

## Pes Cavus

### Indexing Metadata/Description

- › **Title/condition:** Pes Cavus
- › **Synonyms:** Claw-toe foot; high-arched foot; cavus foot
- › **Anatomical location/body part affected**
  - The foot is divided into 3 sections
    - Hindfoot: composed of the talus and calcaneus
    - Midfoot: composed of the navicular, cuboid, and 3 cuneiform bones
    - Forefoot: composed of the 5 metatarsals and 5 phalanges
  - The foot also has 3 arches
    - Longitudinal arches
      - Medial longitudinal arch
      - Lateral longitudinal arch
    - Transverse arch
- › **Area(s) of specialty:** Orthopedics, Pediatrics, Neurological Rehabilitation
- › **Description**
  - Pes cavus is an abnormally high medial longitudinal arch that does not reduce while weight-bearing due to increased rigidity. This characteristic results in a decreased ability to absorb ground reaction forces, and thus is associated with gait deficits and foot pain.<sup>(1)</sup> It is normally associated with neurological conditions<sup>(10)</sup>
  - It is estimated that 8–15% of the population has pes cavus<sup>(11)</sup>
  - Although pes planus, or flat feet, tends to garner more attention as a significant lower extremity condition, researchers have reported that 60% of individuals with pes cavus will have some chronic foot pain in their lifetime. Due to the abnormal foot pressure distribution perpetuated by the high-arch foot type, pes cavus is associated with significant disability<sup>(1)</sup>
  - Measures of a cavus foot include arch height at 50% of the foot length, arch height ratio, arch rigidity index, and arch drop. See *Special Tests* in Examination for more detail
  - There are 3 main types of pes cavus<sup>(1)</sup>
    - Pes cavovarus<sup>(12)</sup>
      - Most common type of pes cavus
      - Usually seen in neurologic and idiopathic disorders
      - Characterized by rearfoot varus, plantarflexed first ray, and claw-toe deformity
    - Pes calcaneovarus
      - Usually due to poliomyelitis
      - Characterized by calcaneal dorsiflexion with forefoot plantar flexion
    - “Pure” pes cavus
      - Characterized by a normally positioned calcaneus with a plantarflexed forefoot
  - Foot mechanics during gait
    - During the stance phase of the gait cycle, the foot dramatically changes shape. When the foot first hits the ground, the forefoot normally medially rotates (pronation) and the midfoot joints “unlock” to enable the foot to absorb shock. Toward the end of the stance phase, the foot and lower leg muscles induce an elevation of the arch

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(supination) and cause the midfoot joints to “lock.” This creates a rigid lever with

which the posterior lower leg muscles can propel the leg forward<sup>(2)</sup>

–In persons with pes cavus, the midfoot remains locked with an elevated arch throughout the stance phase. This results in reduced shock absorbance and an increased risk of metatarsalgia, stress fractures, plantar fasciitis, and ankle instability<sup>(2)</sup>

› **ICD-10 codes**

- Q66.7 pes cavus

(ICD codes are provided for the reader’s reference, not for billing purposes)

› **Reimbursement:** Although custom orthoses are a typical treatment intervention for pes cavus, the use of custom orthoses is limited due to practitioner inexperience, as well as patient cost and limited insurance reimbursement. Reimbursement for physical therapy will depend on insurance contract coverage

› **Presentation/signs and symptoms**

- Pes cavus commonly has the following characteristics
  - Elevated medial longitudinal arch<sup>(10)</sup>
  - Plantarflexed first ray<sup>(10)</sup>
  - Rearfoot varus with varying degrees of rigidity<sup>(10)</sup>
  - Claw-toe deformity<sup>(1)</sup>
- Other signs and symptoms associated with pes cavus
  - In hindfoot
    - Achilles tendinopathy with reduced ROM of triceps surae<sup>(10)</sup>
    - Tibial stress syndrome, stress fractures, varus knee malalignment, iliotibial band syndrome, plantar fasciitis
  - In midfoot
    - Callus formation
    - Sesamoid stress fracture
    - Fifth metatarsal fractures

