THE COLLEGE OF PEDORTHICS OF CANADA

Study Guide

Workbook 1

Pedorthic Foundations

The College Of Pedorthics Of Canada

The College of Pedorthics of Canada is a national self-regulatory body whose primary purpose is to protect the Canadian public who receive foot-related services from Canadian Certified Pedorthists.

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We ensure that certified members are accountable to the highest standards of practice through our certification of members and facilities, the monitoring of continued competency and the enforcement of ethical conduct.

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LEARNING OBJECTIVES

1. Develop strategies using your structural and functional anatomy knowledge to identify the injured structure, determine what tests to do in assessment, and determine appropriate treatment options.

2. Utilize fundamentals in biomechanics to better understand the presenting problem, understand compensations, determine testing during the assessment, and develop appropriate treatment options.

3. Develop best practices in history taking within a pedorthic clinical setting.

4. Develop best practices of non-weightbearing and weightbearing assessment in a pedorthic clinical setting.

5. Define fundamental pedorthic terminology.

RATIONALE

What is the purpose of this learning material?

This workbook will help learners review key concepts and develop best practices using the fundamentals of Pedorthics - anatomy, biomechanics and assessment in a clinical setting. It can be used to bridge the gap between academic studies and practical clinical experience, readying the learner for a greater development of these fundamentals in other workbooks and in professional clinical setting.

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When you complete this objective you will be able to identify the assessment process to help offer treatment and preventative options by treating the patient as a whole.

ANSWER KEY & TERMINOLOGY

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Workbook excersise answer key.

LEARNING OUTCOMES

When you complete this module you will be able to...

Apply key concepts and develop best practices of anatomy, biomechanics and assessment strategies in a professional pedorthic setting.

INTRODUCTION

Pedorthists see patients when the foot structure or lower limb function is thought to be a contributing factor to a presenting problem, or a concern for future problems. At times, the presenting problems will be common and familiar, and at other times the cases will be less common or completely new to you.

Generally, patients will come with a referral from a medical doctor that has a diagnosis. But there will be times when a physician does not know what the problem is, and the physician is looking for your expertise to help determine if the problem is treatable with pedorthic treatment.

This workbook is also an excellent guide for you to use throughout your placement or apprenticeship, with your supervisor, to promote an interactive, effective learning experience. If there are areas where you need clarity you are urged to reach out to your supervisor and work through any areas of concern or confusion. You may want to seek out several opinions to broaden your learning experience.

Seeing a new patient can at times be a challenge, and when you are young in the profession, it can be a bit scary. But as anatomy, biomechanics, orthotic and footwear experts, we have a tool box full of tools that can help us provide answers.

Our pedorthic tools are:

- *Anatomy and biomechanics knowledge*
- *Assessment skill*
- *Gait analysis specialization*
- *Orthotic and footwear design and fabrication expertise*

This workbook will review key concepts and develop best practices using most of the tools in our tool box to help our patients.

This is the first workbook in a series of five designed to sharpen your pedorthic knowledge and better ready you for clinical practice. This first workbook is intended to start with the basics – the foundations of pedorthics. It will take your current knowledge of anatomy, biomechanics, assessment, and terminology and apply them into your clinical apprenticeship or internship. It will help you establish key concepts and develop best practices that are foundational to pedorthic clinical practice. Development of these fundamentals will be important for the underpinning of the other workbooks that will go into greater depth in these topics.

Throughout this workbook, key pedorthic words and acronyms will be bolded. The bolded words are further explained in the Glossary of Terms at the end of this workbook.

OBJECTIVE ONE

Anatomy Concepts

When you complete this objective you will be able to…

Develop strategies using your structural and functional anatomy knowledge to identify the injured structure, determine what tests to do in an assessment, and determine appropriate treatment options.

LEARNING MATERIAL

Our anatomy knowledge provides us with the understanding of the structures in our body and how they work. Our skeleton is the basic framework of our body. Each groove, tubercle or trochanter has a purpose. Ligaments hold one bone to another, allowing most joints to move, helping control their range of motion and providing stabilization so that the bones move in proper alignment. It is the muscles and their tendons that have contractile properties and the ability to produce force and move the bones, or to provide strength to maintain a position. And it is the nerves that transmit signals from our brain and spinal cord to the muscles to make them work. An understanding of this intricate system of tissues is key to a pedorthist understanding how a patient functions, and how we can help our patient.

This objective is designed to take your pre-existing understanding of structural and functional anatomy and develop key critical thinking skills in your practical pedorthic setting to help you reach your assessment and treatment goals. It will provide you with:

- Exercises to review your knowledge of structural and functional anatomy and corresponding conditions, and to apply this knowledge in pedorthic specific settings.
- Examples of best practices using your knowledge of anatomy for:
  - Identifying what structure(s) may be injured
  - Determining what tests to perform in your assessment
  - Deciding which treatment options are available or best for your patient
- Activities for implementing best practices into your clinical setting.

Exercise 1.1

Fill-in-the-Blank Anatomy Charts for Anatomy Review

This objective, and ones that follow in this workbook, requires you to recall your structural and functional anatomy as you follow processes and examples of best practice. To make it easier to follow the processes, let's take some time to put your pre-existing knowledge in charts. Completing these charts will be a good anatomy review. The completed charts will be helpful resources as you work through this objective and while you practice the processes in your clinical practice. Feel free to use your anatomy textbooks or reputable anatomy websites to help you complete this activity – we all tend to forget details when we don't use them regularly.

For this activity, we will divide the foot into 3 regions - forefoot, midfoot, and hindfoot/rearfoot. The lower limb will be divided into the 2 regions – pelvis and upper leg, knee and lower leg. The ankle joint will be considered part of the hindfoot.

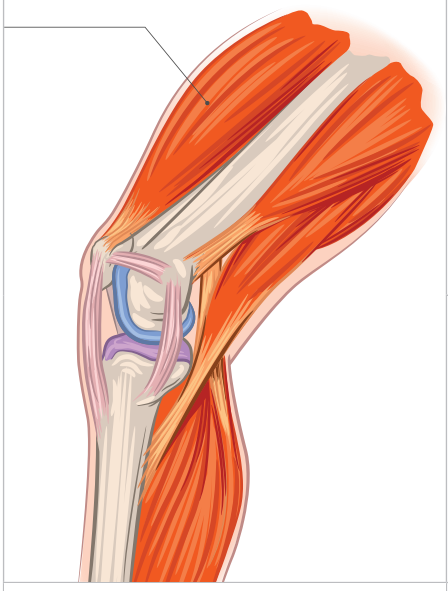
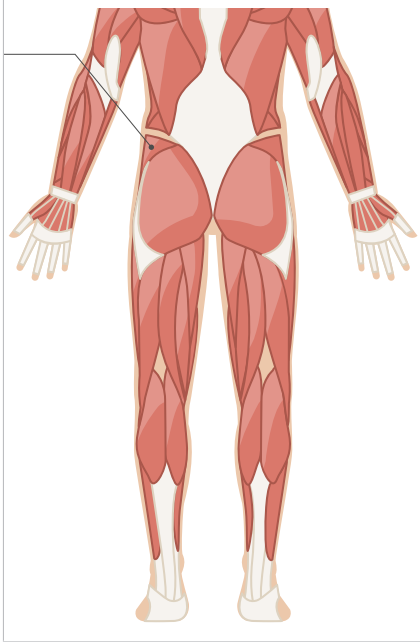
To the left you will find 5 fill-in-the-blank charts, each focusing on a different region of the lower limb: Forefoot, Midfoot, Hindfoot, Lower Leg, and Upper Leg. An answer key is provided at the back of this workbook for each of the charts. Keep in mind that the answers provided are just suggestions and examples to make sure you are on the right track. It is ok if your answers are slightly different, so long as you cover the important basics in the answer key.

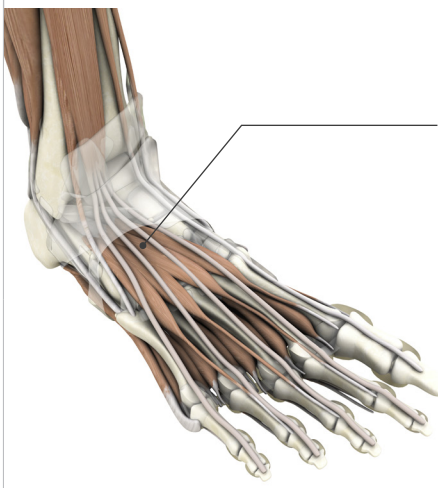
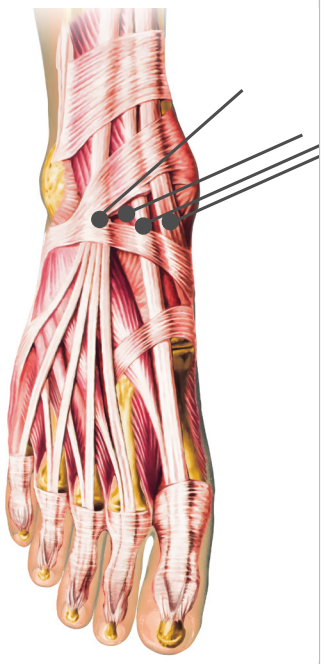
Fill-in-the-Blank Anatomy Charts for Anatomy Review

- List all the bones in that region of the foot/body.
- List all the joints in that region. For each joint, identify the movement(s) available at that joint.
- List all the muscles and be aware of their attachments. Identify the action(s) of each muscle.
- List all the important ligaments in that region.

Exercise 1.2

Applied Anatomy Review Questions

	**The following diagrams show the origin and insertion of a muscle. Name the muscle and describe its function and innervation.**
	In addition to naming the muscle and its innervation, describe the influence this muscle may have on knee function.
	**Name the muscle pinned and the muscle it most closely influences. Describe its function.**

	**Name the muscle, describe its function and its innervation. What other muscles are innervated by the same nerve?**
	Name the ligaments that are indicated and describe their function. What are the structural implications of damage to these ligaments?
	**Motion occurs in three cardinal planes. Name the planes and using the planes as reference describe how motion in the foot differs from that in the lower leg.**

Best Practices Using Anatomy Knowledge

With every patient you see there are 3 key questions that you the pedorthist need to answer, each answer relying on your anatomy knowledge. This objective will guide you through a thought process that will help you develop critical thinking skills to find the answers to these key questions.

1. What structure or type of tissue is injured?
2. What tests do you need to perform in your assessment?
3. What are the best treatment options for your patient?

Determining What Structure or Tissue is Injured?

In some cases, our patients will come to us with a diagnosis from a medical doctor. However, there will be many times when a patient comes without a referral, without a diagnosis, or with symptoms that have changed since they saw the doctor. While it is not our job to diagnose, we have a responsibility to understand our patient's case as best as we can and try to determine or confirm to the best of our abilities, what tissue is injured if an injury is present. Much like being a detective, we look for clues and "put the pieces together to solve the case". When trying to figure out what type of tissue(s) or specific structure(s) are injured or involved, there are steps that can be taken to help with this process.

6 Questions to Help Identify the Injured Tissue

1. If pain is present, where is the pain located?
    - If your patient has symptoms, have the patient point to where it hurts. Just asking them to tell you where it hurts can end in a miscommunication. For example, they might say "the ball of the foot" referring to their heel in the hindfoot but you believe they are referring to the metatarsal heads in the forefoot.
    - Once the area is identified, we need to use our knowledge of anatomy in that area to consider all the tissues it might be. Look back to your anatomy chart fill-in-the-blank exercise, and we can identify tissues or structures that we need to consider.

2. How is the pain described?
    - Knowing how the pain is presenting can narrow down your list of possible tissues involved.
    - The properties of the pain can help identify the tissue. For example, pain described as burning, tingling or numbing is often associated with nerves. Pain that is deep and boring is often associated with bones.

3. When is the pain present?
    - Different tissues respond differently to periods of rest or activity. Understanding when pain is present, and how it changes with rest or activity can help you identify the type of tissue you are dealing with.
    - For example, muscle pain can hurt when a muscle is first initialized, but often subsides as the muscle "warms up". Bone pain is often characterized by pain during activity and at rest.

4. Was there an injury?
    - If yes, what was it? Knowing the mechanism of injury can help you identify what anatomical structures may have been injured and should be considered.

5. Can you reproduce the pain?
    - Questions 1 through 4 are often asked during the history taking portion of an assessment. When you get to the hands-on portion of the assessment, you will want to tailor your choice of assessment tests to involve the tissues that you have narrowed down during the history taking.

    Different techniques to reproduce symptoms can include:
    - Palpation - palpate the structure(s) you suspect and the surrounding structures in the region of pain.
    - ROM testing - check active and then passive ranges of motion of joints to identify if any restrictions are present or if any pain is reproduced with motion.
    - Functional testing - perform weightbearing and non-weightbearing tests that will use the tissues that you suspect are injured to see if these movements elicit symptoms.

6. Have you ruled out other tissues or conditions that may have similar symptoms?
    - Don't forget to test the other tissues or conditions that may have similar symptoms to further rule out tissues or conditions.

This is not an exhaustive list of questions to ask your patient, but these questions use our fundamental anatomy knowledge and are key to answering our first important question – what structure is injured? We will look at the history taking and assessment process in more detail in Objectives 3 and 4, and in other workbooks.

CONTINUED

WHAT IF THE ANSWERS PROVIDE CONFLICTING RESULTS?

If you find that your patient's answers to each question point to a different tissue, don't worry. You are just trying to narrow down your findings, and there will be times when you cannot identify a specific tissue injury or a specific condition. Further communication with the referring health care practitioner may be needed.

WHAT IF THE PATIENT HAS NO SYMPTOMS?

There will be times when a patient comes in to your clinic with no symptoms. Maybe they just need to replace an old orthotic or pair of shoes before symptoms return. Or maybe they have a structural problem that has been identified and your job is to help reduce the possibility of that patient developing symptoms. You still need to perform a thorough assessment, so ask the same key questions, ensuring that there are no hidden issues the patient has not considered, or thinks is irrelevant.

