FOOT AND ANKLE CURRICULAR GUIDELINES FOR PHYSICAL THERAPIST PROFESSIONAL DEGREE PROGRAMS

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INTRODUCTION

Foot and Ankle Curricular Guideline Task Force

This manuscript is based on the input and draft writing of the full Task Force who are listed alphabetically. It was formatted, completed and edited by the first three authors. All authors had the opportunity for final review prior to dissemination.

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Purpose

The purpose of this consensus document is to provide guidance on foot and ankle curricular objectives and content for physical therapy professional degree programs. The intent of the document is to lay the groundwork for educators to produce entry-level clinicians with a common foundation related to the foot and ankle. This is a particularly challenging task with the regional diversity by which foot and ankle care is approached by clinicians across the country. Additionally, there are relatively limited numbers of individuals with specialized practice and knowledge in this area. For these, and other reasons, the need for curricular guidance for the 200+ academic programs training future physical therapists is paramount. These guidelines are not intended to represent content that needs to be in one particular course. In fact, it is would be highly appropriate for the content to be included in different courses. Programs may adopt different models for integrating this material in their curricula.

The science guiding the practice of the foot and ankle in physical therapy (PT) is in some ways abundant (eg, there are 3 complete Orthopaedic Section of American Physical Therapy Association (APTA) clinical guidelines published—heel pain, Achilles tendinopathy, ankle sprain). However, in other ways, evidence may be viewed as weak (eg, evidence for selected manual therapy techniques). The recommendations put forth in this consensus document are a product of the time in which they written, and hence, are expected to change as our current knowledge base and practice evolve. Copy written documents have been referenced and not included. It is anticipated that revisions to this document will be needed on a regular basis. It will be reviewed in 3 to 5 years.

Method of Document Development

The Foot and Ankle Special Interest Group of the Orthopaedic Section put forward a motion in February 2012 to "Establish a multi-member Task Force charged with recommending the standard curriculum of foot/ankle content for graduates of an entry-level physical therapy program." A 35 member "community" of people from across the country expressed an interest in participating in response to open calls from the Orthopaedic Section for volunteers. This initial group participated in an online discussion that started the process of identifying and gathering the necessary information to establish these curricular guidelines.

In the summer of 2012, a smaller "writing" group met in a face-to-face, multi-day meeting focused on curricular development and writing these specific guidelines as a *consensus document*. Hence, the reader is cautioned that not all of the document is supported by evidence from the

literature, although it has been adapted to be consistent with evidence where it exists. The guidelines were developed following the *format* of the Normative Model.[1] The first authors organized and documented the development process, and searched for evidence supporting or refuting that proposed by the Task Force. That evidence is referenced in this document.

Task Force Guiding Principles

The guiding principles for curricular guidelines development were as follows:

1. The basics of anatomy and physiology are considered foundational sciences that support these curricular guidelines, and therefore, are not covered in detail but referred to only as necessary to provide some of the needed context.
2. The content covered is not intended to be solely covered in a single course, but rather is recommended to be threaded throughout the curriculum as it fits within the various curricular models that exist. It is likely that certain courses may be a "good fit" for large portions of the content (courses that focus on musculoskeletal examination and intervention). However, individual programs may choose to deliver or apply the content in other courses. For example, an orthotic course may include content, or a geriatrics course may contain a case study describing an older adult living in a nursing home who has ankle pain.

The writers of these recommendations were cognizant of the risk of "curricular obesity" and made a conscious attempt to identify the most essential entry-level skills related to the foot and ankle. The goal was to have a document to provide guidance and a set of recommendations that would be immediately helpful to the educator and that could be implemented in curricula. The Task Force acknowledges that important areas have not been included, or covered comprehensively enough (ie, shoe fitting and prescription, wound care, or computerized data collection methods such as plantar pressure measurement). These may be addressed in future revisions.

RECOMMENDATIONS FOR PROFESSIONAL PHYSICAL THERAPY CURRICULA FOR THE FOOT AND ANKLE

Organization of the Curricular Guidelines

The Guidelines have been organized in a table format, or clinical matrix, to make it an easy reference tool. The first column labeled "Primary Content" is material that is recommended for inclusion in entry-level professional physical therapist curricula. The "Terminal Behavioral Objectives" column provides recommendations for foot and ankle learning objectives that ideally should be achieved by graduates of an entry-level Doctorate of Physical Therapy (DPT) program. The final two columns, "Instructional Objectives for the Classroom" and the "Instructional

Objectives for the Clinic" provide examples (not an exhaustive list) of objectives to be achieved in these respective settings to facilitate development of the Terminal Behavior Objectives. The matrix is organized by the components of the Patient/Client Management Model from the *Guide to Physical Therapist Practice*[2] including sections organized by diagnosis and then by intervention. Prognosis/Goal writing was not addressed in specifics.

Foot and Ankle Clinical Sciences Matrix

Primary Content	**Terminal Behavioral Objectives** *The student will:*	**Example Instructional Objectives for the Classroom** *The student will:*	**Example Instructional Objectives for the Clinic** *The student will:*
Examination - History			
Patient/client history and review of medical record using the domains of the International Classification Framework (ICF) model.[3] System reviews based on patient/client needs. Use standardized tests and measures from the *Guide to Physical Therapist Practice* (as available). Consider referral if patient has: (1) night sweats, (2) sleep disturbance, (3) change in neurologic function, (4) progressive weakness and/or sensatory changes, (5) diabetes - Charcot foot, or deep vein thrombosis (DVT) - screening using Wells' Criteria.[5-8]	Determine the severity, irritability, nature, and stage and stability of the complaints of the patient and understand their relevance in the domains of the ICF model.[3] Recognize the components of the history (including symptom investigation and review of systems) that may be part of the medical diagnosis and PT diagnosis considering the issues related to the benign senescent forgetfulness impairments that may require examination. Select appropriate system examination techniques for the integumentary, cardiopulmonary, neurological, and musculoskeletal systems to determine needed PT examination procedures and appropriate diagnosis, prognosis, and plan of care.	Describe the components of the history (including symptom investigation and review of systems) and how it relates to the domains of the ICF model. Generate (synthesize) a complete history (including symptom investigation and review of systems) to determine the local, remote, referred, or systemic origins of the patient's complaint. Recall the components of the Systems Review and correctly perform the aspects of the examination enabling them to determine potential local, remote, referred, or systemic origins of the patient's complaint.	By the final clinical experience, perform a history (including symptom investigation and review of systems rated at entry-level by the clinical instructor on the Physical Therapist Clinical Performance Instrument (PT CPI).[4] Compare and contrast the findings from the history (including symptom investigation and review of systems) to help determine if the patient is: (1) appropriate for PT, (2) appropriate for PT with referral to others, or (3) not appropriate for PT and requires referral elsewhere. Determine the appropriate tests and measures for screening specific to the foot and ankle.