## **Causes, Pathogenesis, & Risk Factors**

› **Causes**

- Classified as neurological, congenital, or traumatic<sup>(10)</sup>
  - Neurological<sup>(12)</sup>
    - Charcot-Marie-Tooth (CMT) disease, also known as hereditary sensorimotor neuropathy (HSMN); accounts for half of all neurological cases
    - Friedreich ataxia
    - Polio
    - Spina bifida
    - Any form of dysraphism, cerebral palsy, or spinal tumor
- Congenital
  - Idiopathic
  - Residual clubfoot
  - Arthrogyriposis
- Traumatic
  - Compartment syndrome
  - Crush injury
  - Severe burn
  - Injury to susceptible muscle group causing a muscle imbalance

› **Pathogenesis**

- The pathogenesis of pes cavus is unclear, although researchers theorize it is initiated by muscle imbalances that cause the pes cavus deformity. This deformity progresses through stages in which muscle imbalances in the initial stages of pes cavus are still “flexible.” With time, however, contractures develop and the muscle imbalances causing the pes cavus deformity become “stiff” and eventually “rigid”<sup>(10)</sup>
  - Peroneus brevis and posterior tibialis imbalance – stronger peroneus brevis pulls the first ray into plantar flexion<sup>(12)</sup>

–Imbalance between weaker foot intrinsics and stronger extrinsics<sup>(12)</sup>

- With the development of foot intrinsic weakness due to traumatic injury or neuromuscular disease, the extrinsic musculature becomes unopposed, causing a claw-toe deformity<sup>(10)</sup>

- As the long extensors overpower the weakened intrinsic foot muscles, the condition is further worsened by the long toe extensors having to assist a weakened anterior tibialis to dorsiflex the foot<sup>(10)</sup>

–Stronger fibularis longus/triceps surae and weaker anterior tibialis imbalance

#### › **Risk factors**

• Family history of pes cavus

• Ballet dancers<sup>(9)</sup>

• Neurological conditions (see *Causes*, above)<sup>(12)</sup>

• Traumatic injury

## **Overall Contraindications/Precautions**

› See specific **Contraindications/precautions to examination** and **Contraindications/precautions** under Assessment/Plan of Care

## **Examination**

#### › **Contraindications/precautions to examination**

• If through direct access a patient presents to a physical therapist with pes cavus and an undiagnosed neurological condition is suspected as the cause, a referral to an appropriate physician is warranted

• Be aware that many flat feet (pes planus) are pes cavus feet that have collapsed. This condition is seen with a pes planus foot in weight-bearing but significant elevation of the medial longitudinal arch in sitting<sup>(11)</sup>

#### › **History**

##### • **History of present illness/injury**

###### –**Mechanism of injury or etiology of illness**

- When did the symptoms start and how have they progressed since onset?

- Was development of pes cavus idiopathic? Was it linked to any neurological, congenital, or traumatic cause – crush injury, laceration of peroneus longus, compartment syndrome, neurological condition?

###### –**Course of treatment**

- **Medical management:** Ask about patient's past and current medical management. How has the condition responded to treatments?

- Surgery

- Surgical intervention is an option for treating pes cavus if nonoperative treatment has failed or the deformity continues to worsen<sup>(10)</sup>

- The goals of surgery are to create a foot that is more pain free, mobile, and stable<sup>(2)</sup>

- Surgical management options include<sup>(10)</sup>

- For hindfoot correction

- Supramalleolar osteotomy

- Triceps surae lengthening

- Correction of talar tilt

- Plantar fascia release

- Calcaneal osteotomy

- For midfoot correction

- First metatarsal basal osteotomy

- Composite midfoot osteotomies

- Triple fusion (subtalar, calcaneocuboid, and talonavicular joints)