Determining What Tests to Perform During Assessment

KEY QUESTIONS TO ALWAYS ASK YOURSELF DURING ASSESSMENT WHEN YOU HAVE NARROWED DOWN THE POSSIBLE TISSUES:

1. What tests are available to test the tissue(s) you have identified?
    - For example, if you believe that the Achilles tendon is injured, you would want to test the gastrocnemius and soleus muscles function in non-weightbearing and weightbearing scenarios, active and passive muscle tests, check ankle dorsiflexion and plantarflexion, and palpation of the gastrocnemius, Achilles tendon, Achilles tendon insertion.
2. Choose at least 2 tests (if more than one is available to you) and perform them.
3. What are other conditions or tissues that may have similar symptoms?
4. Have you ruled out the other possible tissues or conditions?
    - In the case of the Achilles tendon mentioned above, we should rule out Achilles bursitis, Sever's disease if this is a growing child, retrocalcaneal bursitis, superficial calcaneal bursitis.
5. What tests can you perform to rule out these other conditions?
6. Perform at least one test for every possible condition you have considered.

ASSESSING INJURIES WITHOUT CONCLUSIONS

There will be times when you will perform numerous tests and are not able to determine what structure is injured or what condition may be present. Communicate your findings with the family physician and/or referring health care practitioner. In many cases you will have spent more time assessing than they did, and your findings may help them determine a diagnosis, or make decisions for diagnostic imaging or next steps in their treatment.

If you believe that the structure or function of the foot is a contributing factor to your patient's current condition, or a risk for the future, let you patient know and explain how you can help them. If you don't think your patient needs pedorthic treatment, communicate that to your patient and their referring professional. Not only will they appreciate your honesty, but you will avoid starting down the path of possible endless adjustments and possible delays in other treatments as you try treating a patient you are unable to help. Be sure to let them know if an alternate treatment such as manual therapy may be worth considering or suggest they return to their family physician or referring health care practitioner.

Determining What Treatments to Consider

Pedorthic treatment options for your patient should always account for the following:

- Age and weight of your patient
- Activities of daily living at home, work, and sports or other leisure activities
- The condition that they are presenting with
- The structure and function of their foot

Key Questions to Ask Yourself When Considering Pedorthic Treatment:

Is pedorthic treatment appropriate?

If your assessment findings suggest that the function or structure of the foot or lower limb may be a contributing to the presenting problem, pedorthic treatment should be considered.

If you don't believe the presenting problem is related to the foot or lower limb, referral back to the referring physician would be appropriate. For example, if a patient is diagnosed with a neuroma but you think the numbness is related to an L5 nerve impingement, refer the patient back to their doctor. Make sure you send a copy of your assessment to the referring professional so that your findings can be considered in the next steps for the patient.

If pedorthic treatment is appropriate, what are the goals of your treatment?

Your goal will depend on what the problem is, and what the contributing factors of the foot and lower leg may be.

- Alleviate or reduce painful or debilitating symptoms?
- Redistribute external pressures?
- Redistribute internal forces by reducing tension or load placed on injured tissues?
- Control the rate or magnitude of excessive motions?
- Accommodate fixed deformities?
- Improve balance?
- Improve function?
- Reduce risk of future problems?

What pedorthic treatment options will best reach these goals?

- Education or stretching program
- Footwear recommendations or modifications
- Foot orthoses
- Custom made footwear
- Dorsiflexion night splints
- Toe splints and spacers or other products that reduce friction and pressure for the toes, bunion, bunionette or other point tender areas of the foot
- OTC foot drop brace or ankle brace
- Compression hosiery

Are there non-pedorthic treatment options that your patient could benefit from?

- Manual therapy such as physiotherapy, massage therapy or osteopathy
- Referral to another specialist

CASE STUDIES

Applying Structural and Functional Anatomy

Each of these 3 case studies will walk you through the thought processes that you as a pedorthist should follow during your patient history taking and assessment. Answers are provided in the back of the workbook. Keep in mind that the answers provided are just suggestions and examples to make sure you are on the right track. It is ok if your answers are slightly different, so long as you cover the important basics in the answer key and have reasonable justification for your clinical decisions.

Exercise 1.3

Case Study 1:

A patient presents with a referral that has a diagnosis of plantar fasciitis. She is 11 years old, plays soccer 2 times per week, loves to run around her yard with friends, and rides her bike for 10-20 mins at least 3 times per week. She is in overall good health. She has no history of broken bones, sprains, or significant injuries. There are no underlying medical conditions.

- Where is the pain located? The patient indicates on the bottom of her heel.
- Can you point to where the pain is? She points to the apex of her heel.
- How would you describe the pain? It really hurts.
- Is it numb? Tingling? Burning? Sharp? Dull? Aching? Aching.
- When do you feel the pain? While I am running or playing soccer, sometimes even when I am lying down at night.
- Is it sore in the morning when you get out of bed? No.
- Does the pain go away while you are playing soccer? No. Sometimes it gets worse.
- Is it sore when you stop playing soccer? Yes. Sometimes.
- Does it really hurt when you get out of the car after coming home from a soccer game or practice? Yes.
- Was there an injury? No.

Assessment Questions

1. Even though this patient has a diagnosis, you need to think of all the structures that could be involved. What structures do you need to consider at the apex of the heel?
2. Do her symptoms match the diagnosis of plantar fasciitis? Explain your answer.
3. What other conditions should you be investigating with the symptoms presenting?
4. What tests should you include in your assessment?

CASE STUDIES

Case Study 2:

A patient presents with a referral with a diagnosis of pes planus. He is 75 years old and noticed that his “left arch collapsed” in the last year. He is normally very active in senior exercise classes 4 times a week, likes to go for 45 minute walks most days of the week, and is in good health with no underlying medical conditions. He has no history of fractures, sprains, or significant injuries.

His footwear choices include 3 year old walking shoes for his walks and exercise classes, moccasin style slippers around the house, slip on deck shoes when he is out running errands.

Assessment Questions

1. What are important questions to ask this patient?
2. What muscle group should you be most concerned about with his acquired pes planus? What is the primary muscle in this group? What are secondary muscles in this group? What other functions do these same muscles have?
3. What structural implications do you expect when dysfunction of the tibialis posterior exists?
4. What other weightbearing and non-weightbearing tests should you perform?

Case Study 3:

A 58-year-old woman presents with pain in her right SI joint region for years that is getting worse. She is now concerned that she will not be able to finish her 5 hour shifts at work. The doctor has referred her to you because her left foot pronates excessively. She is overweight, does not participate in any exercise, and works in a retail store as a cashier for 20 hours per week. She has never had any surgeries on her legs or feet, but she did break her right tibia and fibula when she was 5 years old and was in a cast for months. Other than high blood pressure, she has no other known medical conditions.

Assessment Questions

1. What are important questions to ask this patient?
2. Why is it important to know that she had a tibial and fibular fracture at the age of 5 that was casted? How does this information influence your assessment?
3. What tests are important to perform for this patient?

ASK YOUR MENTOR

Make an appointment with your mentor and be clear that it will take no more than 15-20 minutes for this exercise.

- Ask your mentor to take a few minutes to look over your answers to the case studies.
- Ask their opinion about what they would change about your answer (if anything) and why?
- Ask if any patient profiles come to mind and if they can briefly describe the profile and the outcome.

OBJECTIVE TWO

Biomechanics Concepts

When you complete this objective you will be able to…

Utilize fundamentals in biomechanics to better understand the presenting problem, understand potential compensations, determine testing during the assessment, and develop appropriate treatment options.

LEARNING MATERIAL

Biomechanics is the study of how structures and systems in our body react to various forces and stimuli; it describes how the muscular and skeletal systems work under different conditions and helps us understand their limits and capabilities. For example, look at the two contradictory main functions of our lower limbs during gait – to be flexible and supple enough to adapt to the surface on which we walk to provide shock absorption, and then to be strong and rigid to propel our body forward through toe-off.

A variety of factors can influence our movements: the type or condition of terrain we walk on, the types of shoes we wear, different forces acting on our body, different properties of each of these forces, and the unique anatomy of the body parts moving.

Movement of a body part occurs about a joint's axis of rotation. The location of a joint's axis depends on the shape of the joint surfaces, but the movement(s) that occurs about this axis is determined by a combination of forces acting on the body part. These forces that are either accelerating/producing, decelerating/resisting, or stabilizing motion all at the same time include:

- *Muscular forces that result from the contraction of a muscle. These contractions can be concentric, eccentric or isometric in nature.*
- *Gravitational forces that result from the attraction of the body to the ground we stand or walk on*
- *Inertial forces that act to resist changes in velocity by providing an equal to, but in the opposite direction of, an applied force.*
- *Frictional forces that are created between 2 surfaces with the purpose of producing resistance to a motion of one surface on another.*
- *Ground reaction forces that are exerted by the ground on a body in contact with it, equal and opposite to the forced exerted on the ground by the person.*

All forces have the following properties, with each property affecting how the force produces movement of a body:

- Magnitude: the strength or size of the force (but remember that strength alone cannot move an object).
- Line of application: the straight path in which a force acts on a body.
- Point of application: the spot where the force is concentrated on the body; when the point of application is small in size, the force is greater; the larger the point of application, the smaller the force due to the force being spread over a larger area.
- Direction: the specific movement pattern of the force along the line of application (remember that the direction of a force will remain constant unless changed by some other force).
- forefoot, midfoot, and hindfoot/rearfoot. The lower limb will be divided into the 2 regions – pelvis and upper leg, knee and lower leg. The ankle joint will be considered part of the hindfoot.

The ability of a force to produce motion at a joint depends on the length of its lever arm and the angle at which it approaches the axis. A force is most effective at producing motion when it has the longest lever arm and its line of application occurs in a plane that is perpendicular to the joint axis. That said, a force is less effective when it has a short lever arm, and ineffective when it lies along a joint axis.

Understanding the physics behind movement is very important for a pedorthist. It allows us to understand how a joint is supposed to move, identify when joint motion is atypical, and understand compensatory motions. When abnormal motions are identified, we can fine tune our assessment to include testing of involved joints and tissues and find ways to accommodate or reduce compensations in our treatments.

Review of Movement at Specific Joints

Exercise 2.1

The following chart is designed to help review your existing knowledge of joint motions. For each joint listed in the left column of the chart, fill in the all the available motions for each joint. An answer key is provided at the back of this workbook.

JOINTS	AVAILABLE MOTIONS
IP	
MTP	
1st Ray	
2nd, 3rd, 4th Ray	
5th Ray	
Midtarsal (Oblique)	
Midtarsal (Longitudinal)	
Subtalar	
Ankle	
Knee	
Hip	

Exercise 2.2

Biomechanics Review

Gait is a sequence of joint movements that can vary from person to person, and even one step to another. In the following chart you will find each phase of the gait cycle listed on the left and 5 blank squares for each phase. Underneath the chart is a list of motions found in an "ideal gait cycle". To complete the chart, fill in each of the blank squares with an appropriate motion from the list, ensuring that each phase has 5 appropriate motions - one motion for the hip, one motion for the knee, one motion for the ankle, plus 2 other motions. Answers are provided in the back of the workbook.

PHASES OF GAIT	HIP	KNEE	ANKLE	OTHER	OTHER
Foot Contact					
Early Mid-stance					
Mid-stance					
Heel Lift					
Toe-off					
Swing					

- Pelvis rotates forward
- Lateral aspect of heel strikes the ground first
- Subtalar joint is pronating
- Knee is beginning to flex
- Hip is flexed and internally rotated
- Dorsiflexion of MTP joints begins and the plantar fascia is drawn tight creating the windlass effect
- Subtalar joint is supinating from a pronated position towards a more neutral position
- Ankle is plantarflexing and the subtalar joint is neutral
- Stance leg hip is externally rotating and extending
- Ankle is plantarflexed
- Knee is flexing
- Subtalar joint is pronated and then supinates just prior to the next phase
- Lower leg is internally rotating
- Hip is extending and preparing to flex through swing phase
- Midfoot is pronated about the oblique axis and supinated about the longitudinal axis
- Knee is flexed but extending while the lower leg is externally rotating

ASK YOUR MENTOR

Make an appointment with your mentor and be clear that it will take no more than 15-20 minutes for this exercise.

- Ask your mentor to take a few minutes to look over your answers to the questions in Exercise 2.
- Ask their opinion about what they would change about your answer (if anything) and why?
- Ask if any patient profiles come to mind and if they can briefly describe the profile and the outcome.

Exercise 2.3

Application of Biomechanics in Abnormal Cases

The following questions will use your knowledge of normal and abnormal motion in gait, possible compensations that may occur due to abnormal motions, and basic biomechanical applications of forces, axes of rotation and lever arms.

Answers are provided in the back of the workbook. Keep in mind that the answers provided are just suggestions and examples to make sure you are on the right track. It is ok if your answers are slightly different, so long as you cover the important basics in the answer key and your answers are well supported.

Questions

1. Normal range of motion of the 1st MTP joint dorsiflexion during gait is between 65 - 75 degrees for efficient propulsion. Let's look at 2 scenarios where abnormal motions are present at this joint and the implications of each:
   - Consider a case where hallux rigidus is present and the 1st MTP joint has less than 10 degrees of dorsiflexion. What biomechanical implications does this have on the patient's gait?
   - Hallux abductovalgus deformity is present but the joint continues to have normal dorsiflexion during gait. What is the impact of this deformity on the adductor hallucis muscle? Consider the anatomy of this muscle, its actions, and the line of application of its muscular force. Comment on how the direction of the muscular force changes with the presence of this deformity.
2. Explain which muscle has the mechanical advantage of flexing the lesser toes – flexor digitorum longus or flexor digitorum brevis?
3. The position of the femoral neck has a significant biomechanical impact. You have noted that your patient has excessive femoral anteversion. What is the normal femoral neck angle and what defines excessive anteversion? How does this affect gluteus medius function? What compensations might result from this change?
4. Variations in joint axes exist from one person to another. Discuss the implications of a high subtalar joint axis versus a low subtalar joint axis.
5. If a muscle crosses a joint, it will produce a compressive and rotational component at that joint. Discuss how the hamstring muscle forces are different with the knees straight versus the knees bent.