Examination - Systems review			
General Constitutional Signs • Fatigue • Fever • Malaise • Weight change Metabolism - diabetes mellitus hemoglobin A1C >7%[9] **Musculoskeletal** • Fractures o Ottawa Ankle Rules[10-12] • Avulsion[13] • Severe pain with weight bearing • Non-mechanical pain • Systemic arthritis (ie, gout) • Rheumatic diseases **Neurological** • Dermatomal versus non-dermatomal (ie, stocking glove) • Sensation testing 5.07 monofilament testing • Vibration - 128 Hz tuning fork • Myotomal patterns of weakness versus peripheral nerve injury pattern (ie, common fibular nerve lesion) • Complex Regional Pain Syndrome[14] **Cardiopulmonary** • DVT - screening Wells' Criteria[5-7] • Peripheral vascular disease	Select appropriate screening examination for the integumentary, cardiopulmonary, neurological, and musculoskeletal body systems to screen for conditions beyond the scope of physical therapist practice that require a referral to another health care provider.	Recall and identify the clinical signs and patient response to written and verbal questions which indicate health conditions beyond the scope of physical therapist practice. Simulated case examples to recognize selected components.	Apply results of written and verbal responses to a review of systems with subjective and objective clinical exam findings to make the determination that the patient is: (1) appropriate for PT, (2) appropriate for PT with referral to others, or (3) not appropriate for PT and requires referral elsewhere.

Integumentary • Infection • Open wounds[15] • Abnormal postoperative wounds • Skin and nail inspection **Psychosocial** • Depression (or other cognitive or psychological concerns) • Alcohol use • Problematic caretaker dynamics (ie, extreme expectations/neglect) • Financial considerations			
Examination – Tests and measures			
Inspection/Observation: • Swelling - Figure 8 test, volumetric measures, circumference measures, Pitting edema? - yes or no • Integument - Color and texture: Noting discoloration, shiny skin, and/or ecchymosis. • Toe nails - Noting whether they are dystrophic and/or thickened. • Temperature - Hot or cold, sweat response. • Trophic changes and hair growth – Signs of vascular problems. • Calluses - Formation or lack of calluses, exostosis, and/or bony overgrowth.	Perform an inspection of the feet and ankles that includes noting, testing, or measuring when appropriate: (1) swelling or (2) integument a. color texture, b. toe nails, c. temperature, d. trophic changes, e. calluses. Correlate inspection findings with other exam findings to develop the evaluation, diagnosis, and plan of care.	Identify clinical signs of inflammation in the foot and ankle. Identify signs of a reduced autonomic response in the foot and ankle.  Identify signs of vascular compromise. 	Interpret and integrate inspection and observation results to develop the evaluation, diagnosis, and plan of care for patients with foot and ankle dysfunction.

		Identify signs of infection and other integumentary problems. Determine when to refer simulated patients to another health care provider for integumentary problems of the foot and ankle.	
Foot Posture /Deformity: Overall Foot Posture Description • Foot Posture Index[16] • Weight bearing and nonweight bearing visual assessment of hind foot • Varus and valgus Midfoot/Forefoot • For medial longitudinal arch, both static (weight bearing and nonweight bearing) and dynamic (movement) assessment are needed. Familiarity with relevant skills, tests, and measures (such as palpation of subtalar joint neutral, navicular height, navicular drop test, arch height index, Coleman block). • Too many toes sign.  Toe Deformities • hallux valgus,	Explain, conduct, and interpret measures of foot posture including the Foot Posture Index. Assess visually foot posture (weight bearing and nonweight bearing). Identify and explain the following foot and ankle deformities: • hallux valgus, • hammer toe, • claw toe, • mallet toe, • overlapping/crossover toes, • Morton's foot structure (2nd toe longer than the 1st), and • metatarsus adductus. Integrate foot posture measurement findings with other exam findings to develop the evaluation, diagnosis, and plan of care.	Perform and score the Foot Posture Index. Identify foot pronation and supination postures in weight bearing and nonweight bearing. Identify and describe various foot deformities.	Perform, interpret, and integrate foot posture and deformity clinical findings correctly to develop the evaluation, diagnosis, and plan of care for patients with foot and ankle dysfunction.

• hammer toe, • claw toe, • mallet toe, • overlapping/crossover, • Morton's foot structure (2nd toe longer than the 1st), or • metatarsus adducts.			
Movement Analysis: Gait examination and evaluation • Temporal spatial measures (including gait speed, step length, stance time, foot angle, step width, etc). • Visual analysis using the Rancho Los Amigos method. • Identify common gait deviations related to the ankle and foot (see Appendix 1). • Stairs. Double leg squats[17] • Dorsiflexion range of motion (ROM). • Visual analysis hind foot, midfoot, and forefoot movement. Single leg squats[18,19] • Lower extremity alignment - note femoral adduction/ internal rotation vs femoral abduction/external rotation. Running • Identify forefoot running pattern. • Identify heel toe running pattern.	Perform a gait examination. Identify demonstrated gait deviations. Identify correctly normal vs abnormal motions of the ankle and foot during the double leg squat test. Identify correctly normal vs abnormal motions of the entire lower extremity during the single leg squat test. Integrate movement analysis findings with other exam findings to develop the evaluation, diagnosis, and plan of care.	Describe key components of a gait examination. Identify and describe gait deviations on a patient video or as performed by a simulated patient. Perform gait examination efficiently with a classmate. Explain the rationale for selection of various gait examination procedures based on setting, severity, intensity, nature, and stage of the patient problem. Describe key components of movement in the double and single leg squat tests. Perform double and single leg squat tests with a classmate. Identify deviations on a patient video or performed by a simulated patient during the double and single leg squat tests.	Perform gait examination and evaluation of a patient. Identify and document gait deviations demonstrated by a patient. Select appropriate gait examination procedures specific to the patient condition and setting. Integrate gait examination findings with other tests and measures including those of patient functional status. Discriminate patients appropriate for double and single leg squat testing. Perform double and/or single leg squat test. Identify and document movement patterns demonstrated by a patient performing the double and/or single leg squat test.

