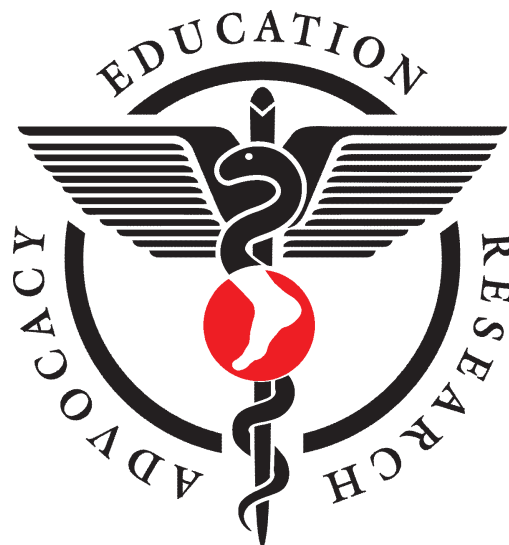


The American College of
**FOOT & ANKLE ORTHOPEDICS
& MEDICINE**

**Prescription Custom Foot Orthoses
Practice Guidelines**

December, 2006



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FOREWORD

The *Prescription Custom Foot Orthoses Practice Guidelines* were developed by the American College of Foot & Ankle Orthopedics & Medicine in response to the need for better definitions and indications for prescription custom foot orthoses. This document provides a comprehensive description of the definitions of and indications for foot orthoses.

Considerable confusion has developed surrounding foot orthoses for many reasons:

- The development of new foot orthoses of varying degrees of sophistication and production investment;
- The development of new technologies and materials;
- The development of multiple disciplines with interest in foot orthoses;
- Differences of opinion between and within those disciplines using and selling orthoses;
- Increasing scrutiny by Medicare, consumers and other payors; and
- Uncontrolled dispensing by some disciplines from venues that run the gamut from State Fairs to physicians' offices.

ACFAOM is committed to maintaining this document in an up-to-date form and the evolution of this document will increase its usefulness over time. The process of growing the document will require constant feedback to the College. Any and all comments from interested parties are welcome.

Past updates have included a literature review update in 2001 by John Walter, DPM, and a coding update in 2004 by Kirk Geter, DPM. This current update is focused on an overall review in addition to a literature review limited to research based publications on the efficacy of foot orthoses. Although research in the area of foot orthoses is nowhere near complete, recent research efforts have certainly begun to move in the right direction for providing evidence for the use of foot orthoses.

Because this document will continue to change, the updated release date will be prominently displayed on the title page. Members can obtain the update at any time for no cost via the ACFAOM web site's members' area. Non-ACFAOM members can order a copy for a nominal fee by calling the College.

As it is, this document is the opinion of the College and serves only as a guideline to those involved with the use of foot orthoses including practitioners, consumers, payors, TPA, Medicare, policymakers and lawmakers. The *Prescription Custom Foot Orthoses Practice Guidelines* represent what the College holds as generally accepted for proper use of foot orthoses. Each practitioner must evaluate individual patients on a case-by-case basis. Obviously, exceptions and differences in opinion are inevitable.

The American College of Foot & Ankle Orthopedics & Medicine is tremendously grateful for the hard work of those committee members listed at the top of the index page, as well as to others who may not be listed. This is a living document that is going to be ever changing.

Lastly, ACFAOM would like to thank the APMA for helping to offset the cost of the original version of this document with a grant that provided partial funding.



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***PRESCRIPTION CUSTOM FOOT ORTHOSES
PRACTICE GUIDELINES***

Updated December 2006

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I. INTRODUCTION

It is important that the podiatric medical profession play a significant role in critically evaluating the use of diagnostic procedures and therapies in the prevention and/or management of disease. Rigorous and expert analysis of the available data documenting relative benefits and risks of these procedures and therapies can produce helpful guidelines that improve the effectiveness of care, optimize patient outcomes and impact the overall cost of care favorably by focusing resources on the most effective strategies.

These guidelines address the appropriate use of prescription custom foot orthoses. They are intended to assist podiatric physicians and other health care providers in clinical decision-making by describing a range of generally acceptable approaches for the diagnosis, management or prevention of specific diseases or conditions. These guidelines attempt to define practices that meet the needs of most patients in most circumstances. The ultimate judgment regarding care of a particular patient must be made by the podiatric physician and patient in light of circumstances specific to that patient.

ACFAOM believes these guidelines will make a positive contribution to the quality of care in the United States. However, this document is not intended to be comprehensive and **does not preclude the use of orthoses for other conditions. The fact that a diagnosis is not covered in these guidelines should not be construed as a statement either for or against the use of orthoses to treat that diagnosis.**

Methodology

These guidelines were developed by a core committee of the American College of Foot & Ankle Orthopedics & Medicine (ACFAOM). During their development, the committee received extensive input from ACFAOM's membership, as well as from others in the profession. The committee used scientific methodology and expert clinical judgment to develop specific statements on patient assessment and on the management of selected clinical conditions. Extensive literature searches were conducted and critical reviews and syntheses were used to evaluate empirical evidence and significant outcomes, when available. Peer review and field review were conducted to evaluate the validity, reliability and utility of the guidelines in clinical practice.

Background

The use of prescription custom foot orthoses (PCFOs) has a well-documented history in the field of medicine. PCFOs have been successfully used to treat a variety of clinical conditions. However, with the proliferation of techniques and materials, it is increasingly important to clarify and codify their appropriate use. ACFAOM intends to update these guidelines periodically to reflect current practice and research findings.

Definitions

The following definitions are used in these guidelines:

- **Orthosis.** A device utilized to assist, resist, facilitate, stabilize or improve range of motion and functional capacity.
- **Foot orthosis.** A custom or stock orthosis utilized to treat the foot.
- **Custom foot orthosis.** A device derived from a three-dimensional representation of the patient's foot.
- **Prescription custom foot orthosis (PCFO).** A custom foot orthosis created specifically to address the pathomechanical features of a foot condition that may be structural or functional in nature.

Consensus Key

The committee developed a consensus key to define the efficacy of prescription custom foot orthoses. PCFOs may be:

- **Medically indicated and essential.** PCFOs are the treatment of choice in the majority of patients, although in extenuating circumstances, PCFOs may be **contraindicated**.
- **Useful.** PCFOs provide significant therapeutic benefit in the majority of patients, although in extenuating circumstances, PCFOs may be **contraindicated**.
- **Adjunctive.** PCFOs may be helpful in conjunction with or in addition to other therapeutic treatment.
- **Not useful.** Although PCFOs may be used, they may not be efficacious.

Indications for PCFOs

PCFOs may be functional (primarily designed to improve joint position and motion) and/or accommodative (primarily designed to alter pressure distribution). These devices should be prescribed with one or more of the following goals in mind:

- Enhance the patient's functional ability.
- Redistribute weight bearing.
- Deter progression or development of morbidity.
- Reduce pain.

The use of PCFOs is appropriate for patients demonstrating signs and/or symptoms related to pathomechanical etiologies when the patients also present with one or more of the following circumstances:

- Prior failed attempts to treat the condition with over-the-counter devices.
- Deformity or forces that are too great to be managed with over-the-counter devices.
- Prior successful use of PCFOs for the condition.

Periodic re-evaluation of the patient and device(s) is necessary to determine the need for modification and/or replacement of PCFOs. The “useful life” of a PCFO is case-specific.

Examination and Documentation

The following evaluation and documentation is required to successfully execute a treatment plan which includes PCFOs:

1. Assessment of the range and quality of motion and the position of the following structures is deemed **essential**:
 - ankle complex;
 - rearfoot complex;
 - forefoot/rearfoot relationship.
2. The gross assessment of muscle strength is **essential** in all patients. Testing of specific muscles is necessary in certain pathologies.
3. An evaluation of the stance position is **essential**.
4. A clinical evaluation of the limb length is **essential**.
5. A gait evaluation is **essential**. (Appendix A)
6. Assessment of the position, range and quality of motion of the following structures **may be necessary** in certain pathologies:
 - spine;
 - hip complex;
 - knee complex;
 - fifth ray;
 - first ray;
 - first metatarsal-phalangeal joint;
 - lesser metatarsal-phalangeal joints;
 - inter-phalangeal joints.

Modes of Modeling Feet

Numerous techniques have been developed to capture the shape and contour of the foot for the purpose of prescription fabrication of custom foot orthoses. These techniques fall into two general categories:

Category 1: modeling the foot in a specific position (most often STJ neutral with the MTJ locked) for the primary purpose of affecting the function of the foot in the gait cycle;

Category 2: modeling the foot in the position it assumes naturally in weight bearing for the primary purpose of accommodating one or more deformities by redistributing weight bearing.

Category 1:

The following techniques are equally appropriate for modeling the foot in a pre-planned position for the fabrication of functional PCFOs. The technique to be used should be based upon the clinician's preference.

- Neutral suspension casting with the foot positioned by holding the sulcus area of the 4th and 5th toe. The cast may be obtained either in a supine or a prone position.
- Computer imaging of the foot held in the same manner.