OBJECTIVE THREE

Best Practices in History Taking

When you complete this objective you will be able to…

Develop best practices in history taking within a pedorthic clinical setting.

NOTE:
See the "Sample Intake Form"

See the "Sample History Taking Form"

LEARNING MATERIAL

History taking is a key part of the assessment process where you gather pertinent background information about your patient. The information you gather helps you understand the presenting problem(s), make decisions to direct the rest of the assessment process, design a pedorthic treatment plan, and determine realistic treatment goals for your patient. This information can be gathered in a variety of ways, depending on how the clinic you work in is set up:

Patient Intake Form: You may choose to have each patient fill out a form when they first arrive at the clinic, or in advance of arriving at the clinic. Some clinics may email a form to the patient to fill out in advance or provide the patient with access to an online charting program where they can input some initial information. Typical intake forms gather information such as patient demographics, general information about why your patient is seeing you, and relevant health history information. By having your patient fill out this information, it will save you time during the assessment. If the patient is filling out the paperwork in your office, it will give him or her a few minutes to get settled in your office. If you use an intake form, it should be filled out prior to you interviewing your patient as the information provided will help shape the rest of your assessment.

Face-to-face Interview: This is the portion of the assessment when you get to ask your patient questions to understand why they are seeing you, and to develop an understanding of their history, current concerns, and daily living needs. If they have filled out a patient intake form, you can learn more about the information they have provided you.

To assist you while you are learning the steps to a thorough history taking, the following 2 sample forms have been developed. Please print them off to reference as we work through a history taking checklist that follows. Feel free to use the templates while you are performing history taking in your work setting if you don't already have one in use.

History Taking Checklist

There are many ways to approach a history taking, and you may have participated in some already. The checklist that follows is one example that takes you step by step through a history taking thought process. It is meant to be a guideline that you can follow to help you develop a history taking process that you can follow with each patient. Development of a process helps ensure consistency and accuracy in retrieving important information from each patient.

1 Determine Patient Demographics

Your records need to have your patient's full name, address, date of birth, and contact information. This may have been gathered by a receptionist or in your intake form that the patient fills out when they come to your office. If this information has not been gathered before the patient sees you, start your history by retrieving this information.

a) How old is your patient?
This information can help with age related conditions. If your patient is a child, it can help with identifying childhood markers or growth-related disorders such as Sever's disease, Legg Calve Perthes, or Osgood Schlatter's. If your patient is older, it can be pertinent with respect to degenerative conditions related to aging such as osteoarthritis or osteoporosis. In addition, knowing the age of your patient can also help you in determining life expectancy of an orthosis.

b) What is your patient's gender?
This can be important later in the assessment, as pelvic landmarks are different in men and women. Also, as you start gathering information and determining what tissues are symptomatic or problematic, it may be important to know that some conditions occur more commonly in women or men.

c) Roughly how much does your patient weigh?
While some patients may not want to answer this question, knowing roughly your patient's weight is important when determining Pedorthic treatment. Weight will be a factor when determining footwear choices and/or orthotic materials. In addition, recent weight gain or loss may contribute to some symptoms or conditions.

2 Identify Diagnoses and Complaints

Now it is time to find out why your patient has come to see you and if they have already been diagnosed with a specific problem. In most cases, the complaint will be pain, but in some cases the complaint may be instability, lack of movement, numbness and/or tingling, clicking or grinding, ulceration, excessive callusing, or bad wear patterns in footwear.

a) Find out why your patient has come to see you. What are their expectations from the assessment?
Simply asking "What brings you to my office today?" can be a good way of starting to understand what your patient is looking for in treatment. Most patients will know that they are there for footwear or orthotic treatment. But despite your best screening and booking processes, there may be the odd patient that thinks you are a podiatrist and is expecting a corn to be debrided, or toe nails cut.

If they are just looking for shoe recommendations, or looking for orthotics, or hoping they don't need orthotics, it is nice to know this in the beginning, so you can tailor your recommendations and provide treatment options that may satisfy their expectations.

Some patients will be painfree but wanting to update current pedorthic treatment before previous problems return. They may be painfree but concerned that their foot structure or an underlying medical condition (such as peripheral neuropathy) predisposes them to an injury that they are trying to prevent.

They may be seeking pedorthic treatment to alleviate, reduce or manage symptoms. Their symptoms may be diagnosed, identifying the problem for you. You should confirm that the current symptoms match up with the diagnosis.

They may not have a diagnosis and you need to investigate further to identify where the problem is located.

Their symptoms may be diagnosed, identifying the problem for you. You should confirm that the current symptoms match up with the diagnosis. They may not have a diagnosis and you need to investigate further to identify where the problem is located.

b) Does your patient have a referral or diagnosis?
Be sure to obtain a copy if they have a referral.
Your patient may or may not have a referral. If he/she does have one, it may provide you with a diagnosis to help with direction of questions in the history taking, and with determining how you proceed with other parts of the Pedorthic assessment and treatment process.

It is important to note if the diagnosis from the physician matches with the symptoms your patient is currently presenting with. It is possible that the symptoms have changed, indicating that your treatment is no longer needed, a different treatment path needs to be explored, or the patient needs to return to the doctor for different investigation.

c) What is your patient's complaint(s)? If there are multiple, find out which is the primary complaint and what are secondary complaints?

- Which complaint is more problematic?
- Which complaint began first?
- Do the complaints occur at the same time? Does one lead to the other? Secondary pain can be a result of compensation or altered mechanics because of the original problem.

d) What is the location of pain or problem?
Ask your patient to point or show you the area that is the problem. Sometimes their description of location may not be the same as what you would describe. Knowing the correct location will direct your subsequent examination and tests. Is the location localized or diffuse?

Localized at a joint or along a joint line can indicate a joint or ligament problem. If it is along the course of a tendon or muscle, it may be contractile in nature.

If the location is diffuse and non-specific, it may be harder

to track the original problem, and it may make you suspect a non-mechanical problem.

e) When did the problem(s) start?
If there are more than one, which came first?

f) What was the cause of the problem?
Was there a specific incident or injury? Be sure you understand how the injury happened and the position of the leg / foot at the time of the injury. Try to identify possible tissue(s) involved - A pop at the time of injury (ligament or tendon tear), immediate pain (ligament, bone), or pain delayed after a period of rest (muscle, tendon)

- Was it an insidious onset, with no cause identified?
- Was there a change in footwear, job demands or activity?
- Was there weight gain or loss?
- Recent injury or surgery to another body part that has changed gait patterns?

3 Discover Symptom Behaviour

You have discovered where the problem(s) exists. To help you understand the presenting problem(s), you need to find out more about the behaviour of the problem and how it is affecting your patient.

a) How does your patient describe the pain?
The quality of the pain can help you identify what tissues are involved, although you must keep in mind that this is subjective information from your patient. Does the patient describe the pain as stabbing, throbbing, numb, dull, sharp, aching, burning, or tingling?

b) When does it hurt?
Knowing when symptoms occur can help you determine which type of tissue may be involved.

- If the pain is constant, meaning that at NO time is the patient painfree, this usually suggests a bony injury (bone bruise, stress fracture), severe OA or a tumour.
- If the pain is intermittent, this indicates that the patient has painfree periods and you need to find out more information about when the pain does occur.

- Night pain wakes a patient from sleep – this may indicate a more severe bone problem and the referring doctor needs to be aware of this pain pattern to rule out bigger concerns.
- Pain with movement:

Does it hurt initially and becomes less painful?
"Start-up pain" is typical of contractile tissue (tendon or muscle) that warms up with movement.

Does it hurt initially and become worse?
Typical of bone or ligament – tissues that are not contractile, and that do not warm up.

Is there pain at rest or when they are not moving (may not be constant)?

Indicative of ligament or bony tissues that are not creating movement.

c) Are symptoms improving? Getting worse? Or staying constant?
If symptoms are improving, the patient may have already discussed a treatment form that is working. Maybe orthotics are not necessary; maybe a program of stretching, icing, rest and/or footwear change would be adequate to achieve symptom resolution.

If symptoms are getting worse or remain constant, this may lead you to think that the aggravating factors have not all been identified. Is your patient still doing the aggravating activity despite the pain? Is the patient's footwear choice less than appropriate given his or her complaints?

d) Does anything make the symptoms better? Or worse? You need to try to identify factors that may be perpetuating the problem, such as a certain type of footwear, a training habit, or gait mechanics.
Conversely, you need to identify factors that are helping the patient, such as a certain footwear, a change in activity, or another treatment form such as physiotherapy, massage therapy, etc.

e) How much is the pain limiting activity?
Is it stopping or limiting their exercise?
Does it limit daily activities?
Is the patient able to work with the pain?

4 Determine History and Other Treatments

A patient's history may help identify compensatory gait mechanics leading up to the current problem (for example, a previous leg fracture or joint replacement surgery may have resulted in a structural leg length difference, or a change in joint alignment or position). Also, an underlying health issue may not be related to the presenting problem but may impact your treatment choices or expected treatment outcomes. Be sure to be specific with your questions - if your patient is presenting with heel pain, they may not realize that hip surgery a few years ago, or an ankle sprain 10 years ago could be relevant.

a) What treatments have already been explored for the presenting problem(s)?

- Has any improvement been noted? Is the treatment finished or ongoing?
- Have any tests been ordered such as X-ray, MRI, or a bone scan? What were the results?
- Has any medication been prescribed that may be altering their symptoms? For example, a patient may have noted a lessening of symptoms in the past few weeks since they started taking a pain-relieving medication.
- If no other treatment has been explored, you may need to consider recommending other treatment, especially in an acute situation or if you suspect muscle weakness or imbalance is a contributing issue.

b) Find out about your patient's general health and past health history.

- Does your patient have a condition or disease that affects the lower limbs? Maybe offer some examples such as diabetes, arthritis, previous stroke, Multiple Schlerosis, or Parkinson's.

- Has your patient had any past injuries to the foot, ankle, lower limb or back? Once again, offer examples to help them understand what you might be looking for – any broken bones, sprains, or car accidents that may have previously injured the foot, ankle, or leg?
- Has your patient ever had surgery on the foot, ankle, lower limb or back?

5 Identify Footwear Choices and Activities of Daily Living

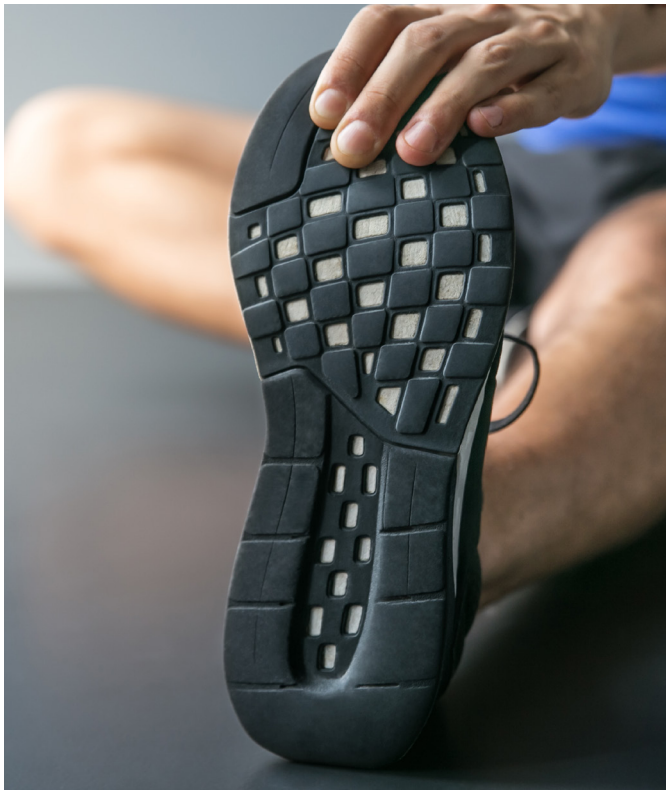
This information is gathered to better understand the stress and load that is placed on your patient and his or her injured tissues, and it will help you identify when and what kind of Pedorthic treatment your patient may benefit from. For example, if a patient has pain every time she is walking but has a job that requires her to sit at a desk all day, your treatment will be focused on the time that she is active, and the footwear that she is wearing for her walks. Conversely, if a patient wears a safety boot and is climbing ladders all day at work, your focus will most likely be on helping your patient in their work boots.

a) What are your patient's daily activities?

- Daily activities include home, work and play
- Does your patient work? Is their work sedentary or active? If the patient's job is sedentary, the job demands are not likely the problem.
- Does the patient's work involve any repetitive demands? For example, is your patient an autoworker who always walks clockwise around a vehicle, or a forklift driver who uses his left foot to hold down a switch. These repetitions may be contributing to an overuse injury or need to be factored into the treatment plan.
- What kind of surface does your patient walk or stand on (cement, hardwood or ceramic floors, nature trails)?
- What is your patient's daily routine at home? Are they home all day or just outside work hours? How much time do they spend on their feet at home or in their yard? Do they spend a lot of time on the couch or at a desk, or are they on their feet and active around their home? The elderly tends to spend more less time out of the home and your focus will be on what they wear on their feet as that may represent the majority of their active time.

b) Does your patient participate in any sports or physical activity outside of work?

Discover all the activities and sports they are involved in. How often do they participate in the average week? And position?



c) What type of footwear does your patient wear?

- At work? Does your patient have specific footwear requirements at work such as dress shoes, steel toes, or slip resistant soles? Your treatment may have to accommodate their footwear requirements.
- Around the house?
- When running errands or going to appointments?
- For specific sports or activities?

Upon completing these 5 steps, you should have some idea of the type of tissue and problem your patient is presenting with. Having this knowledge will help you make decisions on how to proceed with your Pedorthic exam, and how to develop a treatment plan specific to your patient.

Print this 5-step History Taking Checklist as a reference for the exercises that follow below.

Best Practices For History Taking

While the history taking is important for you in retrieving information, you must remember that this is also important for building a rapport with your patient. The history is often your first interaction with your patient, and this is where you will make your first impression on your patient. While the following suggestions may seem a bit trivial, they are important in making a good impression, developing trust and allowing your patient to feel confident and comfortable with you as their pedorthist.