Range of Movement: Ankle Dorsiflexion Weight bearing • Knee to wall- distance of toe to wall or inclinometer. • Knee straight - inclinometer, (consider block for forefoot). Nonweight bearing • Knee extended - supine goniometry.[20] • Knee flexed and extended.[21] Ankle Plantar Flexion Nonweight bearing • Supine goniometry with the distal arm aligned with the inferior aspect of calcaneus and forefoot separately. Subtalar Inversion/Eversion Nonweight bearing prone • Inversion/eversion observe qualitatively and/or using goniometry. Foot Inversion/Eversion Nonweight bearing supine - supine distal arm aligned with the 2nd metatarsal.[20] Hallux dorsiflexion • Nonweight bearing or weight bearing.[23]	Select the most appropriate passive and active ROM measurements for examination. Recognize when dorsiflexion motion is occurring at ankle joint and/or subtalar joint and the ramifications of motions at these joints.[22] Perform correctly selected tests and measures. Interpret correctly objective measurement findings. Identify the need for potential test and measure modification based on setting, severity, intensity, nature, and stage of problem. Articulate limits of valid and reliable of various ROM tests and measures. Identify joint end feel/motion barriers to passive motion. Discriminate mobility findings as hypomobile, hypermobile, or within normal limits. Synthesize information from ROM examination and accessory movement testing to identify bony vs soft tissue restrictions.	Identify various tests and measures to thoroughly assess patient impairments. Describe the procedural components for measuring ROM. Relate the measures to specific anatomic structures being assessed. Identify common procedural errors when performing passive or active ROM measurement. Perform an examination of a student in the classroom simulating ROM restrictions. Provide a rationale for choice of ROM measures selected. Correlate findings of ROM measures to identified abnormal motion patterns. Conduct self-assessment of psycho-motor skills and modify performance based on feedback. Analyze and discuss a patient-client video to identify modifications to ROM testing based on patient condition and setting. Describe the relationship of rear	Perform range of movement/ motion examination on a patient. Perform these tests and measures efficiently. Provide rationale for tests and measures selected. Conduct self-assessment of psycho-motor skills and modify performance based on feedback. Perform accessory joint mobility examination on a patient. Perform accessory motions safely and efficiently. Provide rationale for accessory motion examination. Conduct self-assessment of psycho-motor skills and modify performance, based on feedback.

Medial longitudinal arch • Weight bearing - navicular drop test. Midfoot motion (Calcaneocuboid and talonavicular joints) Nonweight bearing • Assess forefoot movement when the rear foot is everted and inverted. A normal test is when the foot is inverted and stability increases (ie, less forefoot movement is noted). Accessory Joint Movement[24] Talocrural - posterior glide test, anterior/posterior glides/distraction Subtalar- medial/lateral/anterior glides/distraction Talonavicular joint - dorsal/plantar gliding Calcaneocuboid - dorsal/plantar gliding 1st ray mobility - dorsal/plantar glide hallux limitus/rigidus Distal tibiofibular - anterior/posterior gliding Interphalangeal and metatarsal phalangeal joints - distraction/ dorsal/plantar gliding	Integrate ROM and mobility examination findings with other exam findings when developing evaluation and plan of care.	foot to forefoot biomechanical axes and its influence on joint mobility and stability. Perform mobility testing for the joints listed for hypomobility/ normal/hypermobility to determine the potential for manual therapy interventions. Interpret findings of a joint mobility examination on a classmate. Conduct self-assessment of psycho-motor skills and modify performance based on feedback.	
Strength Measurement: Manual muscle testing (MMT) Ankle	Demonstrate competence in performing MMT of the foot and ankle.	Interpret MMT and correlate findings with simulated foot and ankle conditions.	Analyze MMT tests of the foot and ankle in patients with foot and ankle dysfunction.

• Plantar flexion/dorsiflexion • Inversion/eversion • Toe flexion/extension Hip/knee/trunk muscle activity as presumed by movement analysis. Heel Rise Test[25,26] - assessed for height, number of reps, rear foot inversion or eversion position, medial vs lateral forefoot pressure, arch height, and comparison to normative data (see Appendix 2). Functional strength/return to activity.	Demonstrate the ability to conduct and interpret heel raise tests (single leg and double leg). Describe and administer sports-specific tests for return to play. Describe and administer functional tests for return to work. Describe and perform functional tests associated with the foot and ankle including: (1) squats, (2) step ups, and (3) hopping. Integrate strength findings with other exam findings when writing evaluation and plan of care.	Interpret heel rise test from video clips of patients with foot and ankle dysfunction. Discuss when to apply various MMT of the foot and ankle depending patients pathology, irritability, and/or severity. Discuss the limits of reliability and validity associated with MMT of the foot and ankle. Discuss the cause of muscle weakness in conditions associated with the foot and ankle (secondary result of disuse or direct result of injury).	Discriminate modifications to examination of muscle strength based on a patient's pathology, irritability, and/or severity. Generate hypotheses to address the probability a detected weakness is directly caused by the pathology or is the result of a secondary condition (ie, disuse).
Special Tests: Ankle • Talocrural sprain o Anterior drawer o Talar tilt • Syndesmotic sprain o Dorsiflexion/external rotation o Squeeze test Tinel sign[27] Windlass test[27]	Select, perform, and interpret appropriate clinical special tests to assist with evaluation of foot and ankle conditions. Correlate special test findings with other exam findings to develop an evaluation and plan of care.	Describe the procedural components foot and ankle clinical special tests. Accurately perform foot and ankle clinical special tests. Discriminate validity and reliability of selected clinical special tests. Identify common procedural errors when performing selected special tests.	Perform clinical special tests on a patient. Interpret special test results and integrate them into an evaluation and plan of care. Conduct self-assessment of psycho-motor skills and modify performance based on feedback.

Ottawa Foot and Ankle Rules[10-12] Thompson Test[28]		Discriminate between foot and ankle special tests and determine appropriate tests for simulated patients.	
Palpation of Relevant Structures NOTE: Connect to relevant diagnoses **Lateral Structures**: Fibula head/neck/shaft Fibularis longus/brevis muscles Lateral malleolus Anterior inferior tibiofibular joint Anterior inferior tibiofibular ligament Calcaneus Peroneal tubercle Calcaneofibular ligament Fibular tendons (longus/brevis) Cuboid Styloid process 5th metatarsal 5th metatarsal base/shaft/head Sinus tarsi Extensor digitorum brevis Anterior talofibular ligament **Dorsal Structures:** Anterior compartment muscles Anterior inferior tibiofibular joint Anterior inferior tibiofibular ligament Anterior tibialis tendon Extensor hallucis longus tendon Dorsalis pedis artery/pulse Extensor digitorum longus tendon Extensor digitorum brevis muscle Talar neck Navicular	Identify key surface anatomical structures relevant to patient/ client presenting chief complaint(s). Prioritize and demonstrate the ability to apply the basic concepts of gross anatomy to the analysis of patient/client problems related to musculoskeletal system of the leg, ankle, and foot. Differentiate normal vs abnormal findings obtained from surface anatomy palpation. Correlate palpation findings with other exam findings to formulate an evaluation and plan of care.	Discuss normal and potentially abnormal clinical findings identified from a palpation examination given selected pathological scenarios. Perform an examination of a student in the classroom that includes correct identification and palpation of relevant osseous, musculotendinous, and/or neurovascular structures.	Perform an efficient examination of a patient/client with foot/ankle pathology or complaint. Conduct a physical examination using palpation techniques that contribute to the formulation of a differential diagnosis. Provide written and verbal communication using correct terminology and description for accurate recording of physical examination findings. Conduct self-assessment of psycho-motor skills and modify performance based on feedback.

