THE COLLEGE OF PEDORTHICS OF CANADA

Study Guide

Workbook 4

Orthotic Theory

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.

Table of Contents

LEARNING OBJECTIVES

1. Identify the type(s) of pedorthic device(s) available in the clinician's toolbox that can be added to their patient treatment plan.

2. Differentiate between Functional and Accommodative support levels of pedorthic device(s) needed in the patient treatment plan.

3. Understand the key differences between custom, component and over the counter designs of pedorthic devices.

4. Identify casting and measuring protocols associated with utilizing pedorthic device(s) in the treatment plan.

5. Identify key areas of consideration when designing and choosing pedorthic device(s).

RATIONALE

What is the purpose of this learning material?

This workbook will help learners to work through various concepts, theories and constructs that are fundamental to applying critical thinking and problem solving skills to pedorthic treatment. You can use this workbook as a basic structure to discuss with your mentor and ask questions during a workplace apprenticeship or practicum. Work through the various exercises and case studies to help prepare you for the certification exam.

OBJECTIVES SEVEN & EIGHT

page

34-41

When you complete these objectives you will be able to outline the various stages of foot orthoses manufacture and how the stages influence the final device. You will also be able to Identify key considerations when fitting and dispensing pedorthic device(s).

OBJECTIVES NINE & TEN

page

42-45

When you complete these objectives you will be able to identify the problem solving process of determining when/ if adjustments are needed to the pedorthic device(s) dispensed and the best approach for addressing the issues.

OBJECTIVE ELEVEN & ANSWER KEY

page

46-72

When you complete this objective you should be able to demonstrate an improved ability to design and communicate a treatme nt plan/custom foot orthoses work order.

LEARNING OUTCOMES

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

From our previous workbooks we have established that patients have different foot types, dysfunctions, pathologies and symptoms thus treatment plans should also differ. This module concentrates primarily on orthotic treatment plans and also includes some related pedorthic products normally available in a pedorthic setting. When you complete this module, you will have developed a systematic approach to using your strong clinical assessment findings to develop an orthotic and related pedorthic devices treatment plan.

INTRODUCTION

There is undeniable clinical evidence that patients receive positive results when a C. Ped (C) utilizes custom foot orthoses (and other pedorthic devices) in their treatment plan.

Skillful clinicians respect the "hands on" nature of pedorthic treatment plans by systematically balancing the "art" of their practice with justifiable protocols based on clinical experience and research.

The goal of Workbook Four is to assist the reader to develop their own systematic approach which should bridge the "gap" between clinical knowledge, design capability and skillful manufacture. Through your studies the reader should discover that the gap between clinical knowledge and technical application is filled with creativity. Due to the subjective nature of Pedorthics, the reader needs to view this content through the eyes of a fabricator rather than a clinician and they also need to keep an open mind to the multitude of options and opinions available to treat the patient.

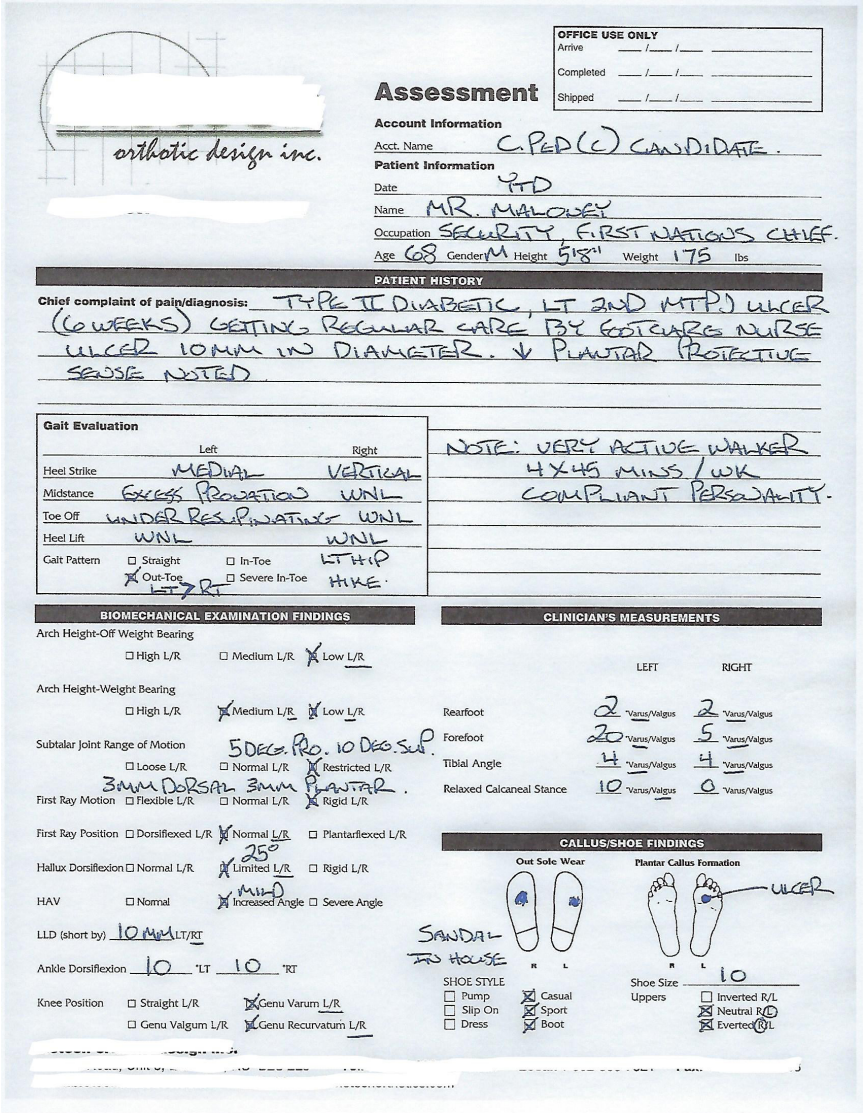
In addition, this workbook is not intended to be a "how-to" document thus the reader needs to draw from their PEDS6014 Orthotic Theory studies and utilize the full potential of the mentorship available to them through their Direct/Practicum Supervisor.

