symptoms of fever, weight loss, loss of appetite, swollen glands, anemia, and myalgias. Polyarthritis associated with RA needs to be differentiated from similar rheumatic diseases such as systemic lupus erythematosus (SLE), systemic sclerosis (scleroderma), psoriatic arthritis, rheumatic fever, reactive arthritis, infectious arthritis and Sjogren syndrome. Blood tests are used to determine levels of inflammation, identify antibodies and other markers that will help determine a diagnosis of RA. Rheumatoid factor (RF) is an antibody that is not normally present in healthy individuals, but 70–80% of individuals with RA have high levels of rheumatoid factor; however, destructive arthritis can still occur in the absence of RF. A positive anti-cyclic citrullinated peptide (CCP) antibody test, in combination with elevated erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) rates and a positive RF supports a diagnosis of RA (Rheumatoid Arthritis, 2011; Tehlirian & Bاثon, 2008). However, high levels of RF may also be present in other autoimmune diseases including Sjogren’s syndrome, systemic lupus erythematosus, scleroderma, polymyositis, and dermatomyositis. Radiographs for RA diagnosis may reveal joint space narrowing, bone erosions, deformities or periarticular osteoporosis (Tehlirian & Bاثon, 2008). MRI and ultrasound may be more sensitive tests in early disease when some blood tests may not yet be positive.

Contraindications
Maintaining a healthy lifestyle can benefit RA patients including cessation of smoking, appropriate exercise, maintaining a normal weight, healthy diet, and utilizing aids for daily living where necessary. Appropriate referrals for these issues are necessary. Some medications used to alter the disease process or treat symptoms may be contraindicated in some patients due to co-morbidity, intolerance, and other factors. For patients taking biologic therapy an immediate referral to their rheumatologist or family physician is necessary if they develop foot or leg ulcers. Do not try pressure-relieving orthotics or footwear as a first line treatment for ulcers if the patient has not consulted with their doctor or rheumatologist for possible medication-related issues first. In addition to drug therapies, patient tolerance for conservative or alternative therapies may also dictate the nature of the treatment plan for each individual.

The Patient Perspective
Bone and joint erosion caused by RA is particularly evident in the feet. 16–19% of RA patients initially present with foot complaints (Goksel Karatepe et al., 2010) and 20% already have radiological damage at diagnosis (Baan, Drossaers-Bakker, Dubbeldam & van de Laar, 2011). Otter et al. (2010) found women reported significantly higher scores for foot pain than men. Patients initially may report foot pain. The metatarsophalangeal joints (MTP) is one of the most common complaints especially in early RA (Magalhaes, Davitt, Filho, Battistella & Bertolo, 2006; Otter et al., 2010).

The patient may complain of callus formation under high pressure areas, pain from nodules, lesions on high friction areas from footwear irritation. The development of subcutaneous nodules occurs in approximately 30% of patients and can further complicate already painful joints. Inflammation alters pain perception, lowering the threshold for pain (Hodge, Bach & Carter, 1999) so higher plantar pressures associated with joint changes is not the only factor at play in the painful RA foot. Dorsal subluxation of the lesser MTP joints can occur exposing the distal end of the metatarsals to increased pressure leading to calllosities and possible ulceration of overlying skin under the metatarsal heads as well as over clawed and hammer toes (Magalhaes et al., 2006). Common foot deformities in RA include hallux valgus, hallux rigidus, splaying of the forefoot, metatarsal subluxation, clawing of lesser toes, rearfoot valgus and damage to the ankle joint (Baan et al., 2011; Goksel Karatepe et al., 2010).

Most patients with involvement of the rearfoot complain of ill-defined ankle pain, lateral ankle pain associated with valgus deformity and lateral impingement (Li, 2007), plantar heel pain, generalized foot pain and difficulty walking on uneven ground and difficulty finding footwear. Changes to ankle stability and talor position may result in damage to the tibialis posterior tendon which further contributes to foot deformity (Magalhaes et al., 2006). Suspected dysfunction of the tibialis posterior tendon can be confirmed by an inability to perform a single heel raise or by a lack of inversion of the rearfoot during heel raise.