1st, 2nd, 3rd cuneiforms Metatarsals I-V base/shaft/head 1st metatarsal joint **Medial Structures:** Medial malleolus Posterior tibialis tendon Flexor digitorum longus tendon Posterior tibial artery/pulse Deltoid ligament Talus Sustentaculum tali Calcaneonavicular “spring" ligament Navicular tuberosity 1st cuneiform 1st metatarsal base/shaft/head Abductor hallucis muscle 1st MTP joint **Posterior Structures:** Calcaneus Achilles tendon Retrocalcaneal bursa Soleus muscle Gastrocnemius muscle **Plantar Structures:** Calcaneus Calcaneal fat pad Calcaneal tubercle (medial) Plantar fascia/aponeurosis Metatarsal heads I-V Sesamoids **Vascular Structures:** Popliteal artery Posterior tibial artery			

Dorsalis pedis artery Capillary refill Recognize the link between palpation and diagnosis. Understand that when available, confirmatory/diagnostic testing should be completed.			
Neurologic Examination: • Reflexes • Myotome • Tinel's sign • Tarsal Tunnel Tests o Dorsiflexion with eversion[29] o Plantar flexion with inversion[30] SLUMP/Straight Leg Raise Test - Neural tension testing to screen for proximal nerve entrapment contribution to the foot and ankle chief complaint.[31]	Understand the proper selection of the tests and measures is dependent on: (1) chief complaint/history (including symptom investigation systems review), (2) demographics, (3) signs and symptoms, and (4) functional level of patient.	Discuss normal and potentially abnormal clinical findings identified from each of the tests used in this area of examination using clinical scenarios. Perform these examination tests correctly and safely. Interpret whether neurologic finding(s) in the foot and ankle are related to another condition of body systems.	Perform neurologic examination measures on a patient. Perform test and measures efficiently and correctly interpret results. Conduct self-assessment of psycho-motor skills and modify performance based on feedback. Interpret and integrate the results into the evaluation and plan of care.
Balance: • Romberg – Sharpened Romberg • Single leg stance or one legged stance test[32] (see Appendix 3) • Balance Error Scoring System[33] o Eyes closed/eyes open o Head neck rotation o Surfaces – foam/no foam o Assess for ankle, knee, and hip strategy	Understand selection of the tests and measures is dependent on: (1) chief complaint/history (symptom investigation and systems review), (2) demographics, (3) signs and symptoms, and (4) functional level of patient. Determine the need for a more in-depth, fall risk testing in selected patients.	Discuss normal and potentially abnormal clinical findings identified from each of the tests used in this area of examination using clinical scenarios. Perform these examination tests correctly and safely.	Perform balance measures on a patient. Perform balance tests and measures and efficiently and correctly interpret results. Conduct self-assessment of psycho-motor skills and modify performance based on feedback. Interpret and integrate the

Star Excursion Balance Test[34] Hop to Stabilization Testing for fall risk – (Berg Balance Score, Timed Up and Go, Tinetti Balance & Gait Assessment)[35] Senior Fitness Test[36]			results in an evaluation and plan of care.
Lower Quarter Screen (LQS)	Recognize the potential for referred pain into the foot and ankle for means of specific examination of other body regions, diagnosis, or potential referral to another health care provider.	Perform the components of a LQS with a classmate. Recognize a referred pain pattern based on LQS examination results.	Perform a LQS on a patient to rule in/out referred pain and the need for specific examination of other body regions.
Functional Outcome Measures Baseline data collection of relevant outcome measures: • Foot and Ankle Ability Measure (FAAM-ADL and Sports) or Foot and Ankle Disability Index • Lower Extremity Functional Scale	Understand selection of the tests and measures is dependent on: (1) chief complaint/history (symptom investigation and systems review), (2) demographics, (3) signs and symptoms, (4) functional level of patient, and (5) patient goals.	Discuss ways in which these outcome measures might be integrated into the clinical system of data collection. Understand the importance of collecting and documenting these data at baseline, periodically and at discharge, and factors that influence when these data collections occur.	Interpret and integrate the results in an evaluation and plan of care.
Evaluation - Diagnosis			
Posterior Tibial Tendon Dysfunction (PTTD)	Describe the continuum of dysfunction. Discriminate between this diagnosis and pertinent differential diagnoses (rules out the following): • stance phase pronation	Describe the location and function of the tibialis posterior, and perform MMT and palpation of same. Describe the associated structural and movement impairments including heel rise	Have experience practicing clinical management of a tendinous structure. Describe exposure to an actual patient, a case study, simulation of a foot tendon problem, or simulated case.

	syndrome without PTTD, • Charcot foot, or • spastic pronation. Describe signs and symptoms, relevant history, and examination including: • tenderness along the tendon course, • reduced calcaneal inversion during heel rise, • weak inversion/plantar flexion, or • abnormal alignment/ movement.	test and associated gait deviations.	Select examination items consistent with severity and nature of the problem.
Plantar Fasciitis[37]	Describe the continuum of dysfunction. Discriminate between this diagnosis and pertinent differential diagnoses (rules out the following): • calcaneal stress fracture, • bone bruise, • fat pad atrophy, • Tarsal tunnel syndrome, • soft-tissue, primary, or metastatic bone tumors, • Paget disease of bone, • Sever's injury, or • referred pain as a result of an S1 radiculopathy. Describe signs and symptoms, relevant history and examination including:	Describe location and function of the plantar fascia including the Windlass mechanism. Perform palpation of the plantar fascia. Describe associated structural and movement impairments including those seen during gait. Perform an examination of potential sources of limited ankle dorsiflexion.	Describe exposure to an actual patient, a case study, or simulation of a heel pain patient. Select examination items consistent with severity and nature of the problem.

	• pain upon palpation of the proximal plantar fascia attachment, • first step pain, or • 1st toe extension reproducing pain at the proximal or distal attachment of the plantar fascia.		
Achilles Tendinopathy[38,39]	Describe the continuum of tendinopathy and progression of symptoms. Discriminate between this diagnosis and pertinent differential diagnoses (rules out the following): • acute Achilles tendon rupture, • partial tear of the Achilles tendon, • retro-calcaneal bursitis, • posterior ankle impingement, • irritation or neuroma of the sural nerve, • Os trigonum syndrome, • Achilles tendon ossification, • systemic inflammatory disease, • insertional Achilles tendinopathy, or • bony enlargement on back of the calcaneus (Haglund's deformity).	Describe location and function of the Achilles tendon. Perform palpation and functional testing (heel rise and MMT). Perform palpation to determine the anatomical location of the tendinopathy. Describe the associated structural and movement impairments including deviations in: gait, unilateral heel rise, single limb hop, or ability to descend stairs.	Describe experience in clinical management of a tendinous structure. Select examination items consistent with severity and nature of the problem for an actual or simulated patient/case study (see sample case study).[39] Discriminate between a tendinous lesion and pertinent differential diagnoses (rule in/out tendinous lesion).