- Talectomy – severe cases only

- For muscle imbalances

- Tendon transfer – redirection of stronger muscle to weaken it

- Weaken stronger tendon by elongation or excision

- For forefoot and toe corrections
  - Jones procedure – correct ‘cock-up’ deformity of big toe
  - Lesser toe correction – e.g., lengthening of extensor tendon for hammer toes
- **Medications for current illness/injury**
  - Determine what medications clinician has prescribed; are they being taken? Are they effective?
- **Diagnostic tests completed:** Usual tests for this condition are the following:
  - X-ray: in weight-bearing, the lateral talar-first metatarsal angle, calcaneal inclination angle, and parallelism of the metatarsals are evaluated. Common abnormalities seen are <sup>(12,13)</sup>
    - Plantarflexed first ray
    - High arch
    - Increased distance between the bottom of the medial cuneiform and the bottom of the fifth metatarsal base
    - Dorsiflexion of the calcaneus
    - Hindfoot supination
    - Decreased talocalcaneal angle
  - MRI: indicated to rule out suspicious lesions and evaluate the integrity of soft tissue structures
  - EMG studies
- **Home remedies/alternative therapies:** Document any use of home remedies (e.g., ice or heating pack) or alternative therapies (e.g., acupuncture) and whether or not they help
- **Previous therapy:** Document whether patient has had occupational or physical therapy for this or other conditions and what specific treatments were helpful or not helpful
- **Aggravating/easing factors** (and length of time each item is performed before the symptoms come on or are eased)
  - What specifically exacerbates/alleviates the pain?
- **Body chart:** Use body chart to document location and nature of symptoms
- **Nature of symptoms:** Document nature of symptoms (constant vs. intermittent, sharp, dull, aching, burning, numbness, tingling)
- **Rating of symptoms:** Use a visual analog scale (VAS) or 0–10 scale to assess symptoms at their best, at their worst, and at the moment (specifically address if pain is present now and how much); a nonverbal scale (e.g., FLACC) can be used with nonverbal patients
- **Pattern of symptoms:** Document changes in symptoms throughout the day and night, if any (a.m., mid-day, p.m., night); also document changes in symptoms due to weather or other external variables
- **Sleep disturbance:** Document number of wakings/night related to this condition, if any
- **Other symptoms:** Document other symptoms patient might be experiencing that could exacerbate the condition and/or symptoms that could indicate a need to refer to a physician (e.g., complaints of dizziness, bowel and bladder issues, pronounced unexplained edema in the extremities)
- **Respiratory status:** Does the patient have any known respiratory compromise?
- **Barriers to learning**
  - Are there any barriers to learning? Yes \_\_\_ No \_\_\_
  - If Yes, describe \_\_\_\_\_
- **Medical history**
  - **Past medical history**
    - **Previous history of same/similar diagnosis:** Document history of the following:
      - Clubfoot
      - Gout
      - Family history of neurological conditions
      - Birth history
      - Developmental delays
    - **Comorbid diagnoses:** Ask patient about other problems, including cancer, heart disease, diabetes, psychiatric disorders, rheumatoid arthritis, and other orthopedic disorders
    - **Medications previously prescribed:** Obtain a comprehensive list of medications prescribed and/or being taken (including OTC drugs)
    - **Other symptoms:** Ask patient about other symptoms he/she might be experiencing
- **Social/occupational history**
  - **Patient’s goals:** Document what the patient hopes to accomplish with therapy and in general