- Introduce yourself to your patient - for example, “Good morning, my name is Sara Goodfoot, and I am a pedorthic intern. Let’s see how I can help you today.”
- Make eye contact - show your patient that they have your attention. Making eye contact will help you be perceived as reliable and confident.
- Dress professionally and appropriately - your patients are coming to you as a professional and a specialist, so dress the part.
- Have a comfortable, clean, and neat setting – your workspace can say a lot about you, so make sure that your patients feel safe, comfortable, and welcome in your office.
- Speak with a friendly but professional tone – what you say to your patient is equally important to how you say it to your patient. A professional but friendly tone is important for the patient to have your respect and feel comfortable with you.
- Ask direct and specific questions. Try to avoid open ended questions that can allow some patients to take off on a tangent and take time away from important information gathering.

Exercise 3.1

Observe Your Mentor Perform History Taking

- Ask your mentor when a good time would be to sit in and observe them perform 4-5 history taking sessions.
- Once a time is determined, sit in with your mentor and watch them perform the history takings. You want to observe 4-5 so that you can identify the process that your mentor follows.
- Record the questions your mentor asks, the order of questions, and the overall flow of the history taking process. You will need to be able to look back on this information in Exercise 3.2 below.
- Compare your mentor's process with the History Taking Checklist in this module.
- Make note of what was different from the process and checklist presented in this module.
    - How did your mentor collect patient demographics?
    - Did your mentor follow a different sequence of questions?
    - Did your mentor use different terminology or language from the template?
    - Did your mentor ask different questions?
    - Are there parts of the history taking process that you prefer in the checklist provided in this workbook?
    - Are there parts of your mentor's process that you prefer?
- Record your answers to these questions for Exercise 3.2 – Create a Personal History Taking Checklist.

Exercise 3.2

Create a Personal History Taking Checklist

Set aside 30-45 minutes to perform this exercise. The goal of this exercise is to develop a new checklist that best suits the history taking thought process that works best for you. Ask your mentor when a good time would be to sit in and observe them perform 4-5 history taking sessions.

- Have a copy of the History Taking Checklist from above and a blank piece of paper or blank document on your computer to create a new document.
- First, review the notes you made in Exercise 3.1 – Observe Your Mentor Perform History Taking.
- Now create a new and personal checklist that includes the following:
- Record your answers to these questions for Exercise 3.2 – Create a Personal History Taking Checklist.
    - All the steps from the History Taking Checklist outlined in this workbook that you like. It is ok to place the questions in a different order if you prefer, or to choose different terminology or language if the terminology is used correctly.
    - All the steps that your mentor uses that you prefer over the checklist example provided above.
- Reread your new checklist and make sure it flows in a process that is more comfortable and preferable for you based on your experiences and your observations with your mentor.
- When you perform your next history taking, use this revised checklist as a guide.

Exercise 3.3

Implementing the History Taking Checklist

Use your Personal History Taking Checklist you developed in Exercise 3.2 and perform a history taking on your own and consider the following questions:

- Did you need to reference or use your checklist during the history? Or did you do it from memory?
- Were there any items on the workbook checklist that were not included in your personal checklist?
- Did you find your checklist flowed reasonably during your history taking?
- Were there any parts of the checklist that gave you trouble?
- What would you change on your checklist for next time?

Exercise 3.4

Applying History Taking Information

You have now developed a step-by-step process on how to complete a history taking. The information gathered in this process helps shape the rest of your assessment. It helps you better understand the presenting problem(s), develop thought processes for the next steps in your assessment process, design a pedorthic treatment plan, and determine realistic goals for your patient. This exercise presents a series of history taking scenarios that helps you apply your pedorthic knowledge and develop thought processes for the next steps in your assessment process:

1. While obtaining patient demographic information, you have identified that your patient is an 85-year-old female. With this demographic, what are important questions that you need to include in your history taking? What considerations will you need to address in your treatment plan.
2. Your patient has a referral from a medical doctor that does not provide a diagnosis. The referral simply states: “assess and treat”. What are your next steps knowing this information?
3. Your patient describes pain with the first steps out of bed or after periods of rest that goes away after about 10-15 steps. What type of tissues present this way? What further questions should you ask to better understand what type of tissue or structure it is? What kind of tests should you include in your assessment to help identify the tissue type?
4. You have discovered that your patient’s main complaint is pain in the 1st MTP joint. What structures/tissues do you need to be considering in this region of the foot? And what further questions do you need to ask to help you determine which structure/tissue it may be?

5. Your patient describes pain around the medial malleolus. What structures/tissues do you need to be considering in this region of the foot? What conditions do you need to consider with each of these structures/tissues? What tests should you perform in your assessment?
6. In your symptom behavior step of history taking you have determined that the patient has tingling in their 3rd and 4th toes. What type of tissue presents this way? What tests do you need to include in your assessment to confirm this?
7. While determining ADLs, your patient indicates that she "likes to walk". What further questions need to be asked?
8. You discover that your patient broke their tibia at the age of 11 in a downhill skiing accident. What considerations do you need to make knowing this?
9. You have finished your history taking and are well into your assessment when you realize that you forgot to ask about your patient's treatments to date. What should you do?
10. You have a patient who is not talkative. When you ask a question, they provide short and incomplete answers. What considerations do you need to make to ensure you gather all the pertinent information from the history taking process?

OBJECTIVE FOUR

Non-Weightbearing & Weightbearing Assessment

When you complete this objective you will be able to…

Develop best practices of non-weightbearing and weightbearing assessment in a pedorthic clinical setting.

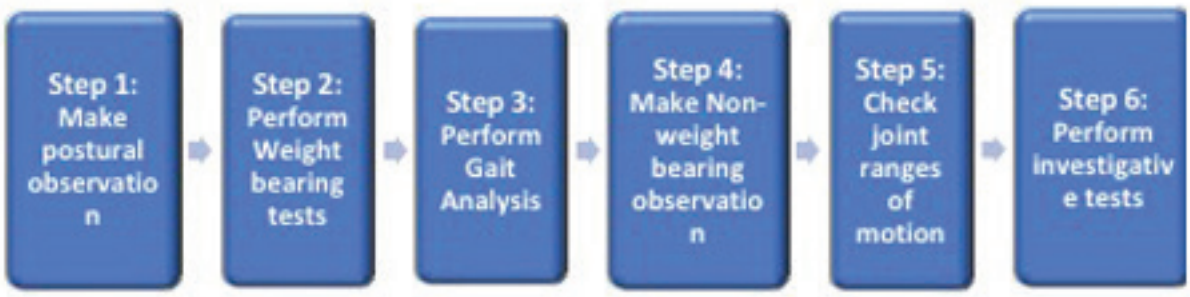
NOTE:
See the "Sample Assessment Form"

LEARNING MATERIAL

Non-weightbearing and weightbearing assessment is key to understanding how your patient's feet are built, and how they are working. Identifying the structure and function of each patient is critical to making important decisions for your patients. Much like the history taking process, the information you gather about foot structure and function helps you understand the presenting problem(s), make decisions to direct the rest of the assessment process, design a pedorthic treatment plan, and determine realistic treatment goals for your patient.

This information can be gathered in a variety of ways, depending on how the clinic you work in is set up. Some clinics may have video analysis, others just visual observations. The order you gather this information can vary from one pedorthist to another. No matter how you collect the information, the information you need to gather remains the same. This objective will provide you with a checklist of the information you need to gather and present a process that you can follow to ensure you gather the appropriate information. You will be able to follow this process while performing video analysis OR visual observations.

To assist you while you are learning the steps to a thorough weightbearing and non-weightbearing assessment, the following sample assessment form has been developed. Please print it off (note that it is 2 pages) to reference as we work through the non-weightbearing and weightbearing assessment checklist that follows. Feel free to use the template while you are performing assessments in your work setting if you don't already have one in use.



Assessment Checklist

There are many ways to approach a non-weightbearing and weightbearing assessment, and you have most likely participated in some already. The checklist that follows is a step by step example of a thought process for performing a non-weightbearing and weightbearing assessment. The order of assessment can vary from one pedorthist to another. This example is meant to be a guideline that you can follow to help you develop a regular process with each patient. Development of a process helps ensure thoroughness and consistency in retrieving important information from each patient. You may choose to modify the order if you have already developed a process in your clinical experiences to date.

1 Make Postural Observations

Performing postural analysis is done to detect deviations from normal posture. This analysis is performed to look for signs of injury, poor postural habits, or physical abnormalities or deformities. Faulty postural observations may be placing stress on joints, creating muscle imbalance or ligamentous tension. While individuals are not expected to be perfect, we want to identify any imperfections that may be contributing to a patient's complaint so that we can reduce stresses and strains, provide maximal efficiency, and ultimately symptom relief.

a) What is your patient's head position?
Does the head tilt to the left or right? Is it rotated to either side?

b) Are the shoulders and scapula level?
Is one side higher than the other? Asymmetry may be due to a leg length difference, a shoulder or neck injury causing muscle spasm or tightness, scoliosis, or a natural difference in muscle bulk from dominant to non-dominant side (dominant side is usually lower).

c) Are there any abnormalities of the trunk?

- Asymmetrical waist contours (e.g. one side straight and one side curved may suggest a LLD, scoliosis, pelvic imbalance, or neurological problem).
- Are there any spinal irregularities such as scoliosis, kyphosis or lordosis?
- Are the arm lengths the same? Do the arms sit an equal distance from the trunk?

d) Is there a difference in pelvic heights and position?

- Have the patient stand with their knees straight and feet together if possible to reduce compensatory positions they may have developed.

Be sure to look at all 3 of these pelvic landmarks:

- iliac crests
- Anterior superior iliac spine (ASIS)
- Posterior superior iliac spine (PSIS)

Note if there is a difference at any or all 3 landmarks, and if the amount of difference appears the same for each of the landmarks.

In obese patients it can be more difficult to note pelvic landmarks, so observing gluteal folds from a posterior view can be helpful.

A difference may indicate a leg length difference (LLD), scoliosis, pelvic imbalance (rotation, translation, shear of one half of the pelvis), or a neurological problem.

e) Are the knee joints level and neutral?

- Check knee fold heights and patella heights to see if the knees are the same height.
- Check the positioning of the knee joint. Is it in a valgus or varus position? Is either knee hyperextended (genu recurvatum) or flexed?
- Is the patella in a neutral position, or is it internally or externally rotated?
  - This is generally easy to see but if you are not certain, place your thumb and index finger on either side of the patella to get an orientation.
  - Have the patient put their legs together to eliminate possible compensations that may skew your observation.
  - Knee / patella position can be indicative of either femoral anteversion/retroversion or lateral/medial tibial torsion.

f) What is the position of the tibia?

- Is the tibia straight? In varum? Is tibial torsion present?
  - Trace the anterior tibial with your fingers from proximal to distal to feel if a twist or curve is present.
  - Look at the position of the foot and the knee. A lateral tibial torsion is present when you see an anterior facing patella while the foot and ankle are pointing outward, and a medial torsion is present when you see an anterior facing patella while the foot and ankle points inward.

g) What is the calcaneal position?

- The natural position of the calcaneus in weightbearing is considered the relaxed calcaneal stance position. Is the natural position neutral, valgus or varus relative to the tibia?

h) What position is the subtalar joint in?

- You can palpate the head of the talus to feel if it is neutral, medially shifted (pronated) or laterally shifted (supinated).

i) Note the medial longitudinal arch heights.

- Compare the location/heights of the medial tubercle of the navicular. In a foot that is more pronated, the navicular will be more prominent and lower to the ground.

j) What is the forefoot position relative to the midfoot?

- Is the forefoot neutral, abducted or adducted relative to the midfoot? An adducted forefoot is a medial orientation of the forefoot relative to the midfoot and is referred to as metatarsus adductus. An abducted forefoot is referred to as metatarsus abductus.

k) At what angle does the foot sit relative to the leg?

- Is the entire foot abducted (out-toeing) or adducted (in-toeing) relative to the leg? We are taught that the natural foot position for each foot is about 5-7 degrees of abduction or external angle from the midline. Excessive angles may be related to tibial torsion deformities, lack of ankle dorsiflexion, imbalances, or structural abnormalities at the hip joint.

2 Perform Weightbearing Tests

You have observed your patient in static weightbearing while performing the postural analysis, noting postural positions. Now it is time to perform some tests, or specific movements while the patient is standing to look at movement and function that is important for gait and ambulation. This information helps identify:

- active ranges of motion
- willingness to move
- if and where pain is present during these active weightbearing motions
- what type of tissue is likely involved if applicable

Note that these active weightbearing movements all involve more than one joint and numerous soft tissue structures. Some tissues will be stretching, some will be contracting. If a patient does experience pain during a motion, be sure to identify exactly where they feel it, when they feel it during the movement, if the pain is the same as their original complaint, and if it is a pain they normally experience.

There are numerous tests that can be performed in this section of the assessment. Here are 4 active weightbearing tests that can help identify gait related issues that should always be considered if your patient is able to perform them:

Double and Single Heel Raise Test

This test is performed with the patient standing near a chair, desk, table or examination bed so the patient has something to hold on to if they feel unstable. The patient should be facing away from you. The patient is first asked to go up on their toes, lifting both heels off the ground. During this test, there are many observations that you can make:

Does the patient have ankle plantarflexion strength to lift both heels off the ground and keep the knees extended?
Does the patient have adequate MTP joint extension to go on their toes?

- Does the patient have adequate peroneal strength to maintain the foot in a neutral position and not go into an inverted foot position?
- Does the patient have a functioning tibialis posterior tendon to invert the heels during this test?
- Does the patient experience any pain during this test?

If the patient was able to perform the double heel raise test with proper function and minimal-to-no pain, ask them to perform the same test with just one foot at a time. The patient should be standing on one foot before you ask them to go up on their toes lifting the heel off the ground.

- Does the patient have ankle plantarflexion strength to lift the heel off the ground without using too much momentum from their arms or torso?
- Does the patient have adequate MTP joint extension to go on their toes?
- Does the patient have adequate peroneal strength to maintain the foot in a neutral position and not go into an inverted foot position?
- Does the patient have a functioning tibialis posterior tendon to invert the heel during this test?

3 Perform a Gait Analysis

The gait analysis is one of the most important aspects of the assessment process. Static foot position alone cannot give you adequate information regarding our patient's function and presentation. Gait analysis is where you get to see the greater picture - how your patient functions and moves through the different phases of the gait cycle. You have already performed a static postural scan and weightbearing functional tests, so you may have already noted some asymmetries or dysfunctions in your patient. Since your patient is already standing from functional testing, you can now transition straight into gait analysis.

a) What is your patient's head position while they are walking?

- Observe if the head is tilted to the left or right, if it is rotated to either side, or if it is shifted anteriorly. Note if this head position changes during the different phases of the gait cycle.
- Abnormal findings can suggest a leg length difference, shoulder or neck injury, muscle spasms or tightness, or a natural difference in muscle bulk from dominant to non-dominant sides.

b) Are the shoulders and scapula level?

- Make note if one side is higher than the other and if the difference changes throughout the gait cycle.
- Abnormal findings here can also be related to a leg length difference, shoulder or neck injury, muscle spasms or tightness, or a natural difference in muscle bulk from dominant to non-dominant sides.

c) Do the arms swing equally?

- Take note is one arm looks longer or is swinging a greater distance in the sagittal plane or is swinging further from the body in the frontal plane.
- Abnormal findings may be due to lumbar shifts or spinal deformities such as scoliosis, muscle inequality due to injury, shoulder injury or dominant vs. non-dominant side.

d) Are there abnormalities in the position of the trunk?

- Look to see if the entire trunk has a side bend to the left or right, if the waist contours are symmetrical, if a curvature of the spine such as scoliosis or kyphosis is present.

Note if the patient has adequate gluteus maximus strength to stop the trunk from bending posteriorly, and quadricep strength to stop the trunk from anteriorly bending.

e) What is the position of the hips and pelvis?

- The pelvis should shift 4-5 cm vertically in a rhythmical up and down motion, lowest at double limb support and highest at single limb support. Abnormal motions may be noted as hip hiking or vaulting gait patterns due to leg length discrepancy, or limited hip, knee or ankle flexion.
- The pelvis should shift laterally to the weightbearing side approximately 2.5cm. Abnormal motions may be noted as a Trendelenburg gait due to gluteus medius weakness, leg length difference or scoliosis.
- The pelvis should rotate forward on the swing leg equally and bilaterally. Abnormal motions can include increased rotation on the swing leg due to pain, stiffness or limited motion of the hip on the stance leg. This can also increase pronation on the stance leg.

f) Do the hips flex equally?

- Abnormal findings may include excessive hip flexion that lifts the knee excessively in a steppage gait pattern. This can be a compensation for foot drop or reduced flexion of the knee or ankle.
- Excessive hip internal rotation may be related to increased subtalar joint pronation, femoral anteversion or weak gluteus medius or weak hip external rotators.

g) Is the knee in a position of varum or valgum?

- This can be congenital or a compensation for degenerative knee problems, past trauma or a leg length discrepancy.

h) Is there normal movement of the tibia?

- Some medial rotation is normal during midstance. If there is excessive rotation, look to see if it is equal or greater than the amount of motion of the foot.
- Does the patient heel strike, and if so, what position is the calcaneus in at foot strike?
- Typically, the heel will strike on the lateral or centrolateral border of the heel. Take note of the position the

calcaneus is in relative to the lower leg – is in a varus, valgus or neutral position?

- Does your patient heel strike? Some patients will be midfoot or forefoot strikers.

j) What motion does the foot go through from heel strike through the stance phase?

- It is normal for the foot to go through some degree of pronation during midstance as it accepts the weight of the body after heel strike. Take note when the pronation begins – is the foot already pronated when stance phase begins? Does the pronation begin after heel strike? Does the foot underpronate or supinate?
- The medial tubercle of the navicular is a good reference point to make this observation. As a foot pronates, the navicular will lower closer to the ground. As a foot supinates, the navicular is further away from the ground.

k) What position is the foot in at toe-off?

- Ideally the propulsion at toe-off comes from the great toe in addition to the 2nd and 3rd lesser toes. Make note if the toe-off is excessively medially off the great toe, or excessively lateral off the lateral lesser toes.
- Also take note that the MTP joints are adequately dorsiflexing during toe-off. Lack of MTP joint dorsiflexion would require more investigation.

l) Does the patient's base of gait fit within the normal 5-10 cm?

- Narrow base of gait is less common, and typically related to neurological or neuromuscular pathologies
- Wider base of gait is often a compensation related to pathology/illness such as dizziness, unsteady balance, decreased sensation on the soles of the feet (neuropathy), ataxic gait patterns, or simply aging.

m) Does the patient have a normal step length?

- A shortened step length may be caused by injury/pathology, muscular imbalances, fatigue, advancing age, disease such as Parkinson's.
- Be sure to take note if the step length is equal left to right.

n) At what angle is the foot in the transverse plane relative to the leg?

- The average person has their feet abducted in the transverse plane approximately 15 degrees.
- Excessive abduction may be a compensation for lack of ankle dorsiflexion, weakness of the hip musculature, or limitation in hip internal rotation.
- Excessive adduction may be related to hip musculature imbalance or limitation in hip external rotation.

4 Make Non-Weightbearing Observations

Observation is the "look" section of the assessment where you make note of what is visible to you. Keep in mind that you will make observations throughout all components of your assessment (watching your patient walk to the assessment room, performing a postural analysis) but at this step you are observing the dorsal, plantar, medial and lateral surfaces of each foot, taking note of foot structure, any deformities and skin conditions in non-weightbearing.

a) What is the shape of the non-weightbearing arch structures?

- This should be compared to the shape you noted in Step 1 Postural Analysis.
- Make note if the medial and lateral longitudinal arches are high, low, or normal and how the right compares to the left. Note if an overall foot deformity such as talipes equinovarus is present.
- Also take note of the transverse arch to see if any of the metatarsal heads are dropped.

b) What is the relationship between the rearfoot and forefoot positioning?

- Is the forefoot in the same frontal plane as the rearfoot? Or is a forefoot supinatus, forefoot varus, or forefoot valgus relative to the rearfoot noted?
- Is the forefoot in the same sagittal plane as the rearfoot? Or is the forefoot plantarflexed relative to the rearfoot?

c) Do any toe deformities exist?

- Look at the first MTP joint and hallux and noted if any deformities are present, such as bunion, hallux abductovalgus, interphalangeal adductus.
- Make note of any lesser toe deformities such as hammer, claw, mallet or cross-over toes, webbed toes, or bunionettes.
- Note if there are any toes missing and find out if the loss was due to congenital, traumatic, or surgical necessity.
- Finally, note if there is any asymmetry between the feet.

d) Are there any unusual lumps or bumps?

- Make note if any bony exostoses, ganglions or fibromas are present, looking on the dorsal, plantar, medial and lateral aspects of the foot.
- If a lump or bump is noted, record.
- where it is located (on a bone, within a tendon, in a muscle, over a joint line).
- whether or not it moves.
- take a minute to palpate it to see if it is hard or soft, warm, tender or painful when palpated.

e) What is the condition of the skin?

- Take note of the skin colour of the foot and the leg. Areas of redness may be indicative of inflammatory response from injury or infection. Ecchymosis is indicative of trauma. Blanching or shiny skin may be indicative of a circulatory problem. Shiny skin with lack of hair should cue to consider diabetes, peripheral neuropathy or circulatory problems.
- Note if any scars are present and find out if they are the result of injury or surgery.
- Note if there is any interruption to the skin such as calluses, corns or warts.

f) Is there any sign of swelling in the feet, ankles or leg?

- Note where it is present and how significant it is. Note if any pitted edema is present.

g) Does the patient have healthy fat pads?

- Make note if the fat pads have atrophied under the calcaneus or metatarsal pads. If the fat pads are present, note if they are positioned properly or if they have drifted distally.

5 Check Joint Ranges of Motion

Range of motion testing has already been performed actively in a weightbearing or closed kinetic chain situation in Step 2. At this point in the assessment your patient is now non-weightbearing for you to check ROM in an open kinetic situation on joints that have the greatest impact on foot function in weightbearing.

Tips for Passive Joint Testing

For each passive test you perform, you are feeling for:

- Equal movement bilateral
- Does each segment feel as tight or loose bilaterally?
- Is there pain found in the ROM? At what point? Is there crepitus or clicking when you move the joint?
- If the ROM is restricted, is it due to pain and muscle spasm or is it a bony block?
- What is the "end feel"?

a) Check active range of motion of the ankle, subtalar and 1st MTP joints.

- Active movement means the patient moves the joint and the examiner is just observing. Active movements involve contractile tissues (muscle and tendon) as well as joint movement and ligament stretch.
- Not all joints of the foot are easy to test actively, but these 3 joints should be incorporated in each assessment prior to passive ROM testing.
- Ankle joint – test dorsiflexion and plantarflexion
- Subtalar joint – test inversion and eversion
- 1st MTP joint – test flexion and extension

b) Check passive range of motion of the ankle, subtalar, tarsometatarsal (TMT), first ray and 1st MTP joints.

- Passive movement means the patient relaxes and the examiner moves the joint. Passive movement eliminates the contractile component of movement.
- Pain actively but no pain passively - likely muscle or tendon involved.
- Pain with both – likely joint or ligament.
- Ankle joint – test dorsiflexion and plantarflexion.
- Subtalar joint – test inversion and eversion.
- TMT joints – test inversion and eversion around the longitudinal axis, abduction and adduction around the transverse axis.
- 1st ray – test dorsiflexion and plantarflexion.
- 1st MTP joint – test flexion and extension.

c) Check passive first ray dorsiflexion and plantarflexion.

- Normal first ray motion is 5mm dorsiflexion and 5mm plantarflexion. Anything greater than this is considered hypermobile. Anything less is considered limited.
- Note the position the first ray sits in relative to the lesser rays. Is the first ray in line or neutral with the other rays? Or is it in a plantarflexed or dorsiflexed position?

d) Check any other relevant or suspect joint range of motion.

- For each patient, you need to consider the information you have learned about your patient up to this point in the examination. If you have observed or suspected an abnormality in function of a joint, or if you suggest a joint motion may be a contributing factor to symptoms discuss, you should include ROM testing for those joints.
- For example, if during gait you have noted excessive adduction of the left foot relative to the leg, you will want to include a hip joint ROM test to see if there is any limitation in hip joint external rotation.
- Or as another example, if during your non-weightbearing observations you noticed significant callusing under the 5th MT head, you may want to check the ROM of the 5th ray and the 5th MTP joint.

6 Perform Investigative Tests in Non-weightbearing

For Steps 1 through 5 there are lists of very specific and recommended observations and tests for you to perform to understand how your patient's foot is built and how it works. In Step 6, you get to "dig a little deeper" and choose tests that you think will help you understand your patient's specific case better. These are the questions you need to ask yourself as you choose the appropriate tests to perform on your patient:

- Have you narrowed down the type of tissue that you think is involved or injured? What tests do you need to perform to confirm your suspicion? What tests do you need to perform to rule out other options?
- Is there a muscle, tendon or ligament that you suspect may be part of your patient's complaint(s)? How are you going to test it?
- Have you narrowed down the condition that you think your patient may have? What tests do you need to perform to confirm this? What tests do you need to perform to rule out similar conditions or other options?
- Is there a sign or symptom that has raised flags that you need to investigate further to better understand your patient's case?

Investigative tests can include:

Palpation

- This is a hands-on physical examination of the foot, ankle or leg used to look for areas of tenderness, find common landmarks, joint lines, or soft tissue structures that you suspect are problems for the patient.
- What tissues or structures do you suspect may be involved in your patient's complaints? Choose the tissues/structures that you think are injured, and any tissue/structure that you suspect may be a contributing factor. Palpate each one, saving the one you think may be most painful till the end.
- Make note of irregularities in how they feel, and your patient's response to palpation. Was there pain? Did the patient pull away or show signs of hesitation?

Strength testing

- If you suspect that contractile tissue is involved, perform a non-weightbearing resisted movement strength test for each suspect muscle or tendon, comparing bilateral. Your test results indicate the strength of the affected limb versus the unaffected, and if muscle contraction is the likely cause or contributing factor of pain or dysfunction.
- To perform the strength test you need to know what muscle(s) you are testing. This allows you to know what movement you are asking your patient to perform and what joint will be involved in the movement.

Sensation testing

- If for any reason you suspect diminished or lack of sensation in your patient, due to a diagnosis of diabetes, neuropathy, peripheral nerve injury, nerve root compression injury, or tingling in the toes or foot, perform a dermatome test.
- Be sure to check bilaterally and make sure the patient is not watching you while you perform the test. If the patient is unsure if the sensation is normal, compare the feeling in that location with a location higher up the leg to see if the touch feels the same. Note if the sensation is void or diminished.

Vascular testing

- Are there any signs or symptoms of poor circulation or peripheral vascular disease? If so, be sure to test both the dorsalis pedal pulse and posterior tibial pulse, and perform a blanching test on the toes.

Upon completing these 6 steps, you should have a good understanding of your patient's foot structure and function, as well as the structures and tissues that are involved in their case. Having this knowledge will help you develop a treatment plan specific to your patient.

Print this 6-step Weightbearing and Non-Weightbearing Checklist as a reference for the exercises that follow.

Capturing Photos or Videos

- If you plan on taking pictures of your patient, seek their permission first and let them know what you will be doing with their photos (uploading them to a chart, using them in presentations, etc.).
- Capturing an image of your patient in a photo or video allows you to show your patient what you are observing.
- Photos also allow you to show your patient the differences in their alignment or posture with and without pedorthic intervention, if a difference exists, with before and after images.

Best Practices for Weightbearing Assessment

- Your postural scan and gait assessment should include the whole body, with focus on the foot and lower limb.
- With both static and dynamic weightbearing assessment, start at the head and work down to the feet. This helps develop a process that includes the whole body, providing consistency to your assessments.
- You should include observations in both the sagittal and frontal planes.
- Your observations should always be bilateral.
- Ask your patient to remove shoes and socks, jackets or loose sweaters, tuck in loose shirts, and remove wallet, cell phone, keys, etc. from his or her pockets.
- Your patient should be dressed so you can see the knees and lower leg – shorts above the knee is ideal, but pants rolled up above the knees will work.
- Have a chair, desk, table or plinth near your patient so that if they have issues with balance they have something to hold.
- Position yourself so that you make observations as close to eye level as possible. This means that you will start standing to observe the upper body of your patient, and you may choose to kneel, sit on a chair or stool to make observations of the lower body. Some Pedorthists even sit on the floor to look at the foot and lower leg more closely.
- Have your patient stand in his or her normal relaxed stance. This allows the patient to be comfortable and allows you to make observations in their natural position.
- Ask the patient to stand with their feet together after you have observed them in their natural stance. This may reveal structural abnormalities that they have accommodated in their natural stance.
- If you need to ask your patient questions during this part of the assessment, be sure to ask direct and specific questions. Try to avoid open ended questions that can allow some patients to take off on a tangent and take time away from important information gathering.
- If you suspect that a patient's current footwear is contributing to their symptoms, ask them to put their shoes on and compare their posture analysis with and without footwear.
- Be sure to clearly record all finding outside of normal. These findings are important to note as they can give you clues as to why a patient is functioning the way they do. These observations are also important for comparison if the patient returns to see you in the future.

Best Practice for Gait Analysis

- Your gait assessment should include the whole body, with focus on the foot and lower limb. Start your observations at the head and work down to the feet. This helps develop a process that includes the whole body, providing consistency to your assessments.
- You should include observations in both the sagittal and frontal planes.
- Your observations should always be bilateral.
- Position yourself so that you make observations as close to eye level as possible. This means that you will start standing to observe the upper body of your patient, and you may choose to kneel, sit on a chair or stool to make observations of the lower body. Some Pedorthists even sit on the floor to look at the foot and lower leg more closely.
- Your patient will need to walk up and down your hallway many times to give you enough time to make all the necessary observations. Be aware that the patient may require a few trips up and down the hall just to get into a normal walking pattern.
- Reduce the duration of walking if your patient is in a great deal of pain or increase the duration if a patient has a unique or unusual gait pattern that requires more time to make observations.
- Depending on the comfort of the patient and the condition that they are presenting with, have them change up their cadence while walking to see if this changes their gait pattern.
- If the patient is having trouble relaxing, make small talk with them, or ask more questions about their problems to distract them.
- If you suspect that your patient's gait is guarded or not relaxed, ask them to perform a task. This distraction can produce a more natural gait for you to make observations.
- If you suspect that a patient's current footwear is contributing to their symptoms, ask them to put their shoes on and compare their gait with and without footwear.
- Be sure to clearly record all finding outside of normal. These findings are important to note as they can give you clues as to why a patient is functioning the way they do. These observations are also important for comparison if the patient returns to see you in upcoming years.

Best Practices for Non-Weightbearing Assessment

- Make sure your patient is in a comfortable position. Many people are not comfortable with their leg raised and straight, especially if they have tight hamstrings or a back problem. They may also feel uncomfortable about their foot being on your lap. Ideally, have your patient sitting or lying on a treatment bed / plinth.
- If an exam plinth is not available, sit on a lower stool and have them rest their foot across your legs or knees.
- Your observations should always be bilateral.
- Assess the contra-lateral (unaffected side) first. If both sides are painful, assess the least painful side first.
- When you are going to palpate an area of reported pain, ask the patient to point to where it hurts the most. Palpate around the area first, and start with light pressure, gradually applying more pressure if your patient can tolerate it.
- Have your patient stand in his or her normal relaxed stance. This allows the patient to be comfortable and allows you to make observations in their natural position.
- When evaluating movement or strength, test in the following order: active, passive, resisted. If a patient experiences pain at the active stage for example, you can stop the testing and not test passive or resisted to avoid hurting the patient.
- Pick the most relevant tests to perform. You don't want to be performing 10-20 tests on each patient. As you work through your history taking and then through the steps of weightbearing and non-weightbearing assessment, you will develop an idea of what structures you need to test. Make them your priority.
- If you need to ask your patient questions during this part of the assessment, be sure to ask direct and specific questions, avoiding open ended questions that can get you off track during your assessment.

Exercise 4.1

Observe Your Mentor Perform a Weightbearing & Non-Weightbearing Assessment

Ask your mentor when a good time would be to sit in and observe them perform 4-5 weightbearing and non-weightbearing assessments.

Once a time is determined, sit in with your mentor and watch them perform the weightbearing and non-weightbearing assessments. You want to observe 4-5 so that you can look for the process that your mentor follows.

Take note of the tests your mentor performs, the order of testing, and the overall flow of the assessment process. You will need to be able to look back on this information in Exercise 4.2 below.

Compare your mentor's process with the Weightbearing and Non-weightbearing Checklist in this module.

Make note of what was different from the process and checklist presented in this module.

- Did your mentor follow a different sequence of assessment?
- Did your mentor use different terminology or language from the template?
- Did your mentor perform different examinations?
- Are there parts of the assessment process that you prefer in the checklist provided in this workbook?
- Are there parts of your mentor's process that you prefer?

Record your answers to these questions for Exercise 4.2 – Create a Personal Weightbearing and Non-weightbearing Assessment Checklist.

Exercise 4.2

Create a Personal Weightbearing & Non-Weightbearing Checklist

Set aside 50-60 minutes to perform this exercise. The goal of this exercise is to develop a new checklist that best represents your thought process for completing a weightbearing and non-weightbearing assessment.

Have a copy of the Weightbearing and Non-weightbearing Assessment Checklist from above and a blank piece of paper or blank document on your computer to create a new document.

First, review the notes you made in Exercise 4.1 – Observe Your Mentor Perform Weightbearing and Non-weightbearing Assessment.

Now create a new and personal checklist that includes the following:

- All the steps from the Weightbearing and Non-weightbearing Assessment Checklist outlined in this workbook that you like. It is ok to place the steps or the specific questions in a different order if you prefer, or to choose different terminology or language if the terminology is used correctly.
- All the steps that your mentor uses that you prefer over the checklist example provided above.

Reread your new checklist and make sure it flows in a process that is more comfortable and preferable for you based on your experiences and your observations with your mentor.

When you perform your next weightbearing and non-weightbearing assessment, use this revised checklist as a guide.

Finding a checklist that is thorough and comfortable for you to follow will make it easier for you to develop your own routine or process. Developing this process will reduce the possibility of forgetting something and ensure a thorough assessment experience for your patients.

Exercise 4.3

Applying Weightbearing & Non-weightbearing Information

You have now developed a step-by-step process on how to complete a weightbearing and non-weightbearing assessment. The information gathered in this process helps you better understand the presenting problem(s), develop thought processes for the next steps in your assessment process, design a pedorthic treatment plan, and determine realistic goals for your patient. This exercise presents a series of scenarios that helps you apply your pedorthic knowledge and develop thought processes for the next steps in your pedorthic assessment process.

1. During your postural analysis you notice asymmetry of the pelvis. The right iliac crest, ASIS and PSIS are higher than the left. What are your next steps after making this observation?
2. Hand position is important in passive range of motion testing to ensure you are only moving the joint you are testing. For each of the following joints, identify the motions tested and describe your hand positions to accurately achieve those motions: ankle, subtalar, midtarsal, 1st MTP.
3. During passive range of motion testing of the ankle joint dorsiflexion you feel an abrupt bony end feel. What does this mean? What considerations should you be making with this finding?
4. In active weightbearing testing you notice that your patient's left subtalar joint does not evert when they look over their right shoulder during the subtalar joint mobility test. What other tests should you perform to test the function of this joint? When limited subtalar joint eversion is present, what do you expect to see during the gait cycle with this foot? What compensatory motions could be present?
5. In your history taking you determined that your 7-year-old patient has pain on the apex of the calcaneus. What conditions do you need to consider with pain in this area of the foot? What special tests will you perform to help determine what structure/tissue is problematic? What treatment options should you consider?
6. You discover that your patient has an open wound under the 1st metatarsal head. What considerations do you need to make during the assessment and treatment decision making processes?
7. You have noted that your patient has a hypermobile first ray in both dorsiflexion and plantarflexion. How could this change a patient's gait pattern?
8. During gait you noted significantly reduced ankle dorsiflexion. However, you noted normal active and passive ankle dorsiflexion in non-weightbearing. What other factors need to be considered? Are there other tests you need to go back to perform?
9. During gait you notice a lack of pronation motion during the entire gait cycle. What are your next steps after observing this lack of motion?
10. During history taking, no underlying medical conditions were noted with your patient. However, during the assessment you notice lack of hair on their feet and absence of dorsalis pedis pulse. What are your next steps?
11. When performing a resisted isometric strength test on a specific muscle-tendon unit (for example the tibialis posterior muscle and tendon), the following responses are possible.

Complete the chart by indicating what type of injury may be present based on these test outcomes:

Strong and pain-free	
Strong and painful	
Weak and painful	
Weak and painless	

ASK YOUR MENTOR

Make an appointment with your mentor and be clear that it will take no more than 15-20 minutes for this exercise.

Here is an opportunity for a focused discussion with your mentor to gain another perspective on the questions in Exercise 4.3 – Applying Weightbearing and Non-weightbearing Assessment Information. When you have answered the questions, make an appointment with your mentor and be clear that it will take about 15-20 minutes for this discussion.

- Pick the 3-4 questions that were most difficult for you to answer.
- Ask your mentor to take a few minutes to look at your answers to those questions.

ANSWER KEY

Exercise 1.1 Answers

Click below for 1.1 answer charts.

1.2 Answers - Applied Anatomy Review Questions

1. Muscle: peroneus (or fibularis) longus
   - Innervation: superficial peroneal nerve
   - Function: everts rearfoot, weak ankle plantarflexor, stabilizes first metatarsal during gait to prevent increased dorsiflexion of the first ray.
2. Muscle: gluteus medius
   - Innervation: superior gluteal nerve
   - Function: abduction of the hip, internal and external rotation of the hip depending on hip position, stabilization of the hip and pelvis during gait.

3. Muscle: quadratus plantae
    - Function: the quadratus plantae inserts onto the flexor digitorum longus tendon and acts to alter the angle of pull of the long flexor tendon by exerting a posterolateral pull. Without the influence of this intrinsic muscle the flexor digitorum longus would apply a shearing force to the metatarsophalangeal joints. In conjunction with the quadratus plantae the angle of pull on the phalanges is more in line with the sagittal plane.
4. Muscle: rectus femoris
    - Innervation: femoral nerve
    - Function: rectus femoris is the only muscle of the quadriceps femoris that crosses the hip and therefore acts to flex the hip. The quadriceps are powerful extensors of the knee.
    - Same Innervation: The femoral nerve innervates the anterior thigh muscles that flex the hip and extend the knee, pectineus, iliacus, sartorius, quadriceps femoris (rectus femoris, vastus lateralis, vastus medialis and vastus intermedius)
5. Ligaments: clockwise from top right - short plantar ligament, calcaneonavicular ligament (or spring ligament) and long plantar ligament
    - Function: These ligaments act to restrain excessive pronation and maintain the integrity of the midfoot and medial arch. Implications: Abnormal midtarsal pronation may overpower these ligaments and lead to ligament laxity or attrition which destabilizes the midtarsal joints and allows excess motion in the medial arch. These factors can contribute to adult acquired flatfoot deformity as the medial arch integrity is compromised and the midfoot is allowed to collapse. The plantar fascia also plays a role in maintaining medial arch architecture acting as a tie beam to maintain the arch. Ligament damage increases the demands on the plantar fascia to maintain arch stability, and in turn the plantar fascia can be overwhelmed as well when ligaments become damaged.

The three cardinal planes are frontal, sagittal and transverse. The anatomic position is the body erect with the palms facing anteriorly. In the lower leg adduction/abduction occur in the frontal plane, flexion and extension occur in the sagittal plane and rotation occurs in the transverse plane. Because the foot is at a 90 degree angle to the rest of the body, motions occur in different planes than that of the lower leg. In the foot abduction/adduction occur in the transverse plane, inversion and eversion occur in the frontal plane, and flexion and extension occur in the sagittal plane.

ANSWER KEY

1.3 Answers - Case Studies Applying Structural and Functional Anatomy

CASE STUDY 1

a. Calcaneus, fat pad, plantar fascia, fascial slips around the calcaneus, Achilles tendon insertion, calcaneal apophysis (growth plate).

b. No. The location of pain is not anatomically correct for plantar fasciitis. The plantar fascia originates further distal at the medial calcaneal tubercle of the calcaneus. Her symptoms are not typical of fascia pain – there is no morning pain or "start up" pain, symptoms get worse while she is running, and she can have pain at rest.

c. Insertional Achilles tendinitis, heel pad syndrome, Sever's disease, calcaneal stress fracture.

d. Palpation: at the apex of the calcaneus over the apophyseal plate, along the Achilles attachment, around the circumference of the heel pad, at the plantar fascia origin
   - Compression: squeeze the fat pad for heel pad syndrome, squeeze the calcaneus to rule out stress fracture.
   - Weightbearing: heel raise test to see if there is any discomfort while the ankle plantarflexors are engaged, toe walking to look for ankle plantarflexion strength and co-ordination and windlass tension, heel walking tests for ankle dorsiflexion strength and co-ordination and direct pressure on the apophyseal plate.
   - Non-weightbearing: ROM testing of the ankle joint to see if there are any restriction in dorsiflexion or plantarflexion; subtalar joint inversion and eversion ROM, Windlass test to check if plantar fascia pain is found.

CASE STUDY 2

a. When did you first notice your left arch was lower?
   - Was there an injury to that foot, leg or your back recently? In the past?
   - Is there any pain associated with this new foot position? If yes, where is the pain present? How would you describe the pain? When is the pain present? What makes it worse? What makes it better?
   - Have there been any other treatments for your foot?
   - Have there been any x-rays or other tests?
   - Since your foot has changed shape, have you had any other symptoms in our knee, hip or lower back?

b. Foot inverters. Primary inverter is tibialis posterior, secondary inverter is tibialis anterior.
   - In addition to tibialis posterior inverting the foot it aids in ankle plantarflexion and helps support the medial longitudinal arch. It functions eccentrically to stabilize the ankle and slow down pronation as the foot contacts the ground in the stance phase of gait.
   - Tibialis anterior functions as an inverter and ankle dorsiflexor. It aids in stabilization of the ankle and works eccentrically to both control the placement of the forefoot after heel strike, gradually guiding it to the ground, and help control rearfoot pronation during forefoot loading and midstance. It concentrically acts to pull the foot clear of the ground in swing phase of gait.

c. When tibialis posterior dysfunction occurs, and an acquired flat foot is present, one would expect to see a foot that has an excessive magnitude of pronation present during the entire gait cycle, with no resupination of the rearfoot at late stance, possibly even after heel lift. The calcaneus will be everted and the ankle slightly dorsiflexed. The foot will be abducted relative to the leg and "toe-many toes" will be present. Excessive demands will be placed on tibialis anterior to compensate with foot inversion, gastrocnemius for ankle plantarflexion, and the midtarsal ligaments and plantar fascia for medial arch and midfoot stabilization. Attenuation of the plantar ligaments allows deformity of the medial longitudinal arch and midfoot to occur. If adult acquired flat foot is present for a long time there is often compression pain felt on the lateral border of the foot distal to the lateral malleolus and around the cuboid region due to collapse of the medial longitudinal arch and midtarsal region.

d. Active inversion and eversion in static stance.
   - Double heel raise test followed by single heel raise test is possible.
   - Palpation of the course of the tibialis posterior tendon. Often the patient will not know how tender the tibialis posterior tendon is until it is palpated.

CASE STUDY 3

a. Where is the pain? How would you describe the pain? When does the pain occur? Does anything alleviate symptoms? Does anything aggravate symptoms?
   - Do you have any symptoms in your thigh, calf or foot on the affected side?
   - Has your left foot always been more pronated than the right? If no, when do you remember first noticing this?
   - What type of shoes do you wear to work? What do you wear on your feet when you are at home? Or while running errands? How old are your shoes?
   - Have any other treatments been explored to date?

a. At the age of 5 the growth plates are still active and the bones are growing. The fractures may have damaged the growth plates, casting may have affected normal development of the tibia, or the fractures may have displaced the bone affecting the repaired length of the bone. You will need to test for a leg length difference to see if a difference exists.

a. Perform postural assessment and look at shoulder heights, waist contours, arm distance from trunk, spine position, pelvic landmark heights, knee fold heights, foot position, heel position.
   - ROM of the hip, ankle, subtalar and TMT joints to see if any dysfunction occurs, whether that is hypermobility or hypomobility. Gait assessment to observe pelvic, lower leg and foot function comparing left to right.
   - Leg length discrepancy tests including the Allis Test, Weber Barstow maneuver, supine to long sit test, and measurements from ASIS to medial malleolus compared to measurements from umbilicus to medial malleolus.

ANSWER KEY

2.1 Answers - Review of Movement at Specific Joints

JOINTS	AVAILABLE MOTIONS
IP	Dorsiflexion / plantarflexion
MTP	Adduction / abduction plantarflexion / dorsiflexion
1st Ray	Relatively equal amounts of dorsiflexion / plantarflexion Inversion / eversion
2nd, 3rd, 4th Ray	Dorsiflexion / plantarflexion
5th Ray	Large amounts of dorsiflexion / plantarflexion and inversion / eversion; small amounts of abduction / adduction
Midtarsal (Oblique)	Large amounts of dorsiflexion / plantarflexion and adduction / abduction with very small amounts of eversion /inversion
Midtarsal (Longitudinal)	Nearly pure inversion / eversion
Subtalar	Inversion / eversion
Ankle	Dorsiflexion / plantarflexion (as the lower leg internally rotates, some talar adduction /abduction can be noted)
Knee	Flexion / extension

2.2 Answers - Biomechanics Review

PHASES OF GAIT	HIP	KNEE	ANKLE	OTHER	OTHER
Foot Contact	Hip is flexed and internally rotated	Knee is extended and lower leg is internally rotating	Lateral aspect of heel strikes the ground first	Subtalar joint is supinated	Midfoot is pronated about the oblique axis and supinated about the longitudinal axis
Early Mid-stance	Hip is flexed but extending	Knee is beginning to flex	Ankle is plantarflexing to lower the foot to the ground	Lower leg is internally rotating	Subtalar joint is pronating
Mid-stance	Stance leg hip is externally rotating and extending	Knee is flexed but extending while the lower leg is externally rotating	Ankle dorsiflexion occurs passively as the stance leg shifts over the foot	Subtalar joint is supinating from a pronated position towards a more neutral position	Midfoot is still pronated and the calcaneocuboid joint is locking to stabilize the rearfoot on the forefoot to provide a rigid lever for toe-off
Heel Lift	Hip is extending and externally rotating	Knee is flexing to prepare to clear the ground	Ankle is plantarflexing and the subtalar joint is neutral	Calcaneocuboid joint is locked	Dorsiflexion of MTP joints begins and the plantar fascia is drawn tight creating the windlass effect
Toe-off	Hip is extending and preparing to flex through swing phase	Knee is flexing	Ankle is plantarflexed	Leg is externally rotating	Subtalar joint is supinating
Swing	Hip rises slightly on the swing leg	Knee flexes and lower leg externally rotates	Ankle dorsiflexes	Pelvis rotates forward	Subtalar joint is pronated and then supinates just prior to the next phase

ANSWER KEY

2.3 Answers - Application of Biomechanics

1a) If 1st MTP joint dorsiflexion is not available, compensations can include the following:

- Weak propulsion with a "plant and lift" gait that avoids forward propulsion through the toe-off phase. Instead of progressing through the toe-off phase the patient may lift the foot before the forefoot is loaded. This may result in excessive ankle dorsiflexion, increased timing and speed of knee and/or hip flexion.
- Excessive abduction of the foot with propulsion off the medial aspect of the hallux; this positioning will create a greater magnitude of pronation through a longer duration of the gait cycle, with the talus more anteriorly shifted. The midtarsal axes become more parallel and making the midfoot more unstable. Up the kinetic chain an increase in tibial internal rotation can be noted affecting the knee joint extension movement, affecting force application and axes. More internal rotation may occur in the femur and internal rotation of the hip joint. All these changes affect the line of application of muscular forces acting on the joints, changing moments and lever arms of muscles.

1b) The oblique head of adductor hallucis originates on the bases of the 2-4 metatarsals while the transverse head originates on the plantar ligament of the MTP joint. The tendons of both heads attach to the lateral side of the base of the proximal phalanx of the hallux. The action of this muscle is to abduct the hallux while assisting with maintaining the transverse arch of the foot. When the angle of the hallux changes, as it does with a hallux abductovalgus deformity, the lever arm of this muscle lengthens, creating a stronger force, increasing the abduction of the hallux.

2. Flexor digitorum longus originates on the medioposterior surface of the tibia and attaches to the bases of the distal phalanx of the lateral four toes.
   - Flexor digitorum brevis originates on plantar surface of the calcaneus and inserts on both sides of the middle phalanx of the lateral four toes.
   - Flexor digitorum longus has a mechanical advantage because of its longer lever arm and more direct point of application.

3. The normal femoral neck angle in the transverse plane is 14 degrees of anteversion. Excessive anteversion would be an angle above 30 degrees. This increased forward angle of the femoral neck reduces the lever arm for gluteus medius, thereby reducing the force it can produce to assist with hip abduction, thereby affecting frontal plane motion. This will also result in less articular contact between the femoral head and acetabulum which often leads to compensatory excessive internal rotation of the lower extremity as a compensatory mechanism to rotate the femoral head back into the acetabulum, increasing the surface area of the femur in the acetabulum.

4. A typical subtalar joint axis is 42 degrees to the transverse plane and 23 degrees to the sagittal plane. The axis sits oblique to the 3 body planes, therefore providing triplanar movement.
   - A high subtalar joint axis may be as much as 68 degrees from the transverse plane, deviating further away from the transverse plane means that greater transverse plane motion is available.
   - A low subtalar joint axis may be as low as 20 degrees from the transverse plane and will be closer to the transverse plane, allowing less transverse motion.

5. When the knee is flexed, the hamstrings lever arm is longer and exerts a strong rotational component of force and a small compressive component of force creating motion about the axis.
   - When the knee is extended, the lever arm length decreases so the rotational component is less, creating less motion, while the compressive component is greater creating more stability at the joint.

3.4 Answers - Applying History Taking Information

1. Questions to ask include:

- Are there any underlying medical conditions that affect your muscles, ligaments, nerves, bones or joints? How long have these conditions been present? How are these conditions managed?
- Are there any medical conditions that have affected your mobility? Cerebral palsy, Multiple Sclerosis, stroke, neuropathy, or Parkinson's are examples of conditions that may be present but if in early stages or mild cases you may not be aware without further questioning at this stage of meeting your patient.
- Have you had any surgeries on your back, pelvis, hips, knees, ankles or feet? When? How many? Where they successful? Were there any complications?
- If a joint replacement has been indicated, when was it performed? Was it successful? Were there any complications?
- Are you on any medications that affect your muscles or balance?
- Do you use any mobility aids such as a walker or cane? While this may seem obvious, some patients may not have brought the aid with them or forgot it in the car.

Treatment considerations:

- If fat pad atrophy or bony prominences are present, more cushioning should be incorporated in the orthotic design.
- If balance is an issue, ensure the orthotic and footwear suggestions include a wide base of support.
- Velcro options may be easier than laces for securing footwear if finger dexterity is an issue.
- Avoiding grippy topcovers, choosing a more slippery option may make it easier to slide a foot into a shoe.
- Limited hip or knee flexion may require slip on footwear options if bending to put on shoes is difficult.
- Encourage use of a shoe horn or long handled shoe horn for easier donning.

2. While the College of Pedorthists does not require a pedorthist to have a diagnosis to make orthotics, most insurance companies require a diagnosis for an orthotic claim to be considered. Knowing this, you need to let your patient know that they need to get a new referral from their doctor that clearly states a diagnosis for insurance purposes.

You can still proceed with the assessment if the patient knows that a new referral would be needed before proceeding with orthotic treatment. Or the patient can choose to go back to get a new referral with a proper diagnosis before booking the assessment appointment.

The referring doctor will not have gathered all the information that you have about your patient's signs and symptoms, foot structure and function. Providing that doctor with a summary of all your findings prior to the patient going back to them for a new referral, can be helpful for the doctor to determine a diagnosis.

ANSWER KEY

3. These symptoms are indicative of soft tissue such as tendon or fascia, possibly ligament.

Further questions will need to be asked to better understand and identify the type of soft tissue and they can include:

- Does it get worse or better with prolonged activity?
- Does it ever hurt at rest?
- Does it hurt when you get up after sitting?
- Does it hurt if you move it while non-weightbearing?

Tests to include:

- Comparison of active and passive range of motion
- Palpation of structures in the area of concern
- Active and resisted strength testing
- Percussion testing if nerve is suspected

4. The main structures you need to consider are the 1st MTP joint, the 1st metatarsal bone, the proximal phalange of the hallux, the 2 sesamoid bones, the joint capsule, plantar plate, flexor hallucis longus and brevis, extensor hallucis longus and brevis, abductor and adductor hallucis

Further questions should include:

- Was there an injury to this part of the foot? How long ago was it? Describe the mechanism of injury.
- When did it start to hurt?
- When does it hurt now?
- How do you describe the pain?
- What aggravates the pain? Does anything alleviate the pain?
- Are you more comfortable barefoot or in footwear?

5. Structures/tissues to consider: medial malleolus, talus, navicular, calcaneus, ankle joint, subtalar joint, tibialis posterior tendon, flexor digitorum longus tendon, flexor hallucis longus tendon, abductor hallucis muscle, posterior tibial nerve, medial and lateral plantar nerves, tarsal tunnel, deltoid ligament

Conditions to consider: arthritic changes to the ankle or subtalar joints, bone contusion, tibialis posterior tendinitis or dysfunction, flexor digitorum longus tendinitis, flexor hallucis longus tendinitis, abductor hallucis strain, tarsal tunnel syndrome, deltoid ligament sprain

Tests to perform:

- Check ankle and subtalar joint ROM active and then passive, noting if pain is present and where, ROM, end feels
- Perform isometric resisted strength testing of the tibialis posterior, flexor hallucis longus and flexor digitorum muscles and tendons
- Perform Tinel's test of the medial and lateral plantar nerves and the posterior tibial nerve
- Palpate joint lines, bony landmarks, ligament attachments, and along muscle pathways

6. Tingling is indicative of nerve pain.

Test to include:

- Lateral squeeze test or Mulder's click test, Tinel's sign, Gauthier's test, digital nerve stress test.
- If other signs and symptoms point to neuropathy, consider monofilament or dermatome testing.

How long are your walks?

- Were your walks the same before your symptoms began?
- Do your symptoms limit your walking?
- How many times do you go walking in an average week?
- Is your walk leisure? Do you break a sweat?
- What shoes do you wear while you are walking?

7. At the age of 11 the tibial growth plates have not sealed and the bone has not stopped growing. The fracture may have displaced the bone affecting the repaired length, or caused damage to the growth plates, or prolonged casting may have affected normal development of the tibia. You will need to test for a leg length difference to see if a difference exists. Depending on the complexity of the fracture, you will want to know if there were any other complications such as joint involvement at the knee or ankle, or nerve injury. Complications such as these can affect joint function or muscle function.

8. If you forget to ask a question during the interview part of the assessment, you can always bring it up while you are performing other parts of the assessment.

- Sometimes asking questions during other parts of the assessment such as the range of motion testing or gait analysis will distract your patient and allow them to relax more while they answer your questions.

9. Ensure your patient is comfortable. Their quiet behavior may be a sign that they are not comfortable or that they are nervous. Make them feel more comfortable by letting them know what you are going to do. For example, “I just have a few more questions for you, it should only take a few more minutes. Once we get through these questions I will be able to take a closer look at how your foot is built and how it moves.” Be sure to have eye contact your patient while you ask them questions. Show them that you are relaxed, and they will most likely feel relaxed too.

- You may need to change your questioning style. If they seem to like to answer simple yes and no questions, ask more of that type of question.
- Be sure to ask one question at a time. For example, avoid a run on question such as “When do you feel the pain and what makes it feel better and what makes it feel worse?” Instead, break it down into 3 separate question. “When do you feel the pain?” Wait for an answer before asking “What makes it feel better?” and get that answer before finally asking “What makes it feel worse?”
- Consider providing examples in the question. For example, when asking what type of pain they are experiencing, you can ask “Is the pain sharp, dull, aching, burning, tingling?”
- If you continue to have problems discovering information, let your patient know why you need to ask these questions. For example: “Can you tell me a bit more about that? The more information you can provide makes it better for me to understand how I can best help you.”

ANSWER KEY

4.3 Answers - Applying Weightbearing & Non-weightbearing Information

1. These findings indicate that a functional or structural leg length difference is present and further investigation is required.
   - Compare the pelvic landmarks and knee levels with the patient in relaxed natural stance, and then again with their feet together. When the patient is in their relaxed natural stance they may be standing in a position that compensates for an existing irregularity or imbalance. When you ask them to stand with feet together these compensations should be eliminated.
   - Check the foot position bilateral. Is one foot pronated or supinated more than the other? If you correct the more pronated or more supinated foot so that the feet are more symmetrical, does this change the pelvic landmark positions?
   - Perform a Trendelenburg single leg stance test to see if dysfunction is apparent on either innominate.
   - In non-weight bearing, assess hip ROM bilateral to see if a limitation is present in either internal or external rotation.
   - Check for leg length discrepancy in non-weightbearing with the Allis test, Weber Barstow maneuver, supine to long sit test, measurements of leg lengths, or similar tests.
   - If your findings suggest a structural leg length difference, treat with lift therapy as appropriate. If your findings suggest functional dysfunction recommend manual therapy such as physiotherapy, chiropractic, osteopathic or massage therapy.

2. Ankle: testing dorsiflexion and plantarflexion
   - One hand stabilizes the tibia/fibula, the other hand cradles the calcaneus (not the toes or the midfoot!) and moves the calcaneus to observe dorsiflexion and plantarflexion.
   - This should be tested with the knee straight and knee bent – is there a difference?

   Subtalar: testing eversion and inversion
   - Your goal is to feel the glide of the calcaneus on the talus.
   - One hand stabilizes the talus, the other hand holds and moves the calcaneus.
   - Common errors: If one hand is not stabilizing the talus, you may feel motion of the talus within the ankle mortice in error. With this error, you may notice leg movement while you are testing. If the talus is stabilized properly, the legs should stay stationary. If your hand is on the midfoot instead of the calcaneus, you may feel tarsometatarsal (TMT) joint inversion and eversion in error.

   Tarsometatarsal: inversion, eversion, adduction, abduction, dorsiflexion, plantarflexion
   - One hand stabilizes the subtalar joint and rearfoot by grasping over the anterior talus and ankle.
   - The other hand grasps the midfoot and moves the midfoot into pronation /supination, adduction / abduction, dorsiflexion / plantarflexion.

- 1st MTP: dorsiflexion and plantarflexion.
- Place one hand on the first metatarsal bone to stabilize it.
- Your other hand holds the proximal phalanx of the hallux between your thumb and 2nd finger.
- Avoid pushing on the distal phalanx of the hallux, as you may end up testing range of the DIP joint.

3. The normal end feel of ankle dorsiflexion is soft or firm, but not abrupt or bony. When the knee is extended, there is muscular limitation to the motion creating a soft end feel. When the knee is flexed, there is ligamentous and capsular limitations to the motion creating a firmer end feel. When an abrupt bony end feel is noted in the ankle, it is an indication that the joint motion has ended due to a bony limitation such as arthritis.

Considerations:

- Is there pain in the ankle?
- How does the patient's ankle ROM compare in weightbearing? During gait?
- Treatment considerations include: slight heel elevation in footwear to reduce compression of the anterior ankle joint, in more significant cases a rearfoot rocker may be helpful, control abnormal subtalar joint motions that may cause compensatory motions in the ankle joint.

4. Is the eversion really limited or did the patient not perform the test properly? Try testing subtalar joint with other tests to confirm if the eversion is limited. Other tests can include:

- Asking your patient to actively evert the left foot in standing
- Actively and then passive in non-weightbearing

If limited eversion is present, you would expect to notice a lack of subtalar joint pronation during gait.
Watch for compensatory motions such as TMT joint pronation, hyperextension of the knee joint, abduction of the foot.

5. Conditions: Sever's disease, insertional Achilles tendinitis, plantar fasciitis, calcaneal stress fracture, fat pad contusion, retrocalcaneal bursitis, subcutaneous bursa
Special tests:

- Palpation of the Achilles tendon, Achilles tendon insertion, plantar fascia origin, circumference of heel pad, calcaneal growth plate at the apex of the calcaneus, retrocalcaneal bursa, subcutaneous bursa.
- Squeeze test or compression of the calcaneus to rule out calcaneal fracture or stress fracture.
- Toe walking and heel walking tests.
- Percussion test over the apex of the calcaneus.

Treatment options to consider:

- Cushion the heel.
- Reduce rearfoot malalignment or excessive pronation or supination motions that may put increased tension on soft tissues.
- Slight heel raise to reduce lengthening of Achilles tendon if it is short; physiotherapy referral if it is too tight
- Deeper heel cup to lessen fat pad splay.
- Footwear with midsole to lessen impact and heel stack to reduce strain on soft tissue.

ANSWER KEY

6. Assessment considerations:
   - Avoid barefoot walking during the assessment.
   - Perform gait analysis in footwear.
   - Wear protective gloves when touching your patient's foot to reduce the possibility of infection for your patient.
   - Perform a diabetic risk assessment.

Orthotic treatment considerations:
   - If casting for orthotics, make sure the wound is well covered to avoid casting material entering the wound.
   - Wear protective gloves while casting.
   - Ensure the cast is taken with the foot weightbearing to capture foot splay. This will lessen the risk of new pressure points from the orthotics.
   - Consider materials that will reduce shearing under their sensitive skin.

Footwear treatment considerations:
   - Proper fitting footwear.
   - Avoid seams and stitching.

7. A hypermobile first ray leads to instability of the medial longitudinal arch and first MTP joint complex in weightbearing and can thereby lead to excessive and/or prolonged pronation that may result in a medial toe-off.
   - A hypermobile first ray is often cited as a contributing factor to forefoot splay or hallux valgus for example.

8. You need to consider the ranges of motion of other joints in that same plane. Does the patient have appropriate hip, knee and 1st MTP joint flexion?
   - Consider structural factors that may reduce dorsiflexion. Does the patient have a plantarflexed forefoot relative to the rearfoot? If yes, the ankle joint may be fully compressed just having the foot plantigrade, inhibiting further dorsiflexion motion.

9. Your next steps are to try to determine why the important pronation motion is lacking.
   - Check weightbearing and non-weightbearing subtalar joint inversion and eversion to see if any restrictions are present.
   - Check the structural position of the rearfoot relative to the forefoot. Is a rigid forefoot valgus present that requires compensatory supination to be plantigrade?
   - Check the alignment of the rearfoot. Is the rearfoot in a fixed varus position?
   - Check the position of the first ray. Is it fixed in a rigid plantarflexed position that results in compensatory supination to get the forefoot plantigrade?

10. These are signs that a circulation issue such as peripheral arterial disease may be present. Look for and ask about other signs or symptoms such as painful muscle cramping in the legs after activity, weakness or numbness in the legs, cold feet, reduced healing of cuts or sores on the foot or leg, discolouration or shininess of the skin Don't alarm your patient, but suggest they follow up with their physician and send a note to their doctor outlining your findings and concerns.

Strong and pain-free	**no pathology or lesion in the muscle-tendon unit**
Strong and painful	**minor pathology of the muscle-tendon unit such as 1st degree muscle strain or tendinitis, minimal tearing of the muscle fibres**
Weak and painful	**more serious problem such as a 2nd degree muscle strain or moderate tearing of fibres**
Weak and painless	**serious injury such as complete tear or rupture of the muscle-tendon, or nerve pathology to the muscle-tendon unit**

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TERMINOLOGY

Pedorthic Terminology

Throughout this workbook key words have been typed in bold. These are fundamental pedorthic terms that you need to fully understand and use appropriately. Here you will find definitions for all the words in bold. Note that these terms are defined in reference to the foot. These terms may have different meanings in reference to other body parts. Be sure to note that some terms are similar, but some are used to describe position, while others are used to describe motion.

Abduction	movement of the foot in the transverse plane away from the midline of the body (i.e., movement outward of the forefoot)
Adduction	movement of the foot in the transverse plane toward the midline of the body (i.e., movement inward of the forefoot)
ADLs	an acronym for “activities of daily living”
Anterior	a term of relationship that describes something nearer to the front
Anteversion	as applied to the hip, anterior rotation of the femoral neck. Normal angle is 14 degrees, abnormal anteversion is more than 30 degrees anterior rotation of the femoral neck)
Ataxic	loss of the ability to coordinate muscular movement
Axis	a straight line about which a motion takes place
Bilateral	occurring or appearing on both sides of the body
Blanching	whitening of the skin in response to an obstruction to blood flow; can be a response to temporary pressure on the skin or from limb position altering blood flow
Central	a term of relationship that describes something nearer to or toward the centre
Circumduction	circular movement combining flexion, extension, abduction and adduction where the distal end of the part being moved describes a circle
Contralateral	relating to the side of the body opposite to the one on which a particular structure or condition exists

Deep	movement of the foot in the transverse plane away from the midline of the body (i.e., a term of relationship that describes something farther away from the surface
Depression	moving a part inferiorly
Distal	a term of relationship that describes something further away from the trunk or point of origin
Dorsal	relating to the upper side or top of the foot
Dorsiflexion	flexion motion in the sagittal plane occurring in the ankle and foot (i.e., bringing the dorsum of the foot closer to the tibia)
Dorsum	a term of relationship that describes something related to the posterior or dorsal surface of the foot; the upper portion of the foot
Elevation	moving a part superiorly
Eversion	movement in the frontal plane in which the plantar aspect of the foot tilts away from the median plane
Extension	straightening movement or increasing the angle between body parts
External	a term of relationship that describes something toward or on the exterior (outer) aspect
Flexion	bending movement or decreasing the angle between body parts
Frontal plane	(also called the coronal plane) an imaginary vertical plane that divides the body into front and back halves, at right angles to the median plane
Hyperextended	a limb or joint that has extended beyond its normal limits
Inferior	a term of relationship that describes something nearer to the feet
Internal	a term of relationship that describes something toward on in the interior (inner)
Inversion	movement in the frontal plane in which the plantar aspect of the foot tilts towards the median plane
Kyphosis	an exaggerated or excessive convex curvature of the spin in the thoracic region; it results in a rounded upper back and forward head position; often seen as a result of osteoporosis, arthritis or spinal trauma
Lateral	aa term of relationship that describes something further away from the median plane of the body
Lever arm	the perpendicular distance from the axis of rotation to the line of action of force/effort

TERMINOLOGY

LLD	acronym for “leg length discrepancy” – one leg being shorter than the other
Lordosis	the spine has normal inward curves of the lumbar and cervical region – excessive amounts of lordotic curve is referred to as lordosis; also referred to as swayback in the lumbar region
Medial	a term of relationship that describes something nearer to the median plane / centre of the body
Median plane	an imaginary vertical plane that passes longitudinally through the body from front to back dividing it into equal right and left halves
MTP	short form of “metatarsophalangeal”
OA	short form of “osteoarthritis”
OTC	short form of “over the counter”; another term for generic or “off the shelf”
Peripheral	a term of relationship that describes something farther or away from the centre
Plantar	a term of relationship that describes something related to the inferior surface (bottom) of the foot
Plantarflexion	extension motion in the sagittal plane occurring in the ankle and foot (i.e., pointing the toes and foot downward)
Posterior	a term of relationship that describes something nearer to the back
Pronation	simultaneous motion in all 3 planes involving abduction, eversion and dorsiflexion (in the foot)
Proximal	a term of relationship describing the position of something nearer to the trunk or point of origin
Retroversion	as in the hip, where the femoral neck angle is less than 8 degrees of anteversion. The femoral neck is rotated posteriorly from a normal 14 degress to less than 8 degress
Rotation	movement of a body part around a long axis
Sagittal plane	an imaginary vertical plane that passes through the body or body part dividing it into right and left halves, running parallel to the medial plane

Sign	objective observations in the assessment for abnormality or disease; signs are observable without asking the individual a question, for example: bruising, or malalignment of a limb segment
Superficial	a term of relationship that describes something nearer to or on the surface
Superior	a term of relationship that describes something nearer to the head
Supination	simultaneous motion in all 3 planes involving adduction, inversion and plantarflexion (in the foot)
Symptom	subjective experience of an individual; things you can't see and are reported by the individual regarding their complaint, for example: "it hurts when I stand up in the morning" or "my toe has a tingling feeling"
Transverse plane	an imaginary horizontal plane that divides the body into superior (upper/top) and inferior (lower/bottom) halves (also called the horizontal plane)
Valgus	a static position in the frontal plane in which a distal anatomical part is tilted inwards (towards the midline of the body) relative to the proximal anatomical part
Varus:	a static position in the frontal plane in which a distal anatomical part is tilted outwards relative to the proximal anatomical part (using the midline of the body as reference) of the rearfoot: a static position in the frontal plane where the calcaneus is tilted outward (an inverted position) of the knee: a static position in the frontal plane where the lower leg is angled outward relative to the upper leg (bow legged)
Velocity	the speed of something in a given direction

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THE COLLEGE OF PEDORTHICS OF CANADA

Study Guide

Workbook 1

Pedorthic Foundations

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