	Describe signs and symptoms, relevant history and examination including: • localized pain and stiffness following periods of prolonged inactivity, • intermittent pain experienced during activity and exercise, • perceived tenderness and pain upon palpation to the Achilles tendon, • positive Achilles tendon palpation test, • decreased plantar flexor strength with either increased or decreased dorsiflexion ROM, and • limited ability to perform repetitive unilateral heel raises compared to the contralateral side.		
Ankle Osteoarthritis (OA) • Nonsurgical • Post-op	Describe signs and symptoms, relevant history and examination for nonsurgical ankle OA: • pain during and after activity, • continuum of joint deformity and loss of motion, or • prior history of ankle instability or trauma. Describe signs and symptoms, relevant history, and examination for post-op OA:	Describe the associated structural and movement impairments. Describe the surgical management of OA including osteochondral procedures, ankle replacement, or ankle fusion (while the current standard of care is ankle fusion for end stage OA). Post-op: Describe and examine the	Describe experience in the clinical management of OA.

	Obtain relevant information about surgical or medical management to identify indications/contraindications for examination and intervention.	tissues involved in the injury and/or surgery including the influence of time on return to function.	
Shin Splints/Medial Tibial Stress Syndrome	Describe signs and symptoms, relevant history and examination including: • pain in the front of the shin, • a patient who has high use (high BMI or activity level) and poor foot alignment, • anterolateral lower leg pain is often associated with the anterior compartment muscles, and/or • anteromedial lower leg pain may be indicative of a stress fracture. Discriminate between this diagnosis and pertinent differential diagnoses (rules out compartment syndrome).	Perform palpation of anterior compartment muscles. Perform palpation of the anterior tibia where there is no muscle coverage. Describe and perform demonstration of the actions of the three muscles in the anterior compartment. Perform correct stretch of each muscle in the anterior compartment including elongation over all the joints each crosses. Describe when to refer the patient to orthopaedics for diagnosis and management of a potential stress fracture.	
Chronic Ankle Instability/Functional and Mechanical[24,40]	Describe signs and symptoms, relevant history, and examination related to chronic (functional and mechanical) ankle instability including: • patients with feelings of instability, • impaired balance and proprioception, and/or	Perform balance and proprioception testing. Perform a group of tests to assess stability of ankle ligaments.	Describe exposure to either an actual patient with ankle instability, a case study, or simulation of a patient with chronic ankle instability. Select examination items consistent with severity and nature of the problem.

	• decreased passive or active ROM. Discriminate between this diagnosis and pertinent differential diagnoses (rules out the following): • peroneal (fibularis) tendon pathology, • accessory ossicles, • Tarsal coalition, • sinus tarsi syndrome, • subtalar sprains with or without instability, • spring or bifurcate ligament damage, and/or • ankle impingement.		
Tarsal Tunnel	Discriminate between this diagnosis and pertinent differential diagnoses (rules out plantar fasciitis). Describe signs and symptoms, relevant history, and examination related to medical management including: • distal production of symptoms with tapping (Tinel's Test) of the posterior tibial nerve pathway,[29,30] • symptoms reproduced with sustained dorsiflexion-eversion of the foot, and • provocative Tinel's test:	Perform palpation of posterior tibial nerve. Perform the Tinel's and provocative Tinel's tests.	Describe exposure to either an actual patient, a case study, or simulation of a foot and ankle case in which they must choose to rule out involvement of the posterior tibial nerve as a source of symptoms.

	symptoms reproduced during tapping of the nerve pathway with the foot in dorsiflexion, maximal calcaneal eversion, and toes extended.[29,30]		
Lateral Ankle Sprain and Syndesmotic/High Ankle Sprain	Describe continuum of dysfunction of lateral ankle sprains and high ankle/ syndesmotic sprain. Describe signs and symptoms, relevant history, and examination including: • pain with palpation of the involved ligaments, • mechanism of injury – inversion/plantar flexion (lateral ankle sprain) vs dorsiflexion and eversion (high ankle sprain/ syndesmotic), and/or • reproduction of ankle instability or pain with special tests. Discriminate between this diagnosis and pertinent differential diagnoses (rules out the following): • peroneal tear, • medial collateral ligament ankle sprain, • Lis Franc fracture/dislocation,	Describe the function of the anterior talo-fibular and calcaneofibular ligaments. Perform palpation of the calcaneofibular and the anterior inferior tibiofibular ligament. Perform a measurement of swelling of the ankle using the figure of eight – in 20° of plantar flexion. Perform a combination of tests to assess ligament stability including: talar tilt, anterior drawer for lateral ankle sprain and external rotation, and squeeze test for high ankle sprain/syndesmotic sprain. Describe the Ottawa Ankle Rules and when to refer a patient for radiograph. Provide rationale for selecting examination items consistent with severity and nature of the problem.	Describe having had exposure to an actual patient, a case study, simulation of a patient with ankle sprain or syndesmotic/ high ankle sprain.

	• subtalar sprain, • Achilles tendon rupture, • lateral talar process injury, and/or • anterior process of the calcaneus injury.		
Hallux Abducto-Valgus (HAV)	Describe the continuum of dysfunction that can be addressed by a physical therapist. Discriminate between this diagnosis and pertinent differential diagnoses (rules out the following): • sesamoid stress fracture, • avascular necrosis, • osteochondral fractures, • chondromalacia, • metatarsalgia, • nerve impingement, • infection, • bursitis, • sesamoiditis, and/or • bipartite sesamoids.[41]	Describe the location and function of the 1st metatarsophalangeal (MTP) and 1st ray. Describe the associated structural and movement impairments including: • palpation, • gait, • static foot alignment, and/or • 1st MTP passive ROM (PROM). Perform an examination of 1st MTP joint motion.	
Hallux Limitus	Describe the continuum and etiology of this dysfunction. Describe signs and symptoms, relevant history, and examination including: • limited accessory motion of the 1st MTP and/or ray, • associated proximal alignment and compensations related to reduced heel rise in gait	Describe the location and function of the 1st MTP, sesamoids, and 1st ray. Describe the associated structural and movement impairments including results of performing: • palpation, • gait examination, • static foot alignment examination,	Describe exposure to an actual patient, a case study, a simulation of hallux limitus. Support selecting examination items consistent with severity and nature of the problem. Perform an examination of the motion of the 1st MTP joint.