Patients report a decreased tolerance for walking and standing (Cho et al., 2009). Joint damage and foot deformities cause functional impairment disrupting normal gait patterns and restricting activities of daily living (Baan et al., 2011; Clark et al., 2006; Woodburn, Helliwell & Barker, 2003). They may have generalized foot pain on weight-bearing, joint damage that causes pain on weight-bearing, pressure sensitive areas of the foot which limit standing and walking activities.

In addition to pain, patients report numbness, stiffness, weakness and decreased range of motion in the joints. Limited mobility has far reaching implications for the lifestyle of rheumatoid arthritis sufferers. Not only do patients suffer from pain, stiffness and deformity of the feet, these complications have severe consequences for independence, employment and maintaining social integration (Otter et al., 2010). In RA deformity and pain have an impact on functional ability but it also has detrimental effects on how the body looks, the perceptions of an individual’s body image, moods, and general quality of life (Goksel Karatepe et al., 2010; Williams & Nester, 2006).

Common Treatment
Early and aggressive treatment of RA is the overwhelming recommendation of the rheumatology community (Breedveld & Combe, 2011; Lacaille, 2000; Mäkinen, Hannonen, & Sokka, 2006) to prevent joint destruction and limit disease progression (Breedveld & Combe, 2011;
Primary treatment of RA includes early intervention with drug therapies, lifestyle changes, and patient education. Overall treatment goals include reducing inflammation, preventing damage to joints and organs, relieving pain, maintaining mobility, and limiting harmful side-effects of medications (Williams et al., 2011). There is no single medication that will address the complex progression of RA, but standard treatment paradigms include the use of disease-modifying antirheumatic drugs (DMARDs) (Jones et al., 2003; Lacaille, 2000). DMARDs target biologic processes that fuel inflammation in joints and have an effect on the progression of the disease. They are often combined with non-steroidal anti-inflammatory drugs (NSAIDs) and/or steroids which work to control symptoms of the disease. While NSAIDs work quickly to relieve symptoms they do not have an effect on the underlying disease and do not prevent damage to the joints or organs. Steroids work quickly but often have side effects so their use is often short-term. There are a number of DMARDs available and depending on patient response, more than one DMARD may be prescribed or a combination of drugs including DMARDs and NSAIDs or steroids. Patients need to be carefully monitored due to possible toxicity of DMARD therapy.

There has been a major shift in the treatment of RA in the past decade as newer biologic agents have been developed which have proven to be successful, preventing damage to the joints and improving the quality of life and lifespan of RA patients, even producing remission (Mäkinen et al., 2006; Winston, 2011). “In patients with well-established RA, biologic agents have been shown to effectively improve clinical, functional and radiographic outcomes and to retard radiographic progression” (Breedveld & Combe, 2011). In more advanced disease, orthopaedic surgery may be necessary due to joint or soft tissue destruction or deformity. In a recent study, Shourt et al. (2012) showed a marked decline in orthopaedic surgeries for RA in a more recent cohort of patients compared to those followed from 1980 to 1994, suggesting that recent treatment advances may be reducing the rate of disease progression and therefore the need for as many surgeries (Shourt, Crowson, Gabriel & Matteson, 2012). Treatment options for RA also include conservative treatment including the use of analgesics, physical therapy, occupational therapy, access to social workers, patient education regarding lifestyle changes, splinting, alternative therapies, specialty footwear, and foot orthoses for foot pain relief.