The following techniques are less than optimal, in some instances, for modeling the foot in a pre-planned position for the fabrication of functional PCFOs, at least in part because they are less likely to capture the relationship of the midtarsal joint. Therefore, they should be used only as determined by clinical judgment.

- Semi-weight bearing casting with the subtalar joint held in a pre-planned position.
- Neutral suspension casting with the foot positioned by holding the 5th metatarsal head. The cast may be obtained either in a supine or a prone position.
- Computer imaging of the foot held in the same manner.
- Compressive foam casting of the foot in a pre-planned position.
- In-shoe casting with the subtalar joint held in a pre-planned position (vacuum casting).

Category 2:

The following techniques are appropriate for modeling the foot in the position it assumes in weight bearing for the fabrication of accommodative orthoses. None of the listed techniques is deemed superior to the others. Therefore, the technique to be used should be determined by clinical preference.

- Weight bearing and semi-weight bearing casting.
- Computer and mechanical imaging systems which reproduce the actual foot shape and contour in a weight bearing or semi-weight bearing position.
- Compressive foam.
- In-shoe casting without attempts to control STJ position.

The following techniques are deemed *inadequate* for the fabrication of PCFOs.

- Any two dimensional representation of the foot (i.e. tracings, pressure sheets, photos, etc.).
- Any technique using measurement of foot size (length, width, etc.) as the only technique.
- Any technique which exclusively uses a single foot impression to make a pair of orthoses (i.e. mirroring).

Prescriptions for Custom Foot Orthoses

For an orthosis to be considered a PCFO, the prescription should include at least the following:

1. Functional orthoses:
 - Type of material to be utilized.
 - Cast balancing technique (intrinsic correction) and/or rearfoot/forefoot posting.
 - Depth of heel seat.
2. Accommodative orthoses:
 - Type of material to be utilized.
 - Location of lesion(s) or areas of pressure to be accommodated or off weighted.

Orthoses fabricated from prescriptions where the practitioner has left these decisions to the laboratory's discretion should not be considered PCFOs **unless appropriate morphological data is provided** to a laboratory that has an appropriate consultant for that purpose.

Additional modifications may be prescribed based on the individual patient's needs:

- forefoot extensions and top covers
- post flaring
- flanges
- length
- cutouts
- cast fill and accommodations
- location of lesion(s)

The following patient information is necessary to create an appropriate PCFO prescription:

- shoe size and width
- heel height of shoe (shoe style)
- heel lifts
- biomechanical data pertinent to the patient's deformity
- weight
- age
- activity level
- occupation
- diagnosis

- previous orthotic use or mechanical treatment
- systemic diseases that have podiatric manifestations
- proximal musculoskeletal pathology

II. PROXIMAL LOWER EXTREMITY PATHOLOGY

Definition

This category of diagnoses refers to conditions involving the leg, knee or thigh area, which may or may not be mechanically induced. Diagnoses included in this category are:

Shin Splints (also known as Periosteal Myositis)

Tendonitis (Tenosynovitis)

Posterior Tibial Dysfunction

Iliotibial Band Syndrome

Limb Length Discrepancy

A. Shin Splints

Etiology

Shin splints is a disease process that presents with pain and discomfort in the leg. Most commonly, this condition is caused by excessive use of the muscles of the lower extremity in an attempt to decelerate. The literature supports the fact that the muscle does not function from origin to insertion, but in this case, from insertion to origin. The result is an irritation or tear of the muscle from its periosteal attachment (1, 2, 3).

The literature discusses athletes with and without shin splints. Consistently, athletes with shin splints exhibit greater external deviation of the calcaneus from the midline of the lower leg (Achilles angle) during stance, greater passive range of motion of the subtalar joint and greater displacement of the Achilles tendon angle while running on a treadmill (4). Excessive pronation during the stance phase may lead to overuse of the posterior muscle group of the shin, causing an increased stretch and eccentric contraction of the shin musculature (5, 6, 7). Shin splints can occur along the anterior crest of the tibia as well as on the posterior surface.

Associated diagnoses

Stress Fractures

Periostitis

Compartment Syndrome

ICD9 Code: 844.9, 730.07, 730.17, 729.1, 729.5

Symptoms

Symptoms may include pain along the posterior-medial or anterior aspects of the lower leg. The pain is exacerbated by activity and often is associated with athletic activity. Associated findings are swelling, point tenderness and increased warmth in the affected area. In addition, associated muscle weakness may ensue.

Treatment

Treatment depends on the severity and/or duration of the symptoms as well as on the structural deformity present and should keep in mind the activity level of the patient. Treatment possibilities may include rest, ice, compression and elevation (RICE), physical therapy, muscle strengthening and stretching, anti-inflammatory medications, shoe modifications, modification of activity, immobilization and PCFOs.

PCFOs designed to maintain the subtalar joint close to its neutral position in order to reduce pronation have been recommended (8). Shin splints, as well as other chronic overuse injuries of the lower extremity, may be treated by the use of biomechanical aids including PCFOs (8). Abnormalities such as excessive over-pronation, limb length discrepancy and pathomechanical entities, such as forefoot varus, often can contribute to shin splints (9, 10).

PCFOs often are used when symptoms of shin splints subside and patients begin training and/or running. In this case, the PCFOs are used to address the underlying mechanical etiology of the patients' shin splints. With proper shoe gear and PCFOs, hyperpronation as well as excessive tibial rotation, can be prevented (11, 12).

Prescription PCFO summary statement

PCFOs can be used in association with proper shoe gear to prevent hyperpronation and excessive tibial rotation. PCFOs also can be used to treat the symptoms of shin splints and to stabilize the etiology that causes the condition.

Consensus statement

PCFOs are useful to medically indicated and essential in the long-term management of patients with shin splint syndrome.

B. Tendonitis (Tenosynovitis)

ICD9 Code: 726.90, 726.71, 726.64, 726.79, 726.72

Etiology

Tendons are the functional extensions of most skeletal muscles by which the force, exerted by the muscle, takes action on a bone. Tendonitis is defined as an inflammation of the tendon, which is usually the result of direct or indirect trauma (repetitive stress) (13, 14, 15, 16) that commonly causes localized inflammation about the tendon or tendon sheath apparatus (tenosynovitis). Systemic etiologies also are noted and may need to be managed locally as well as systemically.

Common causes of localized tendonitis include overuse syndromes, direct trauma, structural deformities and abnormal function. Direct trauma can result in a partial or total tendon rupture. It is this event that triggers an inflammatory response and the accompanying sequelae. Injuries to structures surrounding the tendon (peri-tendon) can cause an alteration in tendon function, which may predispose the tendon to rupture, subluxation, stenosis and chronic irritation (17- 20). Foot dysfunctions can play a prominent role in developing tendonitis within the many muscles which function symphonically in walking. The vascularity of tendons decreases with age (21, 22), making older patients more susceptible to tendonitis as a result of impaired healing ability. Rheumatoid arthritis and other connective tissue diseases can initially manifest themselves clinically as tendonitis (23, 24).

Associated diagnoses

Tendon Rupture

Stenosis

Tendon Subluxation

Limb Length Discrepancy

Symptoms

Symptoms may include signs of inflammation along the course of the tendon and/or at the insertion, loss of function, pain with range of motion and pain upon contraction against resistance.

Treatment

Treatment should be initiated promptly to avoid excessive scarring brought on by protracted inflammation. Some of the treatments include cessation or modification of activity, immobilization, physical therapy, pharmacological therapy (i.e., nonsteroidal anti-inflammatory drugs), steroid injections (with caution), PCFOs and surgery (25-28).

Prescription PCFO summary statement

Through the use of biomechanical aids to decelerate the aberrations of excessive motion, it is possible to control motion and, thus, tendon function. Abnormalities such as excessive pronation, limb length discrepancy and structural imperfections often can contribute to the development of tendonitis.

Consensus statement

PCFOs are often useful and frequently medically indicated and essential in acute and long-term management of patients with tendonitis.

C. Posterior Tibial Tendon Dysfunction

ICD9 Code: 726.72

Etiology

Tibialis posterior tendon dysfunction (PTTD) is a collapsing pes planovalgus deformity, most often associated with acute or chronic trauma, degenerative changes, systemic diseases or structural aberrations of the lower extremity. Degeneration of the tendon is often associated with pes valgus, which places abnormal stress on the tendon. This stress may result in inflammation, microscopic tears, tendon hypertrophy and discontinuity. Functionally, an abnormal gliding mechanism develops and progresses, causing weakening of the tendon. As the function of the tendon is compromised, the ability of the tendon to support the medial arch and to decelerate the internal rotation of the tibia decreases. The rearfoot cannot invert, causing the gastrocnemius-soleus complex, and the antagonist muscles, to overload the talonavicular joint. Lack of resupination at the subtalar joint causes the midtarsal joint to be unstable as weight is transferred to the forefoot, resulting in increased pain and early crippling degenerative arthritis (29-31). PTTD is most commonly seen in middle-aged patients secondary to overuse from a long-standing pes valgus in combination with dysvascular changes, or in association with an os tibiale externum, which alters the pull of the tendon (32-34). It also may be seen with rheumatoid arthritis or as a result of a steroid injection (34, 35).