As demonstrated in the picture below the Pedorthist's thought process from patient assessment to final orthoses fitting is far from linear, in fact the internal conversation we have with ourselves while assessing our patient would likely contain many "forks in the road". One would need to be a skilled mathematician to calculate the countless options of orthotic design for our patient.

This workbook is designed to assist the reader in developing their own strategic approach to orthotic design based on the education and experience they have in their "pedorthic toolbox".

http://salary.1111.com.tw/WorkPost.aspx?pNo=146

Benchmark Exercise – Lets get started



orthotic design inc.

Assessment

OFFICE USE ONLY
Arrive ___/___/___
Completed ___/___/___
Shipped ___/___/___

Account Information
Acct. Name C.PED(C) CANDIDATE.

Patient Information
Date YTD
Name MR. MALONEY
Occupation SECURITY, FIRST NATIONS CHIEF.
Age 68 Gender M Height 5'8" Weight 175 lbs

PATIENT HISTORY

Chief complaint of pain/diagnosis: TYPE II DIABETIC, LT 2ND MTPJ ULCER (6 WEEKS) GETTING REGULAR CARE BY FOOTCARE NURSE ULCER 10MM IN DIAMETER. ↓ PLANTAR PROTECTIVE SENSE NOTED.

Gait Evaluation

	Left	Right
Heel Strike	MEDIAL	VERTICAL
Midstance	EXCESS PRONATION	WNL
Toe Off	UNDER RESPINATING	WNL
Heel Lift	WNL	WNL
Gait Pattern	☐ Straight ☐ In-Toe ☒ Out-Toe ☐ Severe In-Toe LT > RT	LT HIP HIKE.

NOTE: VERY ACTIVE WALKER 4X45 MINS / WK COMPLIANT PERSONALITY.

BIOMECHANICAL EXAMINATION FINDINGS

Arch Height-Off Weight Bearing
☐ High L/R ☐ Medium L/R ☒ Low L/R

Arch Height-Weight Bearing
☐ High L/R ☒ Medium L/R ☒ Low L/R

Subtalar Joint Range of Motion 5 DEG. PRO. 10 DEG. SUP.
☐ Loose L/R ☐ Normal L/R ☒ Restricted L/R

First Ray Motion 3MM DORSAL 3MM PLANTAR.
☐ Flexible L/R ☐ Normal L/R ☒ Rigid L/R

First Ray Position ☐ Dorsiflexed L/R ☒ Normal L/R ☐ Plantarflexed L/R

Hallux Dorsiflexion ☐ Normal L/R ☒ Limited L/R 25° ☐ Rigid L/R

HAV ☐ Normal ☒ Increased Angle MILD ☐ Severe Angle

LLD (short by) 10 MM LT/RT

Ankle Dorsiflexion 10 °LT 10 °RT

Knee Position ☐ Straight L/R ☒ Genu Varum L/R
☐ Genu Valgum L/R ☒ Genu Recurvatum L/R

CLINICIAN'S MEASUREMENTS

	LEFT	RIGHT
Rearfoot	2 °Varus/Valgus	2 °Varus/Valgus
Forefoot	20 °Varus/Valgus	5 °Varus/Valgus
Tibial Angle	4 °Varus/Valgus	4 °Varus/Valgus
Relaxed Calcaneal Stance	10 °Varus/Valgus	0 °Varus/Valgus

CALLUS/SHOE FINDINGS

Out Sole Wear
SANDAL IN HOUSE
R L

Plantar Callus Formation
ULCER
R L

SHOE STYLE
☐ Pump ☒ Casual
☐ Slip On ☒ Sport
☐ Dress ☒ Boot

Shoe Size 10
Uppers ☐ Inverted R/L ☒ Neutral R/L ☒ Everted R/L

- Please read the patient assessment below for Mr. Maloney
- Design a pair of custom foot orthotics based on the information given
- Fill out your own in-house fabrication work order
- Once you complete your work order, "park it for now", we will be using it as a comparison in our Final Exercise.