- **Vocation/avocation and associated repetitive behaviors, if any**
  - Does the patient participate in any recreational or sporting activities?
  - Does the patient work?
  - How does condition affect work or play?
- **Functional limitations/assistance with ADLs/adaptive equipment:** What was the patient’s prior ADL status? Did patient require assistive or adaptive equipment? Does patient wear orthotics? Has he or she worn orthotics in the past? Have they been helpful in reducing symptoms?
- **Living environment:** Does the patient have to negotiate stairs? Number of floors in home? With whom does the patient live? Who are the caregivers? Identify if there are barriers to independence in the home; are any modifications necessary?
- ▶ **Relevant tests and measures: (While tests and measures are listed in alphabetical order, sequencing should be appropriate to patient medical condition, functional status, and setting)**
  - **Anthropometric characteristics:** Calculate BMI
  - **Assistive and adaptive devices:** If the patient uses assistive or adaptive devices, are they appropriate? Do they need modifications?
  - **Balance:** Complete a balance assessment. Assess static and dynamic balance and unilateral stance (if appropriate) and compare time and quality bilaterally. Does the patient use his or her ankle strategy for balance appropriately?
  - **Circulation:** Assess distal pulses (e.g., radial artery, tibial artery, dorsalis pedis artery), especially if vascular involvement is suspected
  - **Cranial/peripheral nerve integrity:** Assess peripheral nerve integrity of lower extremities
  - **Functional mobility** (including transfers, etc.)
    - Complete a functional assessment as indicated
    - The Timed Up and Go (TUG) test can be used for objective measurement
  - **Gait/locomotion**
    - Perform a complete and detailed gait analysis with special attention to the position of the hindfoot and presence of a foot drop
    - Typically, individuals with pes cavus will walk with excessive supination<sup>(10)</sup>
    - Also visually assess the amount of pronation that occurs during the stance phase of gait
  - **Joint integrity and mobility**
    - Assess joint mobility/rigidity of first ray, metatarsals, forefoot, midfoot, and rearfoot
    - Also assess position of rearfoot, forefoot, and first ray/other toes in subtalar neutral (weight-bearing and non-weight-bearing)
  - **Motor function (motor control/tone/learning):** Assess muscle tone in all patients with pes cavus of neurologic origin
  - **Muscle strength**
    - Assess throughout lower extremity
    - Patients with pes cavus commonly present with muscle imbalance. The posterior tibialis, long toe extensors, and gastrocnemius might be stronger and shorter than the weak peroneus brevis, intrinsics (interossei and lumbricals), and anterior tibialis muscles<sup>(10)</sup>
  - **Neuromotor development**
    - Assess neuromotor development in children with pes cavus of neurologic origin
    - Utilize standardized neuromotor development tests such as the Peabody Developmental Motor Scales, Second Edition (PDMS-2)
  - **Observation/inspection/palpation (including skin assessment)**
    - Assess arch height using one of the tests mentioned in *Special Tests*, below
    - Assess skin integrity
      - Are there any lesions on the skin caused by atypical pressure points?
      - A callus might be observed under the first metatarsal head. But it can also be observed under the base or head of the fifth metatarsal<sup>(10)</sup>
    - An enlarged peroneal tubercle might also be present and be tender to palpation
    - Document atrophy of lower extremity muscles (e.g., anterior tibialis, peroneus brevis)
    - Document any toe deformities (e.g., claw-toe deformity)<sup>(10)</sup>
    - Examine shoes for wear, which is commonly evident on the lateral part of the shoe due to increased heel varus
  - **Posture:** Assess for abnormalities throughout spine, hips, knees, ankles, and feet (e.g., increased heel varus)<sup>(10)</sup>

- **Range of motion**

- Complete ROM assessment as indicated
- Ankle dorsiflexion and toe flexion commonly are decreased, whereas plantar flexion might be within normal limits<sup>(10)</sup>
- Also assess knee, hip, and lumbar spine to help rule out other conditions or for tightness/limitations in ROM that might be contributing to the problem

- **Reflex testing**

- Assess deep tendon reflexes of the lower extremity, which might be diminished if there is peripheral nerve involvement
- Assess Babinski reflex to assist in ruling out spinal cord or CNS disorders

- **Self-care/activities of daily living (objective testing):** Complete assessment of ADLs, as indicated

- **Sensory testing**

- Assess light touch, pain, pressure, proprioception, and temperature

- **Special tests specific to diagnosis**

- Arch height, arch height index, arch rigidity index, arch drop<sup>(11)</sup>
  - The arch height at 50% of the foot length is measured and is often compared to the truncated foot length to determine the arch height index. Over 0.37 mm indicates pes cavus<sup>(11)</sup>
  - Other measures include the arch rigidity index (i.e., standing arch height ratio divided by sitting arch height ratio) and the arch drop (i.e., arch height at 50% of foot length [patient sitting] subtracted by the arch height at 50% of foot length [patient standing])
- “Peek-a-boo heel” sign: used to assess for subtle cavus foot (SCF) deformity, a more subtle form of pes cavus that usually appears in adulthood and is not neurological in origin. Testing involves having the patient align his or her feet straight ahead in standing; if the heel pad is visible medially, the test is considered positive. False positives might be caused by the patient having a very large heel pad or severe metatarsus adductus<sup>(10)</sup>
- Questionnaires
  - Foot Health Status Questionnaire<sup>(3)</sup>
  - Lower Extremity Functional Scale (LEFS)