Associated diagnoses

Pes Plano Valgus

Adult Acquired Flatfoot

Posterior Tibial Tendonitis

Symptoms

Classically, PTTD presents with tenderness along the distal course of the tendon and at its insertion on the navicular tuberosity. Pain, along with failure of the heel to invert normally when performing a single limb heel raise (36), may be noted. Forefoot abduction may be pronounced when weight bearing. Asymmetrical flatfoot may be present, and weakness or pain may be present with manual muscle testing.

Treatment

Initially, conservative treatment may include taping and padding, shoe modifications, NSAIDs, physical therapy and PCFOs. Depending on the severity of the resultant deformity and the chronicity of the condition, surgical intervention, including tendon repair, tendon transfer or arthrodesis, may be necessary.

Prescription PCFO summary statement

Aggressive conservative therapy to attempt to control the rate and amount of pronatory force is often successful early (stage one or two) in treatment. Treatment consisting of molded ankle-foot orthoses or functional foot orthoses with medial posting may be indicated for elderly, sedentary patients or for patients at high risk for surgery due to concomitant medical problems (36). This conservative approach, including foot orthoses or ankle foot orthoses in addition to physical therapy, also may be attempted in younger patients initially, before considering surgical intervention (37). Younger patients tend to have a more flexible deformity and may have more success with complete restoration of function through orthotic management. Specifically, a custom orthosis, professionally prescribed, may improve symptoms by decreasing the need for the tibialis posterior tendon to stabilize the midtarsal joint (31, 32).

Consensus statement

PCFOs are medically indicated and essential in the management of the majority of patients with posterior tibial dysfunction.

D. Patellofemoral Pain Syndrome (also known as Runner's Knee, Chondromalacia Patella)

ICD9 Code: 717.7

Etiology

Patellofemoral Pain Syndrome is a common cause of knee pain and is attributed to an overuse injury combined with faulty control of forces across the knee. True chondromalacia patella (softening or pathological changes of the patellar cartilage) is not very common, but this term is frequently used to refer to any anterior knee pain associated with malalignment of the patella (38).

A more oblique pull of the quadriceps femoris will result in malalignment of the patella relative to the distal aspect of the femur. This increased obliquity may be a result of several factors. Often, the basis of the problem is not the knee but the foot (39, 40). Predisposing factors may include misalignment of the extensor mechanism of the knee, limb length inequality or abnormal pronation (41). Excessive subtalar joint pronation with internal tibial rotation may be a significant cause of the problem (42, 43).

Associated diagnoses

Chondromalacia Patella
Patellofemoral Dysfunction/Syndrome
Pronation Syndrome

Symptoms

Knee pain associated with this diagnosis is usually anterior or anterior-medial and often is poorly localized. Pain is usually increased with activity, especially with running and climbing or with descending stairs.

Treatment

Once structural knee deformity is ruled out, treatment often includes rest or modification in activity, physical therapy, including strengthening of the quadriceps and stretching, nonsteroidal anti-inflammatory drugs, shoe modifications and PCFOs (39, 44, 45).

Prescription PCFO summary statement

When patellofemoral dysfunction occurs due to biomechanical problems associated with excessive pronation, such as genu valgum, coxa varum, lack of tibial torsion and equinus, for example, PCFOs play an important role in the treatment (46, 47). Reducing the pronation of the foot decreases the amount of internal tibial rotation (48) and the valgus moment at the knee.

Consensus statement

Foot orthoses and particularly PCFOs are useful in the treatment of patellofemoral pain syndrome when the condition is associated with excessive pronation of the foot. In other cases, PCFOs may be adjunctive in the treatment of patellofemoral pain syndrome.

E. Iliotibial Band Syndrome

ICD9 Code: 728.89

Etiology

Iliotibial band syndrome is an inflammatory condition resulting from iliotibial band irritation at the level of the femoral epicondyle (49). The syndrome is most prevalent in runners and cyclists who perform repeated flexion and extension movements of the knee under stress. In cyclists, training errors and inappropriate bicycle fit can precipitate symptoms (55, 56). In runners, the cause can be excessively worn shoes, uneven training surfaces, inappropriate training routines, excessive foot pronation, contracture of the hip abductors, genu varum, internal tibial torsion and limb length discrepancy (50-53, 57). Excessive subtalar/midtarsal joint pronation coupled with internal tibial rotation pulls the iliotibial band antero-medially and increases the distance between Gerdy's tubercle and the lateral femoral epicondyle (54). This movement tightens the iliotibial band and produces friction across the femoral epicondyle (50, 57).

Associated diagnoses

Genu Varum
Lateral Hamstring Tendonitis
Lateral Collateral Ligament Injury

Symptoms

Pain may be located at the lateral aspect of the knee in the area of the lateral femoral epicondyle, at the lateral aspect of the knee joint itself and/or at the insertion of the iliotibial band on the tibia at Gerdy's tubercle. Pain may be unilateral, especially when associated with a limb length discrepancy or with running on a banked surface. Pain usually is aggravated by increased activity, especially running, with the associated increase in varus position to the ground. Pain also may be aggravated by ascending or descending stairs or by any type of jumping activity.

Treatment

Treatment must be individualized, based on the etiological factors. Rest from the offending activity, ice, neoprene compression sleeves, nonsteroidal anti-inflammatory drugs, injection therapy and physical therapy modalities (balanced stretching/strengthening program for quadriceps, hamstrings and hip abductors) are helpful in decreasing inflammation (54). Changes in running surfaces and efforts to address any significant limb length discrepancies also are important.

Prescription PCFO summary statement

PCFOs have generally been helpful in the treatment of this condition (58). For patients who are diagnosed as having excessive subtalar joint pronation, internal tibial torsion, genu varum or limb length discrepancy, a functional PCFO is used to minimize symptoms and to prevent recurrence of the syndrome.

Consensus statement

PCFOs are adjunctive for the treatment of iliotibial band syndrome.

F. Limb Length Discrepancy

ICD9 Code: 736.81, 755.30

Etiology

Limb length discrepancies can be categorized as structural or functional. A structural discrepancy is defined as an actual shortening of the skeletal system between the head of the femur and the mortise of the ankle joint. A functional limb length discrepancy is a result of altered mechanics in the lower limb. The structural limb length discrepancy may be a result of any number of causes - infection, denervation, fracture, cancer, or congenital defect, to name a few. Some etiologic factors associated with functional limb length discrepancy are pronation, functional hallux limitus and environmental factors (i.e., running on banked surfaces).

Associated diagnoses

Scoliosis

Symptoms

Symptoms are dependent on the amount of discrepancy, the method of compensation and the activity of the patient. Some common symptoms include lower back pain, lateral knee pain and unilateral pronatory problems.

Treatment

Treatment for limb length discrepancy will depend on the etiology of the deformity and on the adaptive changes that have occurred. Treatment may include PCFOs, heel lifts, shoe modifications and surgery (59, 60).

Prescription PCFO summary statement

Functional limb length discrepancy, which results from pronation, should be treated with PCFOs. Treatment of a structural limb length discrepancy may include shoe modifications or heel lifts in addition to PCFOs, aimed at allowing the foot to return to normal function.

Consensus statement

PCFOs are useful for the treatment of limb length discrepancy.

III. ARTHRITIDES

Definition

While arthritis may affect any joint, this discussion refers to conditions involving the joints of the lower extremity. Diagnoses included in this category are:

Inflammatory Arthritis

Osteoarthritis

A. Inflammatory Arthritis
Rheumatoid arthritis (714.0)
Psoriatic Arthritis (696.0)
Other Inflammatory Arthritides

Etiology

Inflammatory arthritis often results in marked muscular skeletal deformities which cause pain and loss of function. Common lower extremity deformities include genu valgum, genu varum, metatarsophalangeal joint dislocations, digital deformities and loss of bony architecture. Associated soft tissue conditions include tendonitis, bursitis, rheumatoid nodules, enthesopathy and soft tissue atrophy.

Associated diagnoses

Tendonitis (726.90, 726.71, 726.79, 729.72)

Bursitis (727.3, 726.71, 726.79)

Rheumatoid Nodules

Enthesopathy (726.39, 726.70)

Soft Tissue Atrophy

Connective Tissue Disorders

Symptoms

Pain and inflammation may be seen, especially in the joint area, which can be aggravated by biomechanical deformities. Loss of function in the joint area may occur due to joint destruction, pain and edema.