NOTE

- Presume the custom foot orthoses you are designing will be fabricated by a C. Ped (C) who you don't know.
- Remember no peeking at the suggested answers or consulting with your mentor just yet! We'll do that later!

OBJECTIVE ONE

Pedorthic Devices

When you complete this objective you will be able to…

When you complete this objective, you will be able to identify the type(s) of pedorthic device(s) available in the clinician's toolbox that can be added to their patient treatment plan.

LEARNING MATERIAL

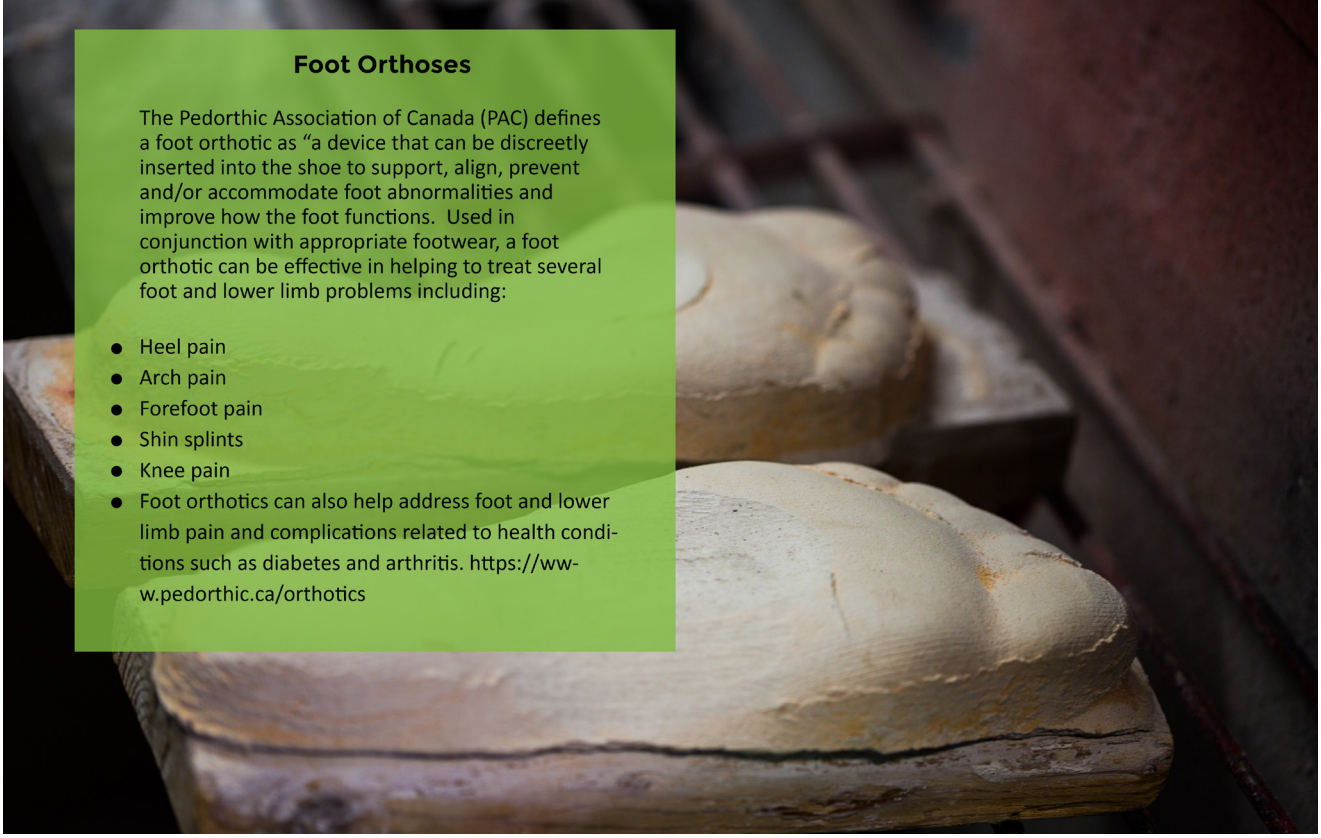
Dorland's Illustrated Medical Dictionary defines orthoses as: "an orthopaedic appliance or apparatus used to support, align, prevent, or correct deformities or to improve the function of movable parts of the body." Patients with different body types, dysfunctions, pathologies and symptoms should receive different pedorthic device(s). Part of a systematic approach of deciding a treatment plan is the understanding of the types of pedorthic devices that are available to the clinician for their patient.

As defined above, the term "orthoses" is a much broader term encompassing the whole body and not limited to just foot orthoses. For the purposes of this workbook, we will focus on the orthoses (pedorthic device(s)) that are within the scope of practice of a C. Ped (C) set out by the College of Pedorthics of Canada (CPC), http://www.cpedcs.ca/scope-of-practice/.

Common Pedorthic devices utilized by a C. Ped (C) include:

- **Foot Orthoses**
- **Complementary Assistive Devices**
- **Footwear**
- **Footwear Modifications**

Footwear and Footwear Modifications are addressed in Workbook 3. Although the content of Workbook 4 will focus on Foot Orthoses and Complementary Assistive Devices the reader cannot underestimate the value and influence that Footwear and Modifications have on their outcomes. Going forward, the reader needs to presume the patient has properly fitted footwear and should understand that one or more of these pedorthic devices could be part of the recommended treatment plan for the patient.