The relatively small amount of research in the foot in RA is disproportionate to the contribution of the foot to pain and disability (Baan et al., 2011; Riskowski et al., 2011). Inconsistencies in methodology, orthoses terminology, orthoses fabrication techniques, trial quality, trial sizes, and outcome measures have made evaluating the available evidence and applying to clinical practice challenging (Clark et al., 2006; Riskowski et al., 2011). In a review of studies of foot orthoses in the RA foot, Clark et al. (2006) state that there is strong evidence that foot orthoses do reduce foot pain and improve functional ability, despite the range of types of orthoses being assessed in the studies examined. However, a Cochrane review of research on custom foot orthoses for RA in the foot only awards foot orthoses a “silver level” of evidence for their use, finding results of clinical trials not strong enough to develop guidelines (Hawke, Burns, Radford, & du Toit, 2008; Riskowski et al., 2011). Regardless, repeated findings and clinical observations in these studies may be helpful in making treatment decisions regarding foot orthoses and footwear to treat foot pain in RA.

The purpose of providing orthoses is to relieve pain, maintain or improve function and mobility, reduce plantar pressures, prevent or minimize deformity, reduce ulceration risk (Magalhaes et al., 2006; Williams, et al., 2011; Woodburn & Helliwell, 1997). Several studies found that stabilizing deformities and providing pain relief increased walking tolerance and improved gait measures (Chalmers, Busby, Goyert, Porter, & Schulzer, 2000; Cho et al., 2009; Woodburn et al., 2003), however the mechanism by which orthoses and footwear achieved these goals is not clear. While it is commonly believed that orthoses have an effect on kinematics and mechanical alignment these effects may be small and may not be the primary influence of orthoses. Other research provides alternative, or perhaps complementary, explanations for the efficacy of foot orthoses and specialized footwear. Orthoses may change muscle activation patterns in the foot and leg (Nurse, Hulliger, Wakeling, Nigg & Stefanyshyn, 2005; Nurse & Nigg, 2001) as well as gait pattern changes which may influence joint loading, reducing stresses to the joints (Woodburn et al., 2002). This may explain why orthoses of various densities, designs, and materials have shown positive results in a wide range of studies. There may be a variety of influences at play to achieve improved results (Riskowski et al., 2011). In a review, Egan supported the current practice of recommending orthoses recognizing their potential to provide pain relief at a relatively low cost (Egan, 2010).

Both rigid (carbon graphite) and semi-rigid (subortholene, EVA) orthotic materials have been shown to reduce pain and improve function in adults with RA (Chalmers et al., 2000; Cho et al., 2009; Woodburn et al., 2002) and in children with JIA (Powell, Seid, & Szer, 2005). In early disease, patients responded well to harder orthoses, showing a reduction in metatarsal and rearfoot pain, however, Woodburn et al. (2002) cautioned that rigid devices should only be used in patients where the tarsal joints are not affected by disease. Soft orthoses (plastazote and polyurethane foam) did not produce as positive a reduction in forefoot pain as semi-rigid or EVA orthoses with metatarsal pads (Chalmers et al., 2000; Hodge et al., 1999). Magalhaes et al. utilized EVA orthoses and found the orthoses effective in reducing pain, perceived disability and activity limitation. Foot type may also play a role in the selection of orthotic materials. Lower arched or pronated feet generally respond well to harder materials whereas rigid deformity and pes cavus foot types do better with softer materials (Riskowski et al., 2011). As Chalmers et al. (2000) found, too soft a material does not produce a therapeutic effect.

Wearing time appears to have a dramatic effect on the efficacy of custom foot orthoses with increased wearing time resulting in decreased pain, disability, and deformity (Clark et al., 2006). Other authors support the continuous use of custom foot orthoses to reduce pain and improve function.
(Woodburn et al., 2003; Clark et al., 2006), one suggesting an average wearing time of six hours per day for optimal treatment effect. Williams et al. found that patients who wore their prescribed orthoses and footwear for longer periods of time had better pain reduction than those who did not wear them as often.

Foot orthoses have also been found to reduce plantar pressures under the feet of RA patients. Li (2007) found that orthoses provided greater pressure and loading stress relief in RA patients than in control subjects with no foot problems. Surprisingly Hodge et al. (1999) using in-shoe pressure measurement found no relationship between foot pain and planter peak pressure, however a relationship was found between average pressure and foot pain. They postulate that pain perception in RA is not well understood and that while peak pressures may be an important variable in the insensate foot evaluating risk of ulceration, average pressure appeared better correlated to pain in the RA foot. In-shoe pressure-measuring systems can provide vital information when working with patients at high risk of ulceration, but according to Hodge et al. those using in-shoe pressure systems as a clinical tool should look to average pressure as the more important variable in the management of foot pain in RA (Hodge et al., 1999).