Treatment

PCFOs are commonly used in the management of patients with rheumatoid arthritis who complain of foot pain and/or deformity due to the combined effects of inflammation, bony destruction and connective tissue damage. In clinical trials, the use of functional posted foot orthoses provided significant symptomatic relief of pain in up to 74% of patients (61-63). The authors concluded that patients wearing functional posted orthoses were 73% less likely to demonstrate progression of hallux valgus deformity than those in the control group. The functional foot orthoses were designed primarily to limit pronation by holding the subtalar joint in a neutral position, thereby limiting the stresses on the forefoot that promote hallux valgus deformities (64, 65). In an additional clinical study, rigid functional PCFOs were demonstrated to have reduced foot pain, disability and functional limitation, and the study concluded that effective may be improved when used in early stages of the disease (66). Semi-rigid custom foot orthoses were shown to be more effective in treating patients with juvenile idiopathic arthritis compared to prefabricated off-the-shelf shoe inserts (67).

PCFOs also are widely used to attenuate pain associated with the pathomechanical effects of deformity. By increasing shock absorption, controlling aberrant motion, off loading excessive pressure areas, reducing shearing forces and accommodating existing deformities, progression of deformity decreases (68-71). One of those studies indicated particular improvement using a “metatarsal dome” (raise) (69).

Prescription PCFO summary statement

When clinically indicated, the use of PCFOs in the treatment of arthritides may alleviate a majority of the symptoms as well as diminish the progression of the biomechanical deformities (72) associated with arthritides. The literature indicates that although there is very little consensus as to the most appropriate type of orthosis, strong evidence is available that foot orthoses reduce pain and improve function (73).

Consensus statement

PCFOs are medically indicated and essential in the management of patients with lower extremity deformities and dysfunctions resulting from inflammatory arthritis who:

- a) manifest a degree of deformity or abnormal motion that precludes the use of an over-the-counter device;
or
- b) have failed prior attempts to utilize an over-the counter device.

B. Osteoarthritis

ICD Code: 715.9

Etiology

Osteoarthritis is related to abnormal mechanics of the joint and associated trauma. Trauma ranges from direct trauma to a specific joint, such as intra-articular fractures, to microtrauma that damages the joint over time, such as load imbalances secondary to soft tissue pathology (e.g., ligamentous laxity, muscle weakness) (74).

Associated diagnoses

Post-traumatic Arthritis (716.1)

Connective Tissue Disorders

Degenerative Joint Disease (715.9, 715.09)

Rheumatoid Arthritis (714.0)

Capsulitis (726.90)

Symptoms

Pain and inflammation may be seen along with loss of function. Structural deformities may be associated with this condition and further aggravate the pain and function of the joint area.

Treatment

Osteoarthritis is often treated with nonsteroidal anti-inflammatory drugs (NSAIDs) to minimize pain and inflammation. In acute situations, when a single joint is inflamed, a local steroid injection may be employed (76). Various forms of strapping, bracing and orthoses (75-80), designed to limit the stresses placed on certain joints, may be helpful (81). Shoe modifications also may be beneficial (82, 83).

Primary long-term goals in the treatment of osteoarthritis are relief of pain and prevention of the progression of deformity with its associated limitation of motion (78, 84). A study on the effectiveness of using PCFOs and NSAIDs for relief of pain in osteoarthritis showed a longer period of pain relief in patients using PCFOs and NSAIDs as compared to those using NSAID therapy alone (79, 82, 83, 85). In cases where a severe deformity has occurred due to progression of disease, surgery may be performed to realign and/or fuse joints to eliminate pain and improve functional capacity and ambulation. In such cases, PCFO therapy and bracing is indicated after surgery to prevent degenerative changes from occurring at corresponding joints (80, 81, 86).

Prescription PCFO summary statement

The purpose of PCFOs is to relieve pain, plantar stresses and biomechanical abnormalities from injured soft tissue, bony prominence, joint subluxation/dislocation, rheumatoid nodules, inflamed or chronic bursae, capsulitis, tenosynovitis and dermatological lesions secondary to deforming arthritis (84, 88-90). Appropriate PCFOs are beneficial in many cases of arthritis of the foot (91). In many cases, orthoses institute long-term relief (82, 83, 85). Associated pedal manifestations include capsulitis, nodules, tenosynovitis, etc.

Consensus statement

PCFOs are useful in the management of lower extremity deformity and dysfunction which are secondary to osteoarthritis.

IV. MECHANICALLY INDUCED PAIN AND DEFORMITIES

Definition

These diseases/deformities are believed to be caused by, or to have as a major contributing factor, abnormal biomechanical function. These diseases/deformities are progressive and only rarely resolve spontaneously. Diagnoses included in this category are:

Pes Cavus

Haglund's Deformity

Hammer Digit Syndrome (also known as Hammertoe, Mallet Toe, Overlapping Toe, Claw Toe)

Functional Hallux Limitus, Hallux Limitus and Hallux Rigidus

Plantar Fasciitis (also known as Heel Spur Syndrome)

Equinus

Sinus Tarsi Syndrome

Tailor's Bunion (also known as Bunionette)

Hallux Abducto-Valgus (also known as Hallux Valgus, Bunion)

Pes Planus

Metatarsalgia

Freiberg's Disease (also known as Freiberg's Infraction, Avascular Necrosis of Metatarsal Head)

Sesamoiditis

Morton's Neuroma (also known as Intermetatarsal Neuroma)

A. Pes Cavus

ICD Code: 754.71

Haglund's Deformity

ICD Code: 726.91

Etiology

Pes cavus is a general term used to identify a foot with a high arch structure. Haglund's deformity is a large bony prominence on the posterior lateral aspect of the calcaneus and is occasionally referred to as “pump bump”.

Biomechanical abnormalities which usually are associated with pes cavus, including uncompensated rearfoot varus, partially compensated rearfoot varus, compensated rearfoot varus and rigid forefoot valgus (32), are the most common etiologies of Haglund's deformity. All of these deformities usually involve increased frontal plane motion of the rearfoot during gait (92, 93). Any abnormality creating an inverted calcaneal stance position may cause Haglund's deformity.

Associated diagnoses

Retrocalcaneal Bursitis

Achilles Tendonitis or Enthesopathy

Symptoms

Symptoms of Haglund's deformity may include pain at the posterior lateral aspect of the calcaneus as well as associated erythema and edema. The primary source of irritation is the heel counter of the shoe.

Treatment

Initial management of these conditions should consist of treatment for the biomechanical entity. Treatment measures to control pain may include anti-inflammatory medications, padding, shoe modification, physical therapy, PCFOs and/or surgery (94).

Prescription PCFO summary statement

A PCFO significantly decreases the abnormal shearing forces noted at heel strike in mechanical abnormalities associated with these deformities (32, 95, 96). By decreasing the shearing forces, shoe irritation may be significantly reduced. In one study, the researchers concluded that custom foot orthoses, compared to sham orthoses, are effective in the treatment of cavus foot pain and its associated limitation in foot function (97).

Consensus statement

PCFOs are useful in the treatment of pes cavus and Haglund's deformity.

B. Hammer Digit Syndrome

ICD Codes: 735.4, 755.66, 735.8, 700

Etiology

Hammer digit syndrome encompasses a number of digital deformities, primarily contractures of the digits in the sagittal plane, and the hyperkeratoses frequently associated with these deformities, including heloma durum and heloma molle.

The etiology for hammer digit syndrome is generally a tendon imbalance. This tendon imbalance is most commonly secondary to abnormal biomechanical function or to an arthritic condition (98).

Associated Diagnoses

Hammertoe

Mallet toe

Overlapping toe

Claw toe

Symptoms

Most commonly, hyperkeratoses develop as a result of the hammertoe syndrome. With the hammertoe deformity, the most common lesion is a hyperkeratosis at the dorsum of the proximal interphalangeal joint, sometimes referred to as heloma durum deformity. The mallet toe deformity may be associated with hyperkeratoses at the dorsum of the distal interphalangeal joint and/or the distal aspect of the digit. Hyperkeratoses associated with hammer digit syndrome may also occur between the digits, sometimes referred to as heloma molle. In the presence of decreased vascular or neurological status, hammertoe syndrome may be the etiology for ulcerative pathology. In addition, the resultant plantar prominent metatarsal heads may cause plantar hyperkeratoses or ulcerations (99).

Treatment

Treatment may include palliation, padding and change in shoe gear, orthoses and/or surgery. According to one study, PCFOs reduced or delayed the need for surgery, in general, and in hallux valgus and hammertoe specifically. PCFO use adequately relieved the patient's chief complaints, especially with the conditions of hallux valgus and hammertoe (100). In a severely deformed foot, greater pain relief may be obtained by prescribing a dynamic PCFO in a properly fitted shoe (101-104).

Prescription PCFO summary statement

The purpose of PCFOs in the treatment of hammertoe syndrome is to decrease the abnormal biomechanical stresses that may be contributing to digital instability. In addition, PCFOs may help to unweight plantar prominent metatarsal heads.

Consensus statement

PCFOs are useful in the treatment of hammertoe deformity when the etiology is secondary to biomechanical imbalance and when the deformity results in symptomatic plantar prominent metatarsal heads.