## **Assessment/Plan of Care**

- › **Contraindications/precautions**

- Clinicians should follow the guidelines of their clinic/hospital and what is ordered by the patient’s physician. The summary presented below is meant to serve as a guide, not to replace orders from a physician or a clinic’s specific protocols
- **Patients with this diagnosis can be at risk for falls; follow facility protocols for fall prevention and post fall-prevention instructions at bedside, if inpatient. Inform patient and family/caregivers of the potential for falls and educate about fall-prevention strategies. Discharge criteria should include independence with fall-prevention strategies**
- **Only those contraindications/precautions applicable to this diagnosis are mentioned below, including with regard to modalities. Rehabilitation professionals should always use their professional judgment in their assessment and treatment decisions**
- **Cryotherapy** contraindications<sup>(4)</sup>
  - Cold intolerance
  - Raynaud’s syndrome
  - Medical instability
  - Cryoglobulinemia
  - Cold urticaria
  - Over a regenerating peripheral nerve
  - Over a circulatory compromise
  - Over an area of peripheral vascular disease
  - Paroxysmal cold hemoglobinuria
- **Cryotherapy** precautions<sup>(4)</sup>
  - Hypertension
  - Thermoregulatory disorders
  - Over a superficial peripheral nerve

- Over an open wound
- Over an area of poor sensation
- Individuals with poor cognition
- In the very young or very old
- Persons with aversion to cold
- **Superficial heat** contraindications<sup>(4)</sup>
  - Over areas with a lack of intact thermal sensation
  - Over areas of vascular insufficiency or vascular disease
  - Over areas of recent hemorrhage or potential hemorrhage
  - Over areas of known malignancy
  - Over areas of acute inflammation
  - Over infected areas where infection may spread
  - Over areas where liniments or heat rubs have recently been applied
  - In any situation deemed unreliable by the practitioner
- **Whirlpool** contraindications<sup>(4)</sup>
  - Incontinent bladder or bowel
  - Alcohol or drug ingestion
  - Uncontrolled epilepsy
  - Danger of hemorrhaging
  - Postoperative surgical incision with dehiscence (i.e., bleeding surgical wound), sutures, or staples
  - Skin ulcers caused by venous insufficiency, edema, or lymphedema
  - Skin conditions such as atopic eczema, ichthyosis, and senile pruritus (i.e., itching)
  - Tissue flaps or recent skin grafts
  - Skin infection
  - Thrombophlebitic areas
- **Whirlpool precautions** <sup>(4)</sup>
  - Malignancies
  - Sensory impairments
  - Hypersensitivity to cold
  - Pulmonary disease
  - Cardiac insufficiency
  - Unstable blood pressure
  - Impaired circulation
  - Edema
  - Acute febrile episode
  - Acute inflammation
- **Electrotherapy** contraindications (in some cases, when approved by the treating physician, electrotherapy may be used under some of the circumstances listed below when benefits outweigh the perceived risk)<sup>(4)</sup>
  - Over the trunk or heart region in patients with demand-type pacemakers and implantable cardioverter defibrillators (ICDs)
  - Over the pelvic, abdominal, lumbar, or hip region of a pregnant woman
  - Over the carotid bodies
  - Over the phrenic nerve, eyes, or gonads
  - Over areas of known peripheral vascular disease
  - Over areas of active osteomyelitis
  - Over areas of hemorrhage
- **Electrotherapy precautions**<sup>(4)</sup>
  - With patients without intact sensation
  - With patients who cannot communicate
  - With patients with compromised mental ability
  - With cardiac dysfunction (uncontrolled hypertension or hypotension, irregular heartbeat)
  - Over active or previous neoplasms

- With electrodes
  - Over compromised skin, unless treating wound specifically
  - Over tissues that are vulnerable to hemorrhage
  - Cervical region in patients with history of stroke or seizures
- Do not use within 5 yards of diathermy units or other source of electromagnetic radiation

› **Diagnosis/need for treatment**

- Ankle/foot pain; possibly lower extremity pain
- Ankle weakness/instability
- Decreased ability to ambulate safely/abnormal gait mechanics
- Poor balance
- Decreased ability to participate in work and/or sports/recreational activities