Several other authors found the combination of orthoses and specific footwear to be the most successful at alleviating foot pain (Cho et al., 2009; Li, 2007; Woodburn et al., 2002). Orthoses and footwear cannot be easily separated in the treatment of the rheumatoid foot. These devices should work together to provide a more appropriate therapeutic environment for the RA foot. Despite the need for orthoses and footwear in the RA population, Otter et al. (2010) found poor adherence with prescribed orthoses and footwear, with footwear having poorer adherence than orthoses (de Boer et al., 2009). Reasons for non-adherence to footwear include poor patient education, poor fit of orthoses in shoes, aesthetics, design, comfort, weight, and poor efficacy (Williams & Nester, 2006; de Boer et al., 2009).

The definitions of orthopaedic and therapeutic footwear in the literature varies but most often includes footwear features such as extra depth, increased volume in the toe-box, heat mouldable uppers, rearfoot stability. Foot deformity and pain obviously have a negative impact on finding appropriate footwear to accommodate the structural changes and pain relief demands. Difficulty in finding footwear can lead to prolonged use of inappropriate footwear which can be a major contributing factor to foot impairment (Silvester, Williams, Dalbeth & Rome, 2010). Patient involvement in the process of selecting and designing orthotic and footwear choices may improve adherence to treatment. Patients who perceive the footwear to “look comfortable” are more likely to wear the footwear chosen (Williams & Nester, 2006). Overall mobility needs to be considered when selecting footwear. Limited hand function may restrict closure choices for footwear, eliminating laces as an option for example. Ease of donning and doffing footwear is important in those with spinal or hip involvement where impaired flexion at the hip and back makes reaching the feet impossible. Footwear may need to be modified with Velcro closures, or alternative closures to accommodate the needs of the individual and improve compliance.

In a study comparing running shoes to orthopaedic specialty footwear, using a single blind comparison design, running shoes were the preferred footwear for comfort and weight (Hennessy, Burns & Penkala, 2007). Another footwear condition that also showed a decrease in forefoot loading was custom orthotics in combination footwear that had a forefoot rocker (Cho et al., 2009). Shoes with a forefoot rocker have been shown to reduce plantar pressures in the forefoot independent of orthoses as well (Brown, Wersch, Harris, Klein & Janisse, 2004) but studies repeatedly show better results with a combination of orthoses and footwear with a forefoot rocker.

There are several footwear modifications that are commonly used to treat painful RA feet. To decrease pressure on the forefoot, rocker soles, provided balance and gait parameters permit the use of rocker soles. In-shoe accommodations can be used to relieve pressure on specific painful metatarsal heads, by physically removing material from the inside of the footwear directly under the affected area. Modifications to the shape of the shoe may be necessary in order to accommodate foot deformity such as a splayed forefoot with a narrow heel. The sole can be split and widened in the area that impinges on the foot and the shoe can then be re-soled to secure the modification and seal the bottom of the shoe. In some cases of forefoot pain where extra depth footwear was not suitable, heat mouldable footwear has been shown to reduce forefoot pain (Riskowskii et al., 2011). Due to the extent of deformity of the foot in some cases, custom orthopaedic footwear is the best treatment option.

The provision of specialized footwear and orthoses has larger implications than simply accommodating the feet, they also influence issues such as body image, moods, a sense of well-being, and quality of life (Otter et al., 2010; Williams & Nester, 2006). The Canadian certified pedorthist is uniquely positioned to provide orthotic and footwear treatment for the RA foot and participate as part of the multidisciplinary team treating the patient. The ability to design and dispense patient specific devices, and to adjust and modify those devices in a timely manner is a powerful tool in treating the painful RA foot.

References