C. Functional Hallux Limitus, Hallux Limitus and Hallux Rigidus

ICD Codes: 735.2

Etiology

This condition is defined as a degenerative arthrosis in the first metatarsophalangeal joint (MPJ) that leads to a decrease (limitus) and eventually absence (rigidus) of joint motion. The etiologies of this disease include, but are not limited to, metatarsus primus elevatus, 1st MPJ instability and spasm of the short flexors, excessive pronation and a long first metatarsal (32).

Associated diagnoses

Hallux Abductovalgus

Symptoms

The primary symptom of these conditions is a painful end range of dorsiflexion at the 1st MPJ. As the disease progresses, the entire range of motion may become painful. In addition, as a result of the decrease in the joint range of motion, a hyperkeratosis may develop plantar at the second metatarsal head and/or at the IPJ of the hallux. With subsequent hyperextension of the 1st MPJ, hallux nail changes may develop.

Treatment

Treatments other than orthoses may include NSAIDs, injection therapy, strapping, shoe modification, orthodigita and/or surgery (105-107).

Prescription PCFO summary statement

A correlation exists between the stage of progression and the appropriate PCFO intervention. PCFOs have been the mainstay treatment for functional hallux limitus. They provide external support to the medial longitudinal arch and restrict motion at the subtalar joint (107, 108). PCFO treatment for functional hallux limitus is directed at allowing the first metatarsal head to plantarflex, permitting normal hallux dorsiflexion, thus improving propulsion and gait. These PCFOs may incorporate a standard first ray cutout, a bi-directional first ray cutout, or a first metatarsal-cuneiform cutout (107, 108). Once osteoarthritis has developed, PCFO control is directed at limiting motion (see osteoarthritis section). In one small study, results suggest that PCFOs may gradually improve hallux dorsiflexion over time (109).

Consensus statement

PCFOs are medically indicated and essential for the management of the majority of patients with functional hallux limitus. For cases of structural hallux limitus or hallux rigidus, PCFOs are adjunctive. (See section on osteoarthritis.)

D. Plantar Fasciitis (also known as Heel Spur Syndrome)

ICD Code: 726.73/728.71

Etiology

Plantar fasciitis is an inflammation of the plantar fascia secondary to excessive tension and over use. An associated plantar heel spur may be present.

The most common etiology is a pronatory force with the resulting elongation of the foot placing excess tension on the plantar fascia. Secondary factors, such as obesity, may contribute to the pathogenesis.

Associated diagnoses

Calcaneal stress fracture

Calcaneal nerve entrapment

Seronegative arthropathies

Symptoms

The most common presentation of plantar fasciitis is plantar heel pain. The plantar arch along the course of the plantar fascia also may be painful. The heel pain tends to be most severe on arising in the morning or after being seated. In addition, as more time is spent weight bearing, the symptoms tend to increase.

Treatment

Treatment options include taping, strapping, injection therapy, Unna boot, walking fracture splint, cast to resist foot elongation, NSAIDs, roller-soled shoes, non-weight bearing using crutches, a weight loss program, reduced activity (activity restriction), physical therapy (e.g., ice, stretching, ultrasound, etc.), night splints, temporary foot orthoses, prefabricated foot orthoses (and modifications thereof) and/or PCFOs. In recalcitrant cases, surgery is an option.

Functional foot orthoses are efficacious in treating chronic plantar fascial problems (18, 133). If there is an associated pes cavus or excessive heel pronation, increased stresses and shear forces are present. Abnormal pronation can be corrected with a PCFO with an accommodation built beneath the area of maximum stress. Immobilization strapping can temporarily support the arch, control heel valgus and change the foot strike position. If this relieves pain, permanent PCFOs usually will be beneficial (110-113).

According to one study, 33 patients with treatment-resistant plantar fasciitis were fitted with UCBL orthoses. Successful results were obtained in 31 patients. In the two who did not improve, the problem was associated with systemic disease. These results not only proved that it was possible to unload the stress on the plantar aponeurosis in weight bearing, but that use of the orthoses constituted an ideal treatment for plantar fasciitis (114).

For those with flexible hypermobile feet, an orthosis is needed. Patients with a pronated foot require medial support of the foot and an anterior heel orthosis (115, 116).

Prescription PCFO summary statement

Because a mechanical etiology is responsible for plantar fasciitis, it follows that control of mechanical factors is an integral part of treatment of this disorder. Control of mechanical forces is achieved with rigid or semi-rigid functional orthoses (116-119). One review of available evidence at the time concluded that many studies recommend foot orthoses for the treatment of plantar fasciitis, but proof of efficacy of PCFOs over prefabricated orthoses has not been found (120). In another study, however, the research demonstrated improved compliance of the PCFOs as compared to the prefabricated foot orthoses (113). In the treatment of plantar fasciitis, the purpose of PCFOs is to reduce the elongating stresses on the plantar fascia. In addition, a randomized prospective trial demonstrated both foot orthoses and night splints are effective in the treatment of plantar fasciitis, but suggested that foot orthoses are the best choice for initial treatment (121).

Consensus statement

PCFOs are medically indicated and essential for the treatment of plantar fasciitis, especially in cases where temporary or over-the-counter arch supports provide inadequate relief.

E. Equinus

ICD Code: 736.71, 754.71

Etiology

Equinus deformity generally refers to lack of ankle joint dorsiflexion (122, 123).

Some etiologies for equinus are neuromuscular disease, congenital or acquired short gastrocnemius/gastro-soleus/soleus muscle complex, osseous deformities, biomechanical faults, and degenerative joint changes within the ankle joint. Some of the compensation mechanisms for equinus include early heel lift, toe walking, subtalar/midtarsal joint pronation and genu recurvatum (124). The mechanism of compensation is highly dependent on the severity and the etiology of the deformity. The excessive compensatory subtalar pronation secondary to equinus may lead to some of the most significant of pronatory pathologies, including hammer digit syndrome and first metatarsal phalangeal joint pathology.

Symptoms

Equinus may present as a variety of symptoms, depending on the etiology of the condition and the severity of the deformity. Bouncy gait, knee hyperextension and severe hyperpronation are all common symptoms of equinus. Plantar metatarsal head hyperkeratoses also may be present (99). When the etiology of the equinus is ankle joint arthritis, pain within the joint may be present. When the etiology of the equinus is a tight gastrocnemius or Achilles tendon, equinus may present itself as tendonitis or enthesopathy.

Treatment

Like the mechanisms for compensation, the treatment of equinus is highly dependent on the severity and etiology of the deformity. The spectrum of treatments for equinus includes heel lifts, shoe modifications, foot orthoses, braces, physical therapy, surgery and similar treatments (125, 126).

Prescription PCFO summary statement

The use of PCFOs is primarily indicated when the compensation for the equinus involves excessive subtalar/midtarsal joint pronation. When prescribing foot orthoses in a patient with equinus, the equinus must be accommodated. Functional foot orthoses may be used to effectively treat most, but not all abnormalities of the lower extremity that cause abnormal function of the foot. One such abnormality resistant to treatment with functional foot orthoses is compensated talipes equinus (127).

Consensus statement

PCFOs are useful in the treatment of equinus deformities that result in biomechanical deformity or compensatory symptoms. In addition, PCFOs are adjunctive in the treatment of equinus as a result of a variety of etiologies.

F. Sinus Tarsi Syndrome

ICD Code: 355.5

Etiology

The specific pathology of sinus tarsi syndrome is unknown; however, this syndrome has been attributed to ligamentous damage (128), fat pad hypertrophy within the sinus tarsi (129), peroneal muscle abnormalities (130), anterior talofibular ligament rupture (131), peroneal or intermediate cutaneous nerve pathology (131, 132), degenerative joint disease (131), and cyst formation (131). Excessive pronation, resulting in calcaneal eversion, may cause lateral column compression associated with sinus tarsi syndrome (32). Forefoot varus, forefoot supinatus, and compensated gastrocnemius equinus foot types also are associated with this condition (32). Ligamentous injury may be primary in most cases of sinus tarsi syndrome and may result in synovitis, extensor digitorum brevis myositis, peroneal tenosynovitis or neuritis (33). Other etiologies include rheumatoid arthritis, ankylosing spondylitis, osteoarthritis, gout, tarsal coalition, subtalar instability and soft tissue mass (33).

Associated diagnoses

Pronation syndrome

Osteoarthritis

Symptoms

Sinus tarsi syndrome is a complex of symptoms including diffuse pain over the lateral aspect of the foot, pronounced tenderness over the opening of the sinus tarsi upon inversion of the calcaneus and adduction of the forefoot, and a subjective feeling of rearfoot instability. Classically, it presents as chronic pain which is increased by ambulation, particularly over uneven surfaces, and which is relieved by rest.

Treatment

Conservatively, strapping may relieve symptoms by limiting subtalar joint motion. Immobilization in a below knee cast is another option (33). Depending on the etiology and response to prior care, other treatments may include orthotic therapy, injection therapy, physical therapy and/or surgery.