Foot Orthoses

The Pedorthic Association of Canada (PAC) defines a foot orthotic as "a device that can be discreetly inserted into the shoe to support, align, prevent and/or accommodate foot abnormalities and improve how the foot functions. Used in conjunction with appropriate footwear, a foot orthotic can be effective in helping to treat several foot and lower limb problems including:

- Heel pain
- Arch pain
- Forefoot pain
- Shin splints
- Knee pain
- Foot orthotics can also help address foot and lower limb pain and complications related to health conditions such as diabetes and arthritis. https://www.pedorthic.ca/orthotics

In the text, Recent Advances in Orthotic Therapy, Kevin Kirby, DPM defines foot orthoses: "An in-shoe medical device which is designed to alter the magnitudes and temporal patterns of the reaction forces acting on the plantar aspect of the foot in order to allow more normal foot and lower extremity function and to decrease pathologic loading forces on the structural components of the foot and lower extremity during weight-bearing activities."

Complimentary Assistive Devices:
Complementary Assistive Devices is a very broad term; however, it is another tool for the pedorthist to treat his/her patient. Although such tools are in the scope of practice of the pedorthist, the College of Pedorthics of Canada requires the clinician to be properly trained and competent when dispensing/modifying such devices. Devices that fall into this category are often proprietary to specific manufacturers thus it is imperative that the pedorthist continuously familiarizes themselves with such proprietary training and dedicates appropriate training time to fully understand the risks and benefits to their patients.

Proprietary training would include such things as specified casting techniques, required measurements, unique sizing grids, application/fitting protocols and contraindications. If a pedorthist should choose to modify such devices, they need to be knowledgeable about the raw material characteristics of the devices to further avoid harm or loss of durability.

Note: Manufacturers are often leaders in providing scientific and clinical research, developers in providing new products and major financial contributors to our professional associations thus should be viewed as assets to our profession. The pedorthist needs to understand this important relationship when deciding to add products and services to their treatment protocol. However, the pedorthist also must understand that our suppliers are not regulated by the same bylaws and ethical standards thus it is important to differentiate bias and marketing vs. informative education. Ultimately, the pedorthist is responsible for what they dispense to their patient.

Common complimentary assistive devices include, but not limited to:

- Compression Therapy
- Subtalar Control Ankle Foot Orthosis
- Plantar Fasciitis/Achilles Tendonitis Night Splints
- Below Knee Walkers
- Ankle Braces
- Toe splints and spacers
- Versions of assistive devices can be custom made, component or over the counter. Compression socks as pictured in figure 1, are an example of assistive devices that can found in both custom made and over the counter versions.

MIni Exercise 1.0

The Pedorthist's Toolbox contains many devices to use for patient care, can you complete the table to the right?

Guiding Questions

Consider using the following guiding questions to help you decide which type of pedorthic device(s) may be best suited for your patient:

- Is the patient's foot/ankle ailment acute or chronic?
- Are your recommendations going to be used short or long term by the patient?
- Is there a device(s) in our pedorthic toolbox that can be of assistance to treat this patient? What device(s) is it?
- How does the device(s) you choose apply to the foot/ankle ailment you are treating?
- Are you recommending more than one device? If so, how will these devices work in combination with each other?
- Does the device(s) that you recommend fit into the patient's lifestyle?
- Can the device(s) you recommend be put on by the patient or will they need assistance? Do they have assistance? Can they financially afford it?
- How would you summarize your treatment plan in language that the patient would understand?

Please note: Compare your answers with the answer key at the back of the workbook.

AILMENTS	PEDORTHIC TOOL
Hallux Valgus	**Toe Aligner Splint**
Ankle Sprain	**?**
Haglund's Deformity	**?**
Patellofemoral Syndrome	**?**
?	**Dorsiflexion Night Splint**
?	**Sulcus pads**

CASE STUDIES

Case Studies, Tools in the Pedorthic Toolbox

Using the information found in the Learning Materials, identify the type(s) of device(s) available in the Pedorthist's toolbox that could be used in your patient treatment plan. Keep in mind that Pedorthists have multiple options available to them when treating their patient thus there exists many credible ways to take care of your patient needs; the case studies are designed to encourage critical thinking and justification of your choices.

- For the sake of these Case Studies it is safe to presume that your patient is already wearing well fitted footwear and you have already discussed outside referrals to other medical professionals which will compliment your decisions.
- Make sure to keep your answers basic, using only the information provided, more complex answers will be required as we progress through this workbook.
- When looking at each case study, consider the guiding questions above, remembering the "Who, What, When & Why?"