› **Rule out**

- Vascular compromise
- Peripheral neuropathy
- Spinal stenosis
- Tarsal tunnel syndrome
- Poorly fitting shoes

› **Prognosis:** Dependent on etiology, flexibility of deformity, and progressive vs. nonprogressive nature of underlying condition<sup>(10)</sup>

› **Referral to other disciplines**

- Podiatrist
- Orthotist
- Orthopedic surgeon
- Occupational and/or speech therapy

› **Other considerations**

- Authors of a research study conducted in Italy on individuals with idiopathic pes cavus found no nerve conduction impairment in the lower limbs<sup>(8)</sup>
  - In the 18 patients, absence of deep tendon reflexes, muscle weakness, and hypotrophy were more common than in the control subjects

› **Treatment summary**

- Many pes cavus deformities can be managed conservatively with orthotics and physical therapy<sup>(10)</sup>
  - Most commonly prescribed are lateral heel cup orthotics and eccentric calf muscle stretches
- Although more evidence is needed to demonstrate the efficacy of the following interventions for pes cavus, typical conservative management can include<sup>(1)</sup>
  - Orthotics/proper footwear
  - Medication
  - Weight loss recommendations, if overweight or obese
  - Electrotherapeutic modalities for pain management
  - Callus debridement
  - Therapeutic exercises for strengthening weakened musculature
  - Manual therapy for increasing joint mobility and muscle flexibility
- Therapeutic exercises
  - Achilles tendon/gastrocnemius and plantar fascia stretching has been recommended in the literature, especially in patients with neuromuscular diseases such as cerebral palsy, but there is no evidence to support its effectiveness<sup>(5)</sup>
- Balance training
  - Balance and proprioceptive training for the unstable ankle has also been recommended in the literature without evidence of effectiveness
- Foot orthoses
  - Custom-made foot orthoses
    - Can be effective in relieving foot pain in patients with painful pes cavus<sup>(3,6)</sup>
    - Based on a Cochrane systematic review



- Review included 11 RCTs assessing custom-made foot orthoses prescribed secondary to foot pain; 1,332 patients total were evaluated
  - Custom-made foot orthoses were compared to numerous interventions; examples included
    - sham orthoses
    - noncustom(prefabricated) foot orthoses
    - manipulation, mobilization, or stretching
    - night splints
    - surgery
  - Follow-up ranged from 1 week to 3 years
  - The review included 1 trial (N = 154 individuals) that focused on individuals with pes cavus; custom-made foot orthoses were effective in that trial for relieving painful pes cavus
- Footwear recommendations
- An important component in the management of pes cavus
  - Top of the shoe should be laced and flexible to accommodate an elevated midfoot
  - To provide adequate room for the plantarflexed forefoot, the heel of the shoe should be higher than the toebox. The toebox should also be oblique with extra depth to avoid impacting toes that are already contracted
  - The sole of the shoe should provide adequate cushion and provide some stability from ankle inversion
  - Athletic shoes should be chosen from the “neutral-cushion” category
  - Leather loafers should be discouraged

Problem	Goal	Intervention	Expected Progression	Home Program
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Lower extremity pain	Decrease pain	<p><b><u>Physical agents and mechanical modalities</u></b></p> <p>Cryotherapy or heat packs might be effective in reducing pain. Electrical stimulation might be used for short-term pain relief<sup>(4)</sup></p> <p><b><u>Activity modification</u></b></p> <p>Advise patient to minimize high-impact activities in favor of low-impact exercises (e.g., bicycle, elliptical, swimming)</p> <p><b><u>Prescription, application of devices and equipment</u></b></p> <p>Foot orthotics to assist in correcting foot mechanics. Recommend proper footwear that is accommodating to the pes cavus deformity, as well as able to assist in absorbing shock forces</p>	Wean off modalities, reintroduce aggravating activities	Provide patient with written instructions regarding proper use and wearing schedule for foot orthotics
Increased risk for skin breakdown secondary to atypical pressure points	Skin integrity intact; free from breakdown	<p><b><u>Patient education</u></b></p> <p>Educate patient on appropriate skin inspection</p> <p>Refer to wound care specialist per facility's protocol</p>	Skin integrity should improve over time	Provide patient with diagrams and written instructions