	and during function, and/or • atypical function and position of the sesamoid apparatus.[41]	• 1st MTP PROM examination, and/or • flexor hallucis longus manual muscle testing. Perform an examination of 1st MTP joint motion.	
Metatarsalgia	Describe the continuum of dysfunction. Discriminate between this diagnosis and pertinent differential diagnoses (rules out the following): • interdigital neuroma, • plantar keratosis, • Frieberg's disease, • metatarsal stress fracture, • inflammatory arthropathy (such as rheumatoid arthritis seronegative spondyloarthropathy, or crystalline-induced arthritis), • tarsal coalition, • vertical talus, and/or • accessory navicular.[43] Describe signs and symptoms, relevant history, and examination including: • pain upon palpation of the distal 2nd to 3rd metatarsal heads, plantar MTP, and FDL, • special tests including	Describe the location and function of the distal plantar fascia, flexor digitorum longus (FDL), MTP joint capsule, interdigital nerve, and fat pad. Describe the associated structural and movement impairments including results of performing: • palpation, • gait examination, • manual muscle testing of intrinsic foot muscle strength, • Mulder's test,[42] and/or • Tinel's sign.[29,30]	Describe having had exposure to either an actual patient, a case study, or simulation of forefoot pain. Select examination items consistent with severity and nature of the problem.

	Mulders test,[42] and/or • pertinent gait abnormality.		
Neuropathic (Diabetic) Foot	Describe signs and symptoms, relevant history, and examination including: • loss of protective sensation on at least an aspect of the plantar surface of the foot (generally stocking/glove), • signs of autonomic system dysfunction (eg, hair loss, loss of sweating), and/or • diagnosis that can result in loss of peripheral sensation (diabetes, high BMI, idiopathic). Describe signs and symptoms of associated complications: • ulcer formation, • neuropathic Charcot arthropathy, • joint deformity, • impaired balance, • peripheral vascular disease/ischemia, • loss of joint mobility, • loss of foot bone mineral density, and/or • delayed bone and tissue healing.	Perform the following examination items in the foot: • visual examination of skin and nails, • sensory examination of the foot, • palpation of pulses, and/or • passive and active ROM. Perform a footwear examination discriminating between appropriate and inappropriate footwear and orthosis components. Describe deformity and potential consequences of each deformity in people with this diagnosis (eg, hammer/ claw toe, medial and lateral midfoot and hind foot deformity). List and identify strengths and weaknesses of off-loading devices to treat plantar ulcers [eg, total contact castings, walker boots, Charcot Restraint Orthotic Walker (CROW)].	Perform a screen for diabetes during the history. Describe, and as appropriate, observe precautions for insensate feet during examination and intervention. Describe having had exposure to an actual patient, a case study, simulation, or in-class patient lab of an individual with a neuropathic foot. Perform examination of need for assistive device.
Calcaneal Apophysitis (Sever's Injury)/Calcaneal Epiphyseal Fracture	Describe the continuum and etiology of this dysfunction from apophysitis through epiphyseal fracture.	Describe that this problem warrants intervention and that if it is a fracture it may require immobilization for 8 weeks	Describe exposure to an actual patient or a case study of Sever's Injury that includes its PT management.

	Explain that this type of fracture cannot be diagnosed through x-ray, but rather is made through signs and symptoms and responses to management. Describe signs and symptoms, relevant history, and examination including: • pain at the heel, usually right at the posterior most tip, • patient is a child of an age when their calcaneus has not fully fused (5-14 years), • history of high activity level and/or growth spurt, and • patient stands with heels in eversion relative to subtalar neutral and may have associated dysfunctions, such as functional or real leg length discrepancy, shin splints, proximal compensations and associated pains and dysfunctions. Some evidence has shown that these children are putting more weight on their heels during gait.[44]	followed by rehabilitation (stretching, strengthening, balance work, etc). Describe that the mechanism of injury is that the heel cord is tight and pulls the calcaneal epiphysis apart. Perform appropriate secondary tests to address force distribution. Describe/perform intervention to address aberrant motion including fabrication/ adaptation of temporary foot orthoses and heel lifts to support medial arch and/or hind foot.	

Fracture (5th metatarsal,[45] navicular, midfoot)	Describe signs and symptoms, relevant history and screening examination including: • pain with palpation, • inability to weight bear for 4 steps, and/or • high incidence of non-union. Describe signs and symptoms, relevant history, and examination related to medical management including to obtain relevant information about surgical or medical management to identify indications/contraindications for PT examination, intervention.	Describe signs and symptoms, relevant history, and examination of fracture when performing palpation of bony structures of the foot and ankle. Describe a timeline to guide progression of care following the medical or surgical management of a fracture.	Describe having had experience with PT clinical management post fracture.
Equinus related to any or all of the following: • passive tightness of plantar flexors, • dynamic tightness of plantar flexors (spasticity), • poorly timed dorsiflexion activity, or • weak or absent dorsiflexors.	Describe signs and symptoms, relevant history, and examination related to medical management including: • PROM dorsiflexion less than 10° with the knee extended avoiding pronation, • lack of heel strike during initial contact phase of gait, • early heel off during gait (mild muscle shortening), • stands with heels on ground and pronation or supination, walks on toes (moderate muscle shortening), and • stands and walks on toes	Discriminate between those that do, and do not, attain heel strike during initial contact phase of gait. Describe all the plantar flexor muscles that could be tight, active at the wrong time, or shortening too much. Perform PROM measurements of dorsiflexion with and without pronation, with and without knee flexion. Describe the likely presence of initial resistance (R1) vs ultimate PROM (R2) in patients with spasticity.	Describe having had exposure to an actual patient or a case study involving clinical management of an equinus foot problem including discriminating between origins of the equinus. This involves performing, or describing, an examination that discriminates between tight plantar flexor muscle(s), joint limitation (s), poorly timed plantar or dorsiflexion, or excessive plantar flexion activity. Discriminate between specific situations when referral is warranted being specific as to the type of referral (PT with neurological expertise, MD

	(severe muscle shortening). Describe need to work on motor control in patients needing that intervention including potentially using FES based "neuro-prosthetic" technologies such as Bioness or WalkAide Walking Systems.		skilled in management of spasticity including botulinum toxin injections, orthopaedic surgery, neurosurgery, and/or orthosis fabrication). Describe that which discriminates a patient with plantar flexor spasticity from other patients.
Stance Phase Foot Supination Syndrome	Describe signs and symptoms, relevant history, and examination including: • related source diagnosis including tibial stress fracture, plantar fasciitis, metatarsal (MT) stress fracture/metatarsalgia 1 and 5, sesamoiditis, fibularis tendinopathy/ tear, Achilles tendinopathy, HAV, bunionette, hallux limitus; • hind foot inversion, talonavicular elevated, forefoot adduction, plantar flexion 1st ray, reduced lateral arch height during gait, hopping, running, and stepping; • callus formation at 1st and 5th metatarsal heads; • footwear worn on lateral border; • force distribution and/or addressing aberrant	Discriminate pronation during the stated movements from other motions. Perform appropriate secondary tests to reduce aberrant motion (verbal/tactile cueing, taping, and orthosis fabrication and/or use). Recognize and describe the relationship between center of mass displacement and foot movement during gait.[46]	Support selecting examination items consistent with severity and nature of the problem. Discriminate excessive or poorly timed foot pronation from other motions during gait in a patient. Describe having had exposure to actual, simulated, and/or a relevant case study of foot pronation syndrome.