Prescription PCFO summary statement

For long-term conservative treatment, especially when the etiology is biomechanical, orthotic control may be primary (134). Biomechanical evaluation is especially important when presented with diffuse ankle pain in the absence of trauma. A functional foot orthosis, which controls pronation sufficiently to allow the midtarsal joint to lock, the calcaneus to function in a vertical position, and the subtalar joint to function in a neutral position in midstance, may relieve compression in the sinus tarsi region, alleviating symptoms (33, 135).

Consensus statement

PCFOs are medically indicated and essential in the management of the majority of the patients with sinus tarsi syndrome, especially in the absence of traumatic etiology.

G. Tailor's Bunion (also known as Bunionette)

ICD9 Code: 727.1

Etiology

Tailor's bunion is a fifth ray deformity involving a lateral or dorso-lateral prominence of the fifth metatarsal head. Although tailor's bunion may have numerous etiologies, biomechanical causes are the most common (136). Such biomechanical deformities as partially or uncompensated forefoot or rearfoot varus not only cause excessive weight bearing pressure laterally, but also force pronation of the fifth ray, causing the head of the fifth metatarsal to become more prominent both dorsally and laterally.

Associated diagnoses

Distal interphalangeal joint dysfunction

Splay foot

Symptoms

Frequently, a patient with a tailor's bunion will complain of shoe irritation at the fifth metatarsal head either

laterally or dorsolaterally. Hyperkeratosis or bursitis may occur in this area as well. Due to a medial deviation of the fifth digit often associated with tailor's bunion, an associated digital deformity such as *digitus quinti varus* also may be present, with or without an associated painful hyperkeratosis.

Treatment

Treatment for tailor's bunion is directed at symptomatic relief, and may include accommodative padding, shoe modification, nonsteroidal anti-inflammatory drugs, PCFOs and surgery (136, 137).

Prescription PCFO summary statement

Because the etiology of a tailor's bunion is most commonly mechanical, treating this deformity mechanically with PCFOs often is indicated, even when the deformity is mild. Functional and accommodative devices will help control abnormal foot motion and alleviate pressure points (138).

Consensus statement

PCFOs are useful for the treatment of the symptoms of tailor's bunion deformity, especially when the deformity is of a mechanical etiology.

H. Hallux Abducto-valgus (also known as hallux valgus, bunion)

ICD9 Code: 735.0

Etiology

Hallux abducto-valgus (HAV) is a first ray deformity in which the first metatarsal has deviated toward the midline of the body, resulting in a medially prominent first metatarsal head. The hallux is abducted at the metatarsophalangeal joint and often rotates in a valgus direction.

Hallux abducto-valgus has multiple etiologies, including hereditary factors, trauma, neuromuscular and arthritic diseases. Hypermobility of the first ray is a primary etiology of hallux abducto-valgus deformity. Hypermobility of the first ray results from an unstable midtarsal joint during propulsion (139), which may occur as a result of excessive pronation.

Associated diagnoses

Hallux limitus

Hammer digit syndrome

Symptoms

Among other factors, symptoms vary based on the degree of deformity, the integrity of the joint and the choice of shoe gear. "Bump" pain over the medial or dorsomedial aspect of the first metatarsal head is a common complaint. Related to the first ray hypermobility, hyperkeratosis at the plantar aspect of the second metatarsal head or the plantar or plantar medial aspect of the hallux interphalangeal joint are frequent symptoms of hallux abducto-valgus. As the deformity progresses, arthritis-like symptoms may occur within the first metatarsophalangeal joint.

Treatment

Various treatments for hallux abducto-valgus include accommodative padding, changes in shoe gear, nonsteroidal anti-inflammatory drugs, PCFOs and surgery.

Prescription PCFO summary statement

PCFOs restore more normal first ray function, in part by improving peroneus longus function (144, 140). In some cases, the severity of the hallux abducto-valgus deformity can either be decreased or its development retarded by treatment with PCFOs (139, 141). Postoperatively, the use of functional foot orthoses is beneficial in restoring more normal function and in reducing the potential for recurrence (32, 142).

Consensus statement

PCFOs are adjunctive in reducing the symptoms associated with hallux abducto-valgus associated with a biomechanical etiology.

I. Pes Planus

ICD9 Code: 734, 754.61, 754.69, 268.1

Etiology

In general, the pes planus deformities are those associated with loss of normal arch height. This includes such biomechanical deformities as forefoot varus, forefoot supinatus, pronation resulting from equinus and pronation resulting from other more proximal pathologies (143). Non-biomechanical etiologies may include loss of muscle function, hereditary factors and trauma (144). In general, a primary etiology or cause for the pes planus should be investigated and the condition should then be treated accordingly.

Associated diagnoses

Adult Acquired Flatfoot

Ligamentous laxity

Tarsal coalition

Symptoms

Symptomatology associated with pes planus is generally specific to the etiology of the condition. A flexible flatfoot may be more susceptible to such conditions as plantar fasciitis, posterior tibial tendonitis, halux limitus/rigidus, hammer digit syndrome and hallux abducto-valgus. In addition, leg fatigue, knee pain, midfoot arthritis and shin splint-type symptoms may all be associated with pes planus.

Treatment

Treatment should address the symptoms as well as the pes planus when the symptoms are a result of the pes planus. Treatment for the pes planus may include taping and padding, shoe gear modifications, PCFOs and physical therapy.

Prescription PCFO summary statement

When asymptomatic, pes planus may not require any treatment. When the condition causes symptoms, PCFOs are often the treatment of choice. By preventing further collapse of the medial longitudinal arch, tension and force are decreased at the surrounding tendons and soft tissues. This may be especially true in such associated symptoms as plantar fasciitis, posterior tibial tendonitis and shin splints (144-146).

Consensus statement

PCFOs are useful in cases of symptomatic pes planus.

J. Metatarsalgia

ICD9 code: 726.70

Etiology

Metatarsalgia is a generalized term suggesting localized pain at the level of the metatarsophalangeal joint, with inflammation of the joint and/or periarticular structures (54). Metatarsalgia can be categorized as *primary* or *secondary*.

Primary metatarsalgia may be:

- structural (metatarsal length/declination abnormalities, fat pad atrophy, etc.),
- functional (muscle imbalance leading to digital deformities and equinus deformities),
- traumatic (caused by overuse), or
- iatrogenic (transfer lesions) (54).

Secondary metatarsalgia results from systemic diseases, such as rheumatoid arthritis, gout, seronegative arthritides, avascular necrosis and neuromuscular diseases (54).

Associated diagnoses

Freiberg's Disease - (also known as Freiberg's Infracion, avascular necrosis of metatarsal head) ICD9 Code: 732.5, 732.7, 733.49

Metatarsophalangeal joint capsulitis

Symptoms

Pain in the area of the forefoot, particularly in the area of the metatarsal heads, is the predominant complaint. Depending on the specific etiology of the complaint, edema also may be present. The pain is generally increased with increased weight bearing and activity.

Treatment

Nonsteroidal anti-inflammatory drugs, the application of ice, range of motion exercises, decreased activity, shoe modifications, steroid injections, PCFOs and immobilization may all be used for the treatment of metatarsalgia. When the condition is a result of significant deformity or soft tissue defect, surgery also may be indicated. When treating secondary metatarsalgia, the primary disease state also should be addressed when appropriate.

Prescription PCFO summary statement

The use of accommodative or functional PCFOs is appropriate in almost all *primary* or *secondary* categories. PCFOs provide added cushioning and decrease abnormal foot forces (147). They may not be appropriate in traumatic *primary* metatarsalgia, unless there is a bony deformity, in which case padded accommodative orthoses would be an adjunctive treatment (54, 148). Many forms of metatarsalgia are a result of structural or biomechanical abnormalities. These types of metatarsalgia are often best treated with PCFOs (149).

Consensus statement

PCFOs are medically indicated and essential in the management of patients with primary metatarsalgia. For cases of secondary metatarsalgia, see the section on the related primary cause.

K. Sesamoiditis

ICD9 Code: 733.99

Etiology

Sesamoiditis is inflammation of the hallucal sesamoid bone(s) and associated soft tissue structures (148, 170). Sesamoiditis is due to repetitive microtrauma of the first ray, most often resulting from activities that place excessive weight on the forefoot (e.g., ballet, running, stair climbing, aerobic dance) (54).

Predisposing etiologic factors include a plantar-flexed first metatarsal, enlarged or multiple sesamoids, acute or repetitive trauma and inappropriate shoes. Other mechanical conditions associated with sesamoiditis include uncompensated rearfoot varus, partially compensated rearfoot varus, partially compensated forefoot varus, fully compensated forefoot varus, forefoot supinatus, flexible forefoot valgus, rigid forefoot valgus, compensated congenital gastrocnemius equinus and compensated transverse plane deformity (32, 177).

Associated diagnoses

Sesamoid stress fracture

Avascular necrosis of the sesamoid

Turf toe

Symptoms

The patient usually will complain of pain in the ball of the foot, especially with increased activity or increased weight bearing on the forefoot. In addition, any passive or active dorsiflexion may increase the pain. When caused by a plantar-flexed first ray, a sub first metatarsal head hyperkeratosis also may be present.

Treatment

The treatment plan should be based on the patient's level of pain and disability. Treatment choices consist of shoe modifications, negative heel shoes to unweight the forefoot, accommodative padding, nonsteroidal anti-inflammatory drugs, activity restrictions, physical therapy, accommodative or functional PCFOs, injection therapy, non-weight bearing and immobilization.

Prescription PCFO summary statement

In cases where abnormal foot function places increased weight bearing on the first metatarsal head during the midstance and propulsive phases of gait, functional PCFOs will reduce symptoms in that area. In cases where initial treatment with functional PCFOs is ineffective, a flexible forefoot extension that off weights the sesamoid apparatus (32) may be used. In cases of rigid deformity or in insensate patients, orthoses that accommodate the first metatarsal head are indicated (150).

Consensus statement

PCFOs are useful for the treatment of sesamoiditis.

L. Morton's Neuroma (also known as Intermetatarsal Neuroma)

ICD9 Code: 335.6

Etiology

Morton's neuroma is a benign, reactive proliferation of axonal elements, Schwann cells, fibroblasts and perineural cells that occurs from the proximal end of a nerve that has been traumatized, occurring most frequently at the third intermetatarsal space as a single lesion in one foot (148, 149).

The etiology of Morton's neuroma is generally considered to be mechanical. Histological studies leave little doubt that the syndrome is indeed a mechanical entrapment neuropathy. Based on common observation, the majority of the intermetatarsal space neuromas occur in the pronated foot, where there are not only excessive stretch forces imposed on the interdigital nerves but also compressive and shear forces from the adjacent metatarsal heads (152). Occupations that require repetitive hyperextension can result in the development of intermetatarsal space neuroma regardless of foot type. Pointed toe, narrow or high-heeled shoes can further add compressive forces that favor the development of neuromas regardless of foot type (153, 154).

Associated diagnoses

Tarsal Tunnel Syndrome

Symptoms

Morton's neuroma may be associated with a variety of symptoms. Complaints of numbness in the ball of the foot, sharp shooting pains to the digits and pain in the ball of the foot are all common. In addition, the pain may be episodic, lasting from a few minutes to several hours. The symptoms are most often associated with tight shoes; patients may relate that removing the shoe and massaging the foot may provide relief. Occasionally, the symptoms are very nonspecific, making diagnosis more difficult. Although more associated with tight shoe gear, Morton's neuroma is not uncommon in runners.

Treatment

Wider shoes with adequate toe space along with good arch support, metatarsal pads and injection therapy are all recommended initial treatments (54, 155). Multiple treatments including PCFOs, injection therapy and surgical excision have been used with varying degrees of success (151, 155, 156).

Prescription PCFO summary statement

Biomechanical treatment of Morton's neuroma is directed at limiting excess subtalar joint pronation and hypermobility of the forefoot (54, 153, 157). If padding and strapping provide good relief, then neutral position orthoses most likely will be successful (153).

Consensus statement

PCFOs are adjunctive in the treatment of Morton's neuroma.

V. PEDIATRIC CONDITIONS

Definition

The pediatric diagnoses refer to conditions that are usually recognized before adulthood. These diagnoses, however, also may pertain to treatment of residual deformity or long-term sequelae in the adult. Diagnoses included in this category are:

Calcaneal Apophysitis (also known as Sever's disease)

Genu Varum and Genu Valgum

Tarsal Coalition

Metatarsus Adductus

A. Calcaneal Apophysitis (also known as Sever's disease)

ICD9 Code: 732.5

Etiology

Calcaneal apophysitis is an inflammation of the open epiphysis of the calcaneus, seen in physically active children. The age range in which the condition occurs varies, but it is most often seen between the ages of 8 and 15 (158). Although the condition is more common in young males, it is being seen more often in

females as a result of their increased participation in sports activities. The inflammation occurs due to traction of the Achilles tendon and plantar fascia (54).

The most common etiological factor contributing to calcaneal apophysitis is increased physical activity (158). Other contributing factors may include:

- equinus deformity
- partially compensated forefoot varus
- fully compensated forefoot varus
- forefoot supinatus
- flexible forefoot valgus
- compensated transverse plane deformities (32).

Associated diagnoses

Pes Planus

Plantar Fasciitis

Symptoms

The child usually will complain of heel pain located at the posterior inferior border of the calcaneus, although the pain also may be inferior and/or posterior in the heel area. The condition may occur unilaterally or bilaterally. Symptoms are increased by increased activity, especially running and jumping. Rest usually relieves the pain.

Treatment

Treatment of calcaneal apophysitis initially involves limiting activity, using NSAIDs and applying ice. Long-term treatment, if necessary, may include heel lifts, heel pads, heel cups, NSAIDs, stretching exercises and PCFOs to control abnormal foot function (32, 54, 158, 159). In resistant cases or in situations where the child will not comply with decreased activity, cast immobilization also may be indicated.

Prescription PCFO summary statement

When the symptoms are persistent and associated with biomechanical abnormalities, the use of PCFOs is indicated. By decreasing the abnormal forces applied to the calcaneal apophysis by decreasing the tension on the plantar fascia and the Achilles tendon, the condition may resolve.

Consensus statement

PCFOs are useful or adjunctive for the treatment of calcaneal apophysitis.

B. Genu Varum and Genu Valgum

ICD9 Code: 736.42, 755.64, 268.1

Etiology

Genu varum and genu valgum are frontal plane deformities referring to the position of the leg relative to the thigh. In genu varum, the leg is adducted relative to the thigh, giving the lower extremity a “bow-legged” appearance. In genu valgum, the leg is abducted relative to the thigh, giving the lower extremity a “knock-kneed” appearance.

Both conditions have numerous etiologies. At certain ages, the deformity may be considered normal; genu varum is normally present until about age two and genu valgum may then follow up to age six, and may reappear in early adolescence. The etiology may be congenital, hereditary, traumatic, degenerative or metabolic (160, 161).

In genu varum, the deformity causes the lower extremity to be inverted to the ground, requiring greater abnormal subtalar joint pronation for compensation. In genu valgum, the center of gravity is more medial, which results in a propensity for the subtalar joint to maximally pronate.

Associated diagnoses

Tibial Varum

Rearfoot Varus

Tibial Torsion (lack of external tibial torsion)

Symptoms

Tibial varum and tibial valgum are frequently asymptomatic. In the younger age group, tibial varum may be associated with lack of external tibial torsion, resulting in an in-toeing problem.

Tripping may be the primary symptom in this situation. In the older age group, symptoms are usually as a result of the excessive pronation required to compensate for the frontal plane deformity. In this case, symptoms may include leg/foot fatigue, arch pain and knee pain.

Treatment

Treatment of genu varum and genu valgum is dependent on the age of the patient and the etiology of the deformity. Treatment may include casting, bracing, foot orthoses, nonsteroidal anti-inflammatory drugs and surgery.

Prescription PCFO summary statement

When symptoms are associated with excessive pronation or compensation, PCFOs may alleviate the symptoms (161, 162).

Consensus statement

PCFOs are useful in the treatment of genu varum and genu valgum when the frontal plane leg position is causing pronatory symptomatology.

C. Tarsal Coalition

ICD9 Code: 755.67

Etiology

A tarsal coalition is an abnormal union between two or more tarsal bones which may be fibrous, cartilaginous or osseous. The etiology is unknown, but several theories have been proposed including congenital (i.e., undifferentiated mesenchymal tissue) and acquired (i.e., trauma) (163, 164).

Associated diagnoses

Rigid Flatfoot

Peroneal Spastic Flatfoot

Symptoms

The age of onset of symptoms frequently depends on the location of the coalition. Symptoms may include lateral ankle and leg pain associated with peroneal spasm or shortening. Pain may occur at the site of the coalition, with gait requiring motion in the area and the coalition resisting the motion. Arch pain may be present as a result of the flatfoot deformity. The patient may complain of frequent “ankle sprains” in the presence of subtalar coalition as the coalition is continuously broken or traumatized.

Treatment

Treatment of a tarsal coalition is highly variable, depending upon the location of the coalition, the age of the patient, the severity of the symptoms, and the presence of any adaptive changes in the surrounding joints. Treatment may include limitation of activity, cast immobilization, shoe modifications, nonsteroidal anti-inflammatory drugs, PCFOs and surgery (164, 165).

Prescription PCFO summary statement

PCFOs can be helpful in limiting motion at the involved joints to aid in decreasing pain and spasm (166). Once initial symptomatology has been controlled, a rigid functional PCFO can continue to aid in the reduction of symptoms and to facilitate return to activity (167). PCFOs should generally be a first line of treatment for tarsal coalitions once acute symptoms and spasm have been resolved or lessened. The condition should be treated initially with PCFOs, but surgical correction may be necessary (165, 167). In addition, PCFOs may be indicated post-operatively following surgical treatment to minimize arthritic changes in the surrounding joints.

Consensus statement

PCFOs are useful in the treatment of tarsal coalitions.

D. Metatarsus Adductus

ICD9 Code: 736.70, 754.52, 754.53

Etiology

Metatarsus adductus is a transverse plane foot deformity in which the metatarsals are deviated medially or adducted. The etiology is usually congenital or hereditary, although other etiologies have been identified.

Associated diagnoses

Talipes Equinovarus (clubfoot)
Skew Foot

Symptoms

In the very young infant, no symptoms are present, but the parent relates concern over the appearance of the foot. As the child learns to walk, tripping is a frequent complaint. In the older child, difficulty in fitting shoes, pronatory symptoms as a result of compensation for the deformity, and fifth metatarsal base pressure may all occur.

Treatment

Metatarsus adductus is best treated as soon as the deformity is recognized. The initial treatment may include taping, casting, bracing or surgery, depending on the age of the child and the severity of the deformity (168).

Prescription PCFO summary statement

In an older child, gait plate types of PCFOs may be prescribed to encourage abduction during the stance phase of the gait cycle, but care should be taken to avoid causing increased subtalar pronation. In an adult, treatment is aimed at prevention of pronatory compensation for the metatarsus adductus deformity, rather than at the deformity itself. With residual metatarsus adductus after treatment, rigid functional foot orthoses may be used to lessen the likelihood of more significant or severe forms of compensation (167, 169).

Consensus Statement

PCFOs are useful or adjunctive for the treatment of symptoms associated with metatarsus adductus.

VI. SENSORY NEUROPATHIES

Definition

This category of diagnoses involves neuropathies either of systemic or local etiology. Diagnoses included in this category are:

Peripheral Neuropathy (also includes neuropathic ulcers)
Charcot Neuroarthropathy (also known as Charcot Foot)
Tarsal Tunnel Syndrome

A. Peripheral Neuropathy (also includes neuropathic ulcers)

ICD9 Code: 250.6, 250.8

Etiology

Peripheral neuropathy is common in patients with diabetes mellitus, and is seen in other systemic disease entities such as alcoholism, nutritional deficit and tabes dorsalis. The neuropathy may affect the autonomic, motor and sensory pathways, all of which present symptoms in the lower extremity. Loss of protective sensation results in the patient continuing to ambulate on an injured foot. Autonomic neuropathy affects the integrity of the skin itself, and motor neuropathy alters the normal biomechanics of the foot, causing less controlled loading of the foot.

Associated diagnoses

Charcot Neuroarthropathy
Diabetic Neuropathy
Mal Perforans Ulcer
Radiculopathy

Symptoms

Peripheral neuropathy may be associated with a wide variety of symptoms ranging from extreme and constant pain to complete loss of sensation. Initially, the condition may involve pain, commonly burning or radiating in nature, in a localized area or along a specific nerve root. This pain may be constant or episodic in nature. If the condition progresses, more areas may become involved, and episodes may occur more frequently or last longer. As the nerve(s) continues to deteriorate, the pain may be replaced with numbness.

Treatment

Treatment of peripheral neuropathy includes good management of the underlying systemic cause, patient education on proper foot care, appropriate shoes, regularly scheduled palliative care, and PCFOs. When the neuropathy is painful, the condition can be extremely resistant to treatment. Many medications have been advocated with varying results.

Prescription PCFO summary statement

The use of PCFOs in the diabetic patient reduces foot ulceration by increasing total contact area (171, 172). In addition, conservative care, including orthoses, may help to maintain balance and prevent falls (175, 179). PCFOs also are recommended post-operatively for diabetic patients (173, 174, 176, 177).

Research indicates there is a 30%-40% reduction of plantar pressure at the first metatarsal head and medial heel when a properly fitting PCFO is worn (171). In addition, the total contact area of the foot may be increased 5%-10% with a PCFO coupled with an extra depth shoe (178).

Consensus statement

PCFOs are medically indicated and essential in treating and preventing conditions associated with diabetic neuropathy in the majority of patients.

B. Charcot Neuroarthropathy (also known as Charcot Foot)

ICD9 Code: 094.0

Etiology

Charcot neuroarthropathy is a destructive process of the joints of the midfoot and rearfoot, most commonly seen in diabetic patients. Other diseases associated with Charcot neuroarthropathy include tabes dorsalis, alcoholic neuropathy and leprosy.

Initially, this disease process was thought to be associated solely with decreased sensory neuropathy, with unperceived injury leading to joint destruction. Because most patients have associated bounding pulses, a more recent theory associates the joint destruction with the autonomic neuropathy. The arterio-venous shunting which results in a localized hyperemia may weaken the underlying osseous structure, increasing susceptibility to neuropathic fracture dislocations (180).

Associated diagnoses

Diabetic Neuropathy

Symptoms

Because of the associated sensory neuropathy, this condition is usually painless. Symptoms are initially edema and erythema, localized to the affected part. The erythema and edema may be very significant, and cellulitis with associated osteomyelitis becomes a very important differential diagnosis. As the condition progresses, mild to severe deformity may result (181).

Treatment

Treatment for Charcot neuroarthropathy depends on the stage of the disease. Initially, total avoidance of weight bearing may be indicated. Immobilization, custom molded shoes, shoe modifications, PCFOs and surgery may all be indicated, depending upon the stage of the disease and the severity of the residual deformity (183, 184).

Following fusion procedures of the rearfoot, orthoses, braces and shoe modifications should be considered in an attempt to protect the arthrodesis site, as well as the more proximal joints, from potential Charcot breakdown (180).

Prescription PCFO summary statement

PCFOs should be selected that support and accommodate whatever deformity may be present without irritating fragile neuropathic skin. For Charcot joint disease involving the metatarsophalangeal joints, PCFOs that both cushion and reduce the pressure on the involved metatarsal head are indicated. For midfoot deformity, the choice and design of orthoses should accomplish adequate cushioning, dispersion of forces more evenly across the entire foot, and support to resist excessive pronation (180). According to one study, more than 50% of the patients with midfoot level Charcot arthropathy can be managed successfully without surgery using custom foot orthoses and commercially available therapeutic foot wear for the long-term treatment (183).

Consensus statement

PCFOs are medically indicated and essential in the management of the majority of patients with residual Charcot foot deformities.

C. Tarsal Tunnel Syndrome

ICD9 Code: 355.5, 355.8

Etiology

Tarsal tunnel syndrome is a tibial nerve entrapment at the fibro-osseous tarsal tunnel where the nerve runs deep to the lacinate ligament (185).

There are many possible etiologies of tarsal tunnel syndrome, but frequently a specific etiology may not be identified. Etiological factors that induce tibial nerve compression with resultant ischemia and demyelination include:

- excessive subtalar joint pronation
- accessory or hypertrophic abductor hallucis muscle belly
- complications associated with systemic diseases such as rheumatoid arthritis, ankylosing spondylitis, diabetes mellitus and myxedema (185).

Associated diagnoses

Morton's Neuroma

Peripheral Neuropathy

Radiculopathy

Symptoms

Symptoms usually involve sharp shooting or burning type pain localized to the medial ankle or arch area. The symptoms may be highly variable, however. Occasionally, the pain may be localized to the digits making differentiation from a Morton's neuroma difficult. The symptoms may be constant or episodic in nature. Activity may aggravate the condition or symptoms may occur off-weight bearing, even during the night.

Treatment

Treatment of tarsal tunnel syndrome includes rest or modification of activity, nonsteroidal anti-inflammatory medications, injection therapy, physical therapy, shoe modifications, PCFOs and surgery.

Prescription PCFO summary statement

PCFOs are useful to hold the foot in neutral position, thus reducing pronation forces that may stress the tarsal tunnel compartment (88). Based on electrodiagnostic studies on runners, treatment with PCFOs and cessation of running activity decreased the symptoms (186). Conservative therapy for tarsal tunnel syndrome has traditionally revolved around the use of nonsteroidal anti-inflammatory drugs and control of pronatory forces (186).

Consensus statement

PCFOs are useful for the treatment of tarsal tunnel syndrome.

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Appendix A

Gait Analysis Form

General:

Angle of Gait R _____ L _____
Base of Gait R _____ L _____

Stride length _____

Speed _____

Comments:

Gait Cycle: please include any abnormal time periods, positions or motions in each of the phases:

Contact:

Midstance:

Propulsion:

Swing:

Comments:

Postural considerations:

Head:

Shoulders:

Arm swing:

Hips/pelvis:

Comments:

Appendix B

Billing

At this time, there is no standardization of the process for billing PCFOs, nor are there codes that are standard throughout the country. However, in billing for this type of service, the following should be considered:

- range of motion study
- muscle testing (when appropriate)
- gait analysis
- appropriate foot and ankle imaging (casting)
- fabrication of the orthoses (shell materials, posting, modifications, etc.)
- fitting and dispensing
- follow up visits and adjustments as dictated by the type of device and disease state

Current CPT codes do not provide sufficient flexibility to account for all evaluations and various types of orthoses. Any CPT codes listed in these guidelines are for reference purposes only. Contact the patient's insurance carrier to determine the appropriate codes to use in specific cases.

— Notes —