Muscle weakness/ imbalance	Improve strength/ balance between opposing muscle(s)	<p><b><u>Therapeutic exercise</u></b></p> <p>Implement therapeutic program to address strength limitations and muscle imbalances as indicated</p>	Progress duration and intensity of exercises as appropriate. Ankle stability and strength generally improve with continued therapy; lack of progress might indicate need for referral back to physician	Provide patient with description of exercises to do at home
Decreased ROM and muscle flexibility	Improve ROM and muscle flexibility	<p><b><u>Physical agents and mechanical modalities</u></b></p> <p>Whirlpool or contrast baths to relieve stiffness<sup>(4)</sup></p> <p><b><u>Manual therapy</u></b></p> <p>Passive stretching and joint mobilizations to increase flexibility and joint mobility</p> <p><b><u>Therapeutic exercise</u></b></p> <p>Implement therapeutic program to address ROM and flexibility limitations, especially for the gastrocnemius<sup>(10)</sup></p>	Progress duration and intensity of exercises as appropriate	Provide patient with description of exercises to do at home

<p>Impaired balance and gait with increased risk for falls</p>	<p>Improve balance/gait</p>	<p><b><u>Patient education</u></b></p> <p>Educate patient on fall-prevention concepts</p> <p><b><u>Neuromuscular reeducation</u></b></p> <p>Balance/stabilization activities: use of exercises that incorporate elements of balance, such as resisted walking or use of a balance board<sup>(L)</sup></p> <p><b><u>Gait training</u></b></p> <p>Use of assistive device if gait is limited by a neurological disorder</p>	<p>Progress duration and intensity of exercises as appropriate. Ankle stability and strength generally improve with continued therapy; lack of progress might indicate need for referral back to physician</p>	<p>Provide patient with description of exercises to do at home during daily routine</p>
<p>Decreased ability to participate in work and/or sports/recreational activities</p>	<p>Return to desired sports or recreational activities</p>	<p><b><u>Functional training</u></b></p> <p>Functional training will vary depending on patient's needs and goals; implement and modify as indicated</p> <p>Might progress the patient to sport/task-specific exercises (e.g., obstacle course that involves more complex movement such as skipping and backward ambulation)<sup>(L)</sup></p>	<p>Progress duration and intensity of conditioning exercises as appropriate to work toward participation in sports/recreational activities</p>	<p>Provide patient with description of exercises to do at home once he or she is safely completing the desired activities in the clinic</p>

## Desired Outcomes/Outcome Measures

- › Reduced pain
  - VAS
- › Free from skin breakdown
  - Skin assessment
- › Increased muscle strength
  - Manual muscle testing, isokinetic testing, hand dynamometry
- › Improve ROM and muscle flexibility
  - Goniometry, flexibility tests

- › Improved balance and gait
  - Balance testing, gait assessment, LEFS, Foot Health Status Questionnaire<sup>(3)</sup>
- › Return to desired activities/sport
  - Foot Health Status Questionnaire<sup>(3)</sup>
- › Resolved muscle imbalances

## Maintenance or Prevention

- › Home exercise program as indicated
- › Wearing schedule for orthotics as indicated

## Patient Education

- › See “High Arch” from MedlinePlus at <https://medlineplus.gov/ency/article/001261.htm>

## Coding Matrix

References are rated using the following codes, listed in order of strength:

<b>M</b> Published meta-analysis	<b>RV</b> Published review of the literature	<b>PP</b> Policies, procedures, protocols
<b>SR</b> Published systematic or integrative literature review	<b>RU</b> Published research utilization report	<b>X</b> Practice exemplars, stories, opinions
<b>RCT</b> Published research (randomized controlled trial)	<b>QI</b> Published quality improvement report	<b>GI</b> General or background information/texts/reports
<b>R</b> Published research (not randomized controlled trial)	<b>L</b> Legislation	<b>U</b> Unpublished research, reviews, poster presentations or other such materials
<b>C</b> Case histories, case studies	<b>PGR</b> Published government report	<b>CP</b> Conference proceedings, abstracts, presentation
<b>G</b> Published guidelines	<b>PFR</b> Published funded report	

## References

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