	motion reduces signs and symptoms; and/or • associated proximal malalignment and compensation (functional leg length discrepancies, lateral femoral rotation).		
Plan of Care - Intervention			
Therapeutic Exercises • Balance • Strengthening • Stretching • Endurance • Functional training • Work hardening[47]	Select and perform appropriate therapeutic exercises. Demonstrate alternative strategies for applying different interventions: • apply principles of safe practice to patient/client care base on needs, • deliver interventions based on the best evidence available and practice guidelines, and • demonstrate knowledge of how to find this evidence. Recognize and describe the relationship between center of mass displacement and foot movement during gait.[46]	Discuss rationale for selecting specific therapeutic exercises, including dosage. Demonstrate the ability to instruct or perform selected interventions. Discuss the principles of exercise progression. Practice providing instruction related to special interventions for the foot/ankle, including (but not limited to): • stretching of gastrocnemius protecting the mid-foot, • stretching the plantar fascia, • foot intrinsic/extrinsic strengthening, and/or • proximal muscle strengthening including muscles of the core, pelvis, and full lower extremity.	Design, implement, and progress an appropriate plan of care. Monitor patient response to interventions and modify as appropriate. Use objective measures to document change.

Addressing Abnormal Motion
• Excessive Motion
  o Bracing
  o Strapping
  o Foot orthoses
• Limited Motion
  o Mobilization
  o Manipulation
	Discuss the rationale and best available evidence for each of the interventions used to control motion.
	
	Discuss indications and contraindications for motion control, including bracing and strapping.
	
	Recognize the implications of interventions on the various segments of the kinetic chain.
	
	Select and perform appropriate joint mobilization techniques aimed at increasing motion.
	
	Discuss the rationale, indications, and contraindications for manipulation.
		Excessive Motion
		Describe the indications/ contraindications, recommendations, and considerations related to bracing the foot and ankle:
		• knee ankle foot orthosis (KAFO),
		• ankle foot orthosis (AFO),
		• cam walker (Boot),
		• stirrup, or
		• lace-up.
		
		Describe indications/ contraindications for strapping/taping of foot and ankle, practice one of the following techniques:
		• Ankle Instability
		  o Stirrup
		  o Basket weave
		  o Heel lock
		• Medial Arch
		  o Low-dye
		  o Cross X
		  o Reverse six
		• Edema
		  o Compression wrap with pressure gradient
		• Musculotendinous support (Achilles wrap)
		
		Recognize a patient case where management with foot orthoses would be appropriate.
			As available, observe or participate in the prescription, fabrication, modification, or dispensing of bracing:
			• KAFO,
			• AFO,
			• cam walker (Boot),
			• stirrup, or
			• lace-up.
			
			Observe or participate in the prescription, fabrication, modification, or dispensing of foot orthoses:
			• custom,
			• customizable prefabricated,
			• prefabricated, or
			• accommodative.
			
			Demonstrate proper technique when performing at least one joint mobilization of the foot/ankle complex.

		Understand the mechanism by which a foot orthosis restrains or encourages motion. Observe/discuss methods of fabrication, modification, and fitting of a foot orthosis. Fabricate a slipper cast and assess forefoot to hind foot alignment based on this cast. Limited Motion Demonstrate correct hand placement and technique when providing grade I-IV joint mobilizations to all articulations of the foot/ankle, 1st MTP, and inferior and superior tibiofibular joints. Discuss the rationale for mobilization parameters chosen. Identify indications for and safely perform manipulations: • Talocrural distraction • Subtalar joint • Cuboid whip	
Modalities	Discuss indications, contraindications, and precautions for using therapeutic modalities. Select and perform appropriate therapeutic modalities.		Monitor patient response to modalities and make modifications as necessary.

Patient Education	Discuss specific clinical conditions with the patient and/or family, including etiology, intervention options, and prognosis. Educate patient regarding appropriate self-management strategies. Identify and discuss risk factors and strategies for injury prevention.	Provide instruction regarding precautions with loss of sensation (eg, do not use foot to assess temperature of bath water, at least daily examination of plantar foot skin integrity, wear protective footwear whenever walking).	Discuss footwear considerations for athletes or patients with: • Diabetes • Peripheral neuropathy • Peripheral edema • Upper motor neuron lesions o Spasticity o Flaccidity • Trauma • Arthritic conditions o Osteoarthritis o Rheumatoid arthritis
Footwear	Identify and discuss the structural features of a shoe. Discuss critical features of proper shoe fitting. Describe the indications/ contraindications and ramifications of various forms of footwear and footwear modifications, (including ankle foot orthoses, cam walkers, splints, or foot orthoses - prefabricated, customizable or custom), and other specialized footwear, or casting. Describe reasons and options for referral (including those to physicians, other therapists, orthotists, or shoemakers).	Demonstrate shoe fitting knowledge with specific attention to: • Length • Toe box width • Toe box depth • Curvature of the last Make recommendations for footwear options based on patient presentation: • Diabetic population • Pronation syndrome • Supination syndrome • Neurologic population • Arthritic population Discuss the rationale for various features of a shoe, orthosis, or other footwear modification. Identify the specific components of a shoe:	Recommend footwear and/or footwear modifications to address a particular clinical condition: • Running population o Stability o Motion control o Cushioning • Diabetic population o Cushioning o Pressure distribution o Adequate toe box width/depth • Refer to appropriate other providers as necessary.