Exercise 1.3

Sample Case Study: Noah Brown

Mr. Brown is a 70-year old, self-employed carpenter who actively works in his company. He employs a small team of construction workers who do most of the "heavy lifting" duties however he is very active running the administrative aspect of his business. Although he mostly works in an office, from time to time he needs to visit a job site. Last week, while inspecting a job site, he tripped on a piece of wood, inverting his right ankle severely. X-rays confirm a stable, non-displaced distal lateral malleolus fracture. After a week of rest, his physician has authorized Noah to return to work conditional on modified duties, the physician also refers the patient to your clinic for a device that will help support weight bearing for the next 4-6 weeks. Financially, Mr. Brown needs to return to work, he does have a medical plan however no personal accident insurance benefits and his company needs his leadership.

Using the suggested guiding questions below work through Case Study 1 & 2 on the following pages. This sample case study will walk you through the guiding questions to help you determine which pedorthic devices may be suitable for each patient file.

Assessment Questions

1. Is the patient's foot/ankle ailment acute or chronic?
2. Are your recommendations going to be used short or long term by the patient?
3. Is there a device(s) in our pedorthic toolbox that can be of assistance to treat this patient? What device(s) is it?
4. How does the device(s) you choose apply to the foot/ankle ailment you are treating?
5. Are you recommending more than one device? If so, how will these devices work in association with each other?
6. Does the device(s) that you recommend fit into the patient's lifestyle?
7. Can the device(s) you recommend be put on by the patient or will they need assistance? Do they have assistance? Can they financially afford it?
8. How would you summarize your treatment plan in language that the patient would understand?

Use the guiding questions shown above in the sample case study to complete case study 1 & 2 below.

CASE STUDIES

Case Study 1: Joshua Madore

Joshua is a 23-year old runner who has been diagnosed with plantar fasciitis of the right foot. The pain presents in a very typical manner: pain upon rising however pain works out after walking 10-15 minutes, noted pain at the medial calcaneal tubercle, pain radiates through the medial longitudinal arch, you have observed that Joshua excessively pronates at mid-stance. He has purchased suitable footwear for running and daily activity, tried over the counter insoles and has even completed some physiotherapy, all of which has been helpful however not long term. Joshua has been struggling with this pain off and on for over a year and is willing to try anything to help relieve his pain.

Case Study 2: Mya Lynne

Mya is a 35-year old lawyer who needs to wear business attire daily, she complains of bunion pain and her orthopaedic surgeon has diagnosed her with severe hallux abductovalgus on the left foot because of excess pronation. She reports to you that her doctor wants her to try some conservative treatment before proceeding to surgery thus has prescribed custom foot orthotics. Mya also asks, "Is there a splint that I could wear to help straighten my toe?

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 about their successes/failures when using different pedorthic device(s) in similar real-life cases.

OBJECTIVE TWO

Support Levels

When you complete this objective you will be able to…

differentiate between Accommodative and Functional support levels of pedorthic device(s) needed in your patient treatment plan.

LEARNING MATERIAL

Pedorthic devices have goals of control that are described as accommodative or functional. In Michaud's Human Locomotion textbook it notes that as a rule, softer materials are used when control of motion is not as much of a concern and states that this type of orthosis is an "accommodative orthotic". Conversely when "semi-rigid or rigid materials are used to control motion" it would be considered more of a "functional orthotic".

As found on PAC's website, orthoses can be "Accommodative" – where the primary goal is to deflect pressure away from ulcers, callosities and painful pressure points or "Functional" – in which a device is primarily designed to control foot and lower leg biomechanical function.

It is also important to note that an orthoses' goal of control is not limited to just accommodative or functional, rather the pedorthist can choose/modify/design devices which incorporate qualities of both accommodation and functional control.

It is the responsibility of the pedorthist to decide the level of control they wish to utilize for their patient. Admittedly, making this final decision is very subjective thus the pedorthist needs to be very familiar with how orthoses design and material characteristics apply to their patient.

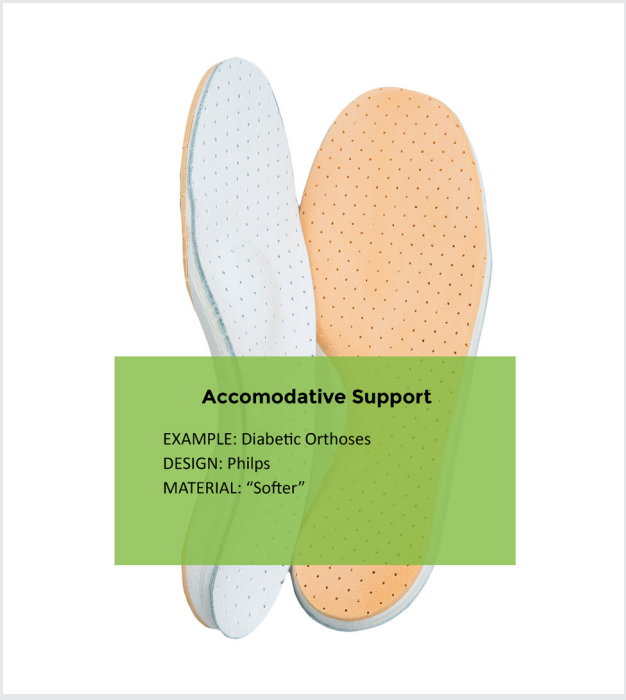
How do we decide whether to use an Accommodative or Functional Level of control in our orthotic design? (fig. 2)

Fig. 2 The pedorthist needs to take into account common clinical and technical factors when deciding the level of accommodation and/or function they utilize in their final designs.

Note: For simplicity purposes, the rest of this workbook will mainly focus on custom foot orthoses however the information derived can readily be applied to other Pedorthic devices in our toolbox.

Make sure to review Clinical Biomechanics of the Lower Extremities by Valmassy, Chapter 14, Orthotic Materials, however, the most common clinical and technical variables that influence the level of accommodation and/or function of a device can include but are not limited to:

- Body weight
- Arch height
- Patient tolerance levels
- Foot/ankle ROM
- Cast techniques
- Shell additions
- Shell modifications
- Footwear interface



Exercise 2.0

Differentiating Accommodative & Functional Support Levels

To better understand the subjective nature of these concepts let's consider the before mentioned clinical and technical factors when utilizing a simple custom made orthotic shell composed of 3 mm polypropylene with no additions or modifications. Complete the table with your opinion on how the variables below may affect the level of control and accommodation in the foot orthoses you would design.

Variable	Effect
Body weight	Orthoses made of 3 mm polypro may feel "hard/rigid" under the foot of a patient who weighs 60 lbs. however "soft/flexible" under the foot of a patient who weighs 250 lbs.
Arch height	
Patient tolerance levels	
Foot/ankle ROM	
Cast techniques	
Shell additions	
Shell modifications	
Footwear interface	

Please note: Compare your answers with the answer key at the back of the workbook

Exercise 2.1

Orthotic Design Element Exercise

Provide the "best match" of Design Elements in Column B to the corresponding Pathology/Deformity in Column A. No items may be used more than once.

Column A	Column B
___Pressure Metatarsalgia	1. Varus Posting
___Plantarflexed first ray	2. Heel height
___Herniated heel fat pads	3. Post to lab evaluation
___Morton's Toe	4. Minimal arch fill
___Achilles Tendonitis	5. First Ray Cut Out
___Pronation	6. Neuroma Pad
___Supination	7. Metatarsal Pad
___Pes Cavus	8. Valgus Posting
	9. Deep Heel Cup
	10. Morton's Extension
	11. SACH Heel

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 about their successes/failures when using different pedorthic device(s) in similar real-life cases.

OBJECTIVE THREE

Pedorthic Devices

When you complete this objective you will be able to…

Describe the key differences between custom, component and over the counter designs of pedorthic devices.

LEARNING MATERIAL

After considering the goals of control best suited for their patient, a pedorthist needs to identify the modality/type of design of the orthoses they recommend for their patients. Most commonly, there exist three classifications:

- Over the Counter (OTC)
- Modified OTC/Component
- Custom

Over the Counter: (prefabricated, stock)

OTC devices are often sold through pharmacies, sport stores, grocery stores and other retail stores. Refers to mass produced devices that are generally fitted by the patient themselves according to their shoe size thus not unique to the patient. However more supportive types of over-the-counter devices can be found at pedorthic facilities.

Modified OTC/Component:

These types of foot orthoses are often sold/dispensed in retail environments such as sport stores, ski shops, home health care centers and medical professionals who utilize 2D Force Plate technology. Refers to OTC foot orthoses that are specifically added to, removed from and/or heat modified unique to the patient however still utilizing prefabricated parts. Severe foot types often cannot be addressed with this modality as the ability to modify such a device is limited to its prefabricated contours.

Custom:

PAC defines a custom foot orthosis as “an internal foot appliance which is manufactured from a three dimensional (3D) image of the foot and made from raw materials. (Pedorthic Association of Canada, Pedorthic Terminology, 2003). These type of foot orthoses are dispensed in a clinical environment by foot care specialists such as a C. Ped (C). After a full biomechanical assessment, the Pedorthist takes a

3D cast of the patient's foot. Custom orthoses are one-of-a-kind devices designed and shaped for the patient's unique needs and anatomy. Utilizing custom foot orthotic therapy allows the clinician to offer the maximum diversity of material choice, design options and intimate fit which reduce limitations of design and improve chances of patient compliance.

Exercise 3.0

Guiding Factor	Type/Modality	Justification
Urgency	OTC OTC/Component Custom	As OTC devices are often inventory items they can be dispensed to your patient within minutes thus can be an excellent tool to provide initial and immediate relief in acute cases such as plantar fasciitis or a diabetic requiring immediate offloading. The clinician's access to lab facilities dictates the time needed to provide OTC/Component and Custom Made Foot Orthoses, this time could range between hours to weeks.
Temporary Need Timing		
Biomechanical Abnormalities		
Activity Level		
Different Shoe Styles		
Cost		

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.
- Ask their opinion as to what they would change about your answer (if anything) and why?
- Ask about their successes/failures when using different pedorthic device(s) in similar real life cases.

OBJECTIVE FOUR

Casting and Measuring Protocols

When you complete this objective you will be able to…

Identify casting and measuring protocols associated with utilizing pedorthic device(s) in the treatment plan.

LEARNING MATERIAL

All device(s) found in your pedorthic toolbox require some type of measuring and/or casting process to ensure appropriate patient fit. It is important to acknowledge that more is required from a Canadian Certified Pedorthist than simply having the "authority" to utilize a device because it fits your scope of practice. The College of Pedorthics of Canada requires its certified members be properly trained and competent when using any devices that are in their "pedorthic toolbox".

Measuring:

As previously discussed in Objective One, OTC or Modified OTC/Component devices often fall into a category where training is proprietary to specific manufacturers thus it is imperative that the pedorthist continuously familiarizes themselves with such proprietary training and dedicates appropriate training time to fully understand the risks and benefits to their patients. Proprietary training would include such things as required measurements, unique sizing grids, application/fitting protocols and contraindications. If a pedorthist should choose to modify such devices, they would want to be knowledgeable about the raw material characteristics of the devices to further avoid harm or loss of durability. It should be noted that some manufacturers also require specific measurements even when a 3D negative cast is supplied, i.e. custom footwear, custom SCFO. Ignoring proprietary training and/or not providing specific proprietary information requested by the vendor is ignoring the needs of your patient.

Casting:

In whatever form used, taking a cast of a patient's foot will yield a negative cast. As discussed in PEDS6013, a clinician will favour one method of negative casting over another however a quality pedorthist will never limit themselves to only one method of casting their patient, doing so is not

Figure 3, 3D Negative Scanning

putting the interest of your patient first. The pedorthist also needs to acknowledge that a quality assessment will be negated by a poor cast, stressing the importance of the pedorthist to hone their ability to take a good cast.

There are numerous casting techniques available to a C. Ped (C):

- slipper casting
- foam casting
- computer generated casting (see fig. 3)
- wax
- direct mold

Your chosen cast method should be based on the needs of your patient thus the following "Guiding Questions" should be considered:

1. Can patient lay prone?
2. Can patient lay supine?
3. Can you apply dorsal pressure to the foot?
4. Can you apply plantar pressure to the foot?
5. Does the patient have attention disorders/issues with staying still?
6. How does the cast method influence the final device?
7. How fast does this patient need their devices?
8. What is the cost of taking the cast?
9. Does patient's medical plan demand specific cast methods?
10. Does the patient have any specific abnormality that lends itself more readily to a specific casting method (ie fixed deformity, hypermobility, sensitivity, deformity)

Exercise 4.0

Mini Case Studies

Using Guiding Questions Justifying Cast Methods Used on your Patient.

Using your Guiding Questions, as it applies to the Mini Case Studies listed below, what casting method would you choose for your patient? Note: your response should be derived only from the information provided however keep in mind that there likely is more than one credible approach.

- 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?

Sample Mini-Case Study: Mrs. MacKenzie

Mrs. MacKenzie has been experiencing pain off/on for years due to plantar fasciitis. Typically, she can keep the symptoms reduced by wearing good footwear and stretching however she is now in her 7th month of pregnancy, her feet are very sore, and her doctor has prescribed custom foot orthoses. Using the "Guiding Questions" above what casting method would a clinician consider avoiding for this patient, why & what would be considered your best alternative?

Answer

Slipper, computer generated, wax and direct mold casting methods taken in the prone and/or supine position should be avoided. At 7 months pregnant, the clinician should not be surprised that Mrs. Mac Kenzie might not be able to lie either prone or supine for casting so another position needs to be found that will be both comfortable and effective for casting. Casting in a seated position could be considered as an ideal approach.

Mini-Case Study One: Ms. Jade

Ms. Jade is a competitive marathon runner who presents with a very painful stress fracture at the midshaft level of her left 3rd metatarsal. Her physician has prescribed custom foot orthoses, using the "Guiding Questions" above what casting method would a clinician consider avoiding for this patient, why & what would be considered your best alternative?

Mini-Case Study Two: Mr. Logan

Mr. Logan is a member of the Department of National Defense, he is being deployed overseas for three months next week however he needs custom foot orthoses. Your clinic outsources their foot orthoses to a central lab facility on the opposite side of the country. Using the "Guiding Questions" above what casting method would a clinician consider utilizing for this patient, why & what would be considered your best alternative?

Mini-Case Study Three: Mr. Cole

Mr. Cole, non-Diabetic, 155 lbs., has been prescribed custom foot orthoses by his doctor. After a biomechanical assessment you conclude that Mr. Cole's problems stem from very hypermobile subtalar and midtarsal joints. His medical plan will only pay for orthotics derived from plaster of Paris slipper casting unless the patient is Diabetic. Using the "Guiding Questions" above what casting method(s) would the clinician be required to avoid for this patient, why & what would be considered your best alternative?

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 mini-case studies.
- Ask their opinion as to what they would change about your answer (if anything) and why?
- Ask about their successes/failures when using different pedorthic device(s) in similar real life cases.

OBJECTIVE FIVE

Designing & Choosing Pedorthic Devices

When you complete this objective you will be able to…

Identify key areas of consideration when designing and choosing pedorthic device(s).

LEARNING MATERIAL

We are now at an integral point of the treatment process where the clinician bridges the gap between clinical assessment and technical application. The clinician needs to use all information gathered during their assessment to recommend solutions for the patient. This Workbook has already discussed the influence that device selection, goals of control and modality/type of design have on our treatment plan however as we travel over the aforementioned bridge we further progress to enter a "fork in the road" that demands the next level of decision making by the clinician. The clinician needs to design the device to be worn by their patient.

The nature of OTC devices does not allow for the clinician to provide design input as the clinician simply chooses the closest premade option that best matches their patient's needs. A clinician can modify an OTC device giving the opportunity for design input however the clinician is limited by the original shape of the OTC device. One of the greatest benefits of using custom made foot orthotics in your treatment plan is your ability to provide countless design options for your patient.

Key areas of consideration when designing foot orthoses can be identified through the basic stages of foot orthoses manufacture:

- Negative Cast
- Positive Cast (see fig. 4)
- Shell Base
- Shell Modifications
- Postings
- Additions
- Covers

Fig. 4, Positive Casts generated through CAD/CAM technology

Note: The clinician needs to respect that changes to any of the above stages can create a "domino effect" which can influence one or more of the basic stages of foot orthoses manufacture.

putting the interest of your patient first. The pedorthist also needs to acknowledge that a quality assessment will be negated by a poor cast, stressing the importance of the pedorthist to hone their ability to take a good cast.

There are numerous casting techniques available to a C. Ped (C):

- slipper casting
- foam casting
- computer generated casting (see fig. 3)
- wax
- direct mold

Your chosen cast method should be based on the needs of your patient thus the following "Guiding Questions" should be considered:

1. Can patient lay prone?
2. Can patient lay supine?
3. Can you apply dorsal pressure to the foot?
4. Can you apply plantar pressure to the foot?
5. Does the patient have attention disorders/issues with staying still?
6. How does the cast method influence the final device?
7. How fast does this patient need their devices?
8. What is the cost of taking the cast?
9. Does patient's medical plan demand specific cast methods?
10. Does the patient have any specific abnormality that lends itself more readily to a specific casting method (ie fixed deformity, hypermobility, sensitivity, deformity)

Exercise 5.0

Orthotic Design

Drawing from your previous PEDS6014 studies and clinical experience identify at least one example of a design element that could be implemented at each of the following stages of foot orthotic manufacture and describe the process, the expected result and your rationale as to why you would choose that design element. Complete the chart below:

Stage	Process	Result	Rationale
Negative Cast			See Objective Four
Positive Cast	Adding plaster to the positive cast at that Navicular	Creates a plantar "bump out" of the orthotic shell	A great technique used to accommodate a prominent Navicular
Shell Base			
Shell Modification			
Postings			
Additions			
Covers			

Please note: Compare your answers with the answer key at the back of the workbook.

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 mini-case studies.
- Ask their opinion as to what they would change about your answer (if anything) and why?
- Ask about their successes/failures when using different pedorthic device(s) in similar real life cases.

OBJECTIVE SIX

Ordering Pedorthic Devices

When you complete this objective you will be able to…

Identify key responsibilities of the C. Ped (C) when ordering Pedorthic device(s).

LEARNING MATERIAL

Whether dispensing custom made, OTC or modified OTC devices, Canadian Certified Pedorthist are held responsible by the College of Pedorthics of Canada for all products they dispense to their patients thus the C. Ped (C) not only needs an awareness of the design and applicability for their patient but also needs to embrace the importance of utilizing the countless design options that are available when dispensing pedorthic devices and/or ordering the correct model/size. A technical work order needs to be written clearly and given the same respect as a clinical assessment. The clinician needs to embrace both their ethical and business responsibility by documenting their work order in such a fashion that a fellow C. Ped (C) can understand and replicate the work order. The clinician needs to be meticulous in their record keeping so that if an ethical or legal challenge occurs then there is an excellent paper trail of what has occurred. Clear assessments and work orders display your competence and create confidence in your decisions to a judicial panel that you may face.

The process of ordering OTC, OTC Modified and Custom Made Devices demand varying levels of responsibility from the clinician:

Over the Counter devices are visually matched to patient need thus the clinician would primarily need to rule out contraindications of the product for their patient and then simply order the product from a vendor according to patient shoe size.

Component/OTC Modified Devices demand the same requirement as described above with OTC devices however the increased responsibility of the clinician to ensure that the modifications they have designed and added to the OTC device can be justified for patient needs. The clinician is also responsible to ensure these modifications are done correctly.

Custom Foot Orthoses requires the clinician to be competent in casting, able to design orthoses according to patient needs, accurately evaluate completed device and ensure ethical manufacturing practices.

When providing custom made or modified OTC devices a clinician will quickly realize that a good fabricating assistant/ lab is a great asset to their practice however when it comes to creating a good work order a C. Ped (C) needs to differentiate between delegating workload vs. avoiding responsibility. The clinician needs to avoid poor habits so that the technician (even if you are building your own devices!) does not have to guess what the clinician was asking for. This lack of careful documentation puts your practice at risk, reduces your professionalism and ultimately ignores the needs of your patient.

Certified Canadian Pedorthists should avoid directions/ habits such as:

- "post to lab evaluation"
- "fabricator