		• Toe box • Heel counter • Vamp • Mid-sole • Sock liner	

Appendix 1A. Foot and Ankle Special Interest Group Gait Form Key[48-50]

Gait Velocity: Normal or Abnormal Cause	NOTES	Stride length: Equal? Yes----NO If no, what is cause?	NOTES	Cadence: Normal or Abnormal Cause	NOTES
Phase of Gait- Reference Limb Circle Left or Right	**Initial Contact Loading Response**	**Mid Stance**	**Terminal Stance**	**Pre Swing - Initial Swing**	**Initial Swing, Mid Swing, Terminal Swing**
Task of Gait Normal Functional	**Weight Acceptance** Heel strikes-takes weight Limb contacts-takes weight	**Single Limb Support** Stable - normal Stable – even if not WNL	**Forward Weight Shift** Heel off/ Hallux extension Effective forward weight shift	**Limb Advancement (Acceleration)** Hallux extension/ Toe off Limb accelerates and lifts	**Limb Advancement (Deceleration)** Full, controlled step Limb clears – then decelerates
ROCKER	**Heel rocker**	**Ankle rocker**	**Forefoot rocker**	**Forefoot rocker**	
Ankle Motion: Normal	Strikes in relative DF moves into PF via foot to ground faster than tibia moves forward	From PF into DF of ankle (via lower leg moving over foot)	DF of ankle reaches peak of 5-10° and starts to PF	Motion to 25° of PF assists knee flex (with quick hip flexion to shorten limb)	Ankle remains in PF during initial swing but is moving into DF, need knee flexion to clear the limb
Ankle Motion: Common Abnormal Findings	Uncontrolled PF Low foot contact* Forefoot contact	Excessive DF (knee flexion in mid stance) Early heel rise No forward lower leg progression over foot.	No heel rise prior to contralateral contact Contact area too lateral	Lack of PF contributes to less knee flexion and loss of forefoot rocker	Toe drag in initial swing Failure to achieve neutral ankle for initial contact
Foot Motion: Normal	Foot pronation (best seen with calcaneal eversion and unlock of midtarsal joints)	Early mid stance pronation may continue, should see pronation cease late mid stance and supination begin	Rise of heel off the ground should see supination to allow the foot to be rigid with decrease weight bearing contact Windlass mechanism	MTP joints continue to extend, weight should progress over the 1st MTP joint, supination of hind foot is maintained	Foot comes off the ground in the position it maintained in pre swing Good place to look for excessive pronation
Foot Motion: Abnormal	Excessive calcaneal eversion Limited calcaneal eversion Excessive midtarsal joint unlock Limited midtarsal joint unlock	Midtarsal joints remain unlocked Midtarsal joints remain locked Excessive inversion of hind foot continues Excessive eversion of hind foot continues	Midtarsal joints remain unlocked 1st ray does not PF Midtarsal joints remain locked 1st ray in too much PF Hallux does not start to extend	Lack MTP joint extension Excessive MTP extension Roll off the side of 1st MTP joint Roll off lateral forefoot	Foot comes off ground in excessive pronation Foot comes off the ground in excessive supination
Phase of Gait - Contralateral Limb	Pre to Initial Swing	Initial to Mid Swing	Mid to Terminal Swing	Initial Contact Loading Response	Mid and Terminal Stance

*"Low foot" – refers to no forefoot contact, but not enough ankle dorsiflexion

Abbreviations: WNL, within normal limits; PF, plantar flexion; DF, dorsiflexion; MTP metatarsophalangeal

Appendix 1B. Foot and Ankle Special Interest Group Gait Form

Gait Velocity: Normal or Abnormal Cause	NOTES	Stride length: Equal? Yes----NO If no, what is cause?	NOTES	Cadence: Normal or Abnormal Cause	NOTES
Phase of Gait Reference Limb Circle Left or Right	**Initial Contact Loading Response**	**Mid Stance**	**Terminal Stance**	**Pre Swing – Initial Swing**	**Initial Swing, Mid Swing, Terminal Swing**
Task of Gait	**Weight Acceptance**	**Single Limb Support**	**Forward Weight Shift**	**Limb Advancement (Acceleration)**	**Limb Advancement (Deceleration)**
Normal Functional	Yes---NO Yes---NO	Yes---NO Yes---N	Yes---NO Yes---NO	Yes---NO Yes---NO	Yes---NO Yes---NO
ROCKER	**Heel rocker**	**Ankle rocker**	**Forefoot rocker**	**Forefoot rocker**	
Normal	Yes---NO	Yes---NO	Yes---NO	Yes---NO	
ANKLE MOTION					
Normal	Yes---NO	Yes---NO	Yes---NO	Yes---NO	Yes---NO
If NO what is deviation?					
What are possible causes for the deviation from normal?					
FOOT MOTION					
Normal	Yes---NO	Yes---NO	Yes---NO	Yes---NO	Yes---NO
If NO what is deviation?					
What are possible causes for the deviation from normal?					
Phase of Gait - Contralateral Limb	Pre to Initial Swing	Initial to Mid Swing	Mid to Terminal Swing	Initial Contact Loading Response	Mid and Terminal Stance

Appendix 2. Average Normative Values from Various Studies for a Single Heel Rise Test

Author	Sample	Average Repetitions	Technique
Madeley, 2006[51]	Young athletes (n = 30) (mean age = 24 ± 5.7)	39 ± 11.7	Strings were used to document heel height and trunk position. The test was terminated if the participant leaned forward touching the string at the level of the pectorals three times, the ipsilateral knee flexed, the dorsal aspect of the foot did not contact the string for 3 consecutive repetitions, or the participant could no longer continue. At this point, the number of heel-rise repetitions that were performed was documented. One trial was used for this test.
Lunsford, 1995[52]	Adults (n = 203) (mean age men = 34.7 ± 8.5, mean age women = 29.3 ± 5.0)	27.9 ± 11.1	Each subject was allowed to touch the examiner with a single finger for balance. The test was terminated if the subject leaned or pushed down on the examiner, the subject's knee flexed, the plantar flexion range of motion decreased by more than 50% of the starting range of motion (measured quantitatively), or the subject quit or asked to stop.
Jan, 2005[53]	Adults (n = 180) (21- 80 years old)	Male 21 - 40 = 22.1 ± 9.8 41 - 60 = 12.1 ± 6.6 61 - 80 = 4.1 ± 1.9 Female 21 - 40 = 16.1 ± 6.7 41 - 60 = 9.3 ± 3.6 61 - 80 = 2.7 ± 1.5	One examiner provided the finger-touch support and counted the total number heel rises accomplished. Another examiner observed the participant laterally for any extraneous trunk lean or knee flexion. The third examiner read the electro-goniometer output on the monitor and terminated the test if the plantar flexion angle became less than 50% of the maximum angle.

Appendix 3. Normative Values for the Single Limb Balance Test

	Age	Gender	Eyes Open Mean of 3 Trials	Eyes Closed Mean of 3 Trials
			Mean	**Mean**
Single Limb Balance (in seconds)[32]	18-39	Male Female	43.5 ± 3.8 43.2 ± 6.0	8.5 ± 9.1 10.2 ± 9.6
	40-49	Male Female	40.4 ± 10.1 40.1 ± 11.5	7.4 ± 6.7 7.3 ± 7.4
	50-59	Male Female	36.0 ± 12.8 38.1 ± 12.4	5.0 ± 5.6 4.5 ± 3.8
	60-69	Male Female	25.1 ± 16.5 28.7 ± 16.7	2.5 3.1
	70-79	Male Female	11.3 ± 11.2 18.3 ± 15.3	2.2 1.9
	80-89	Male Female	7.4 ± 10.7 5.6 ± 8.4	1.4 1.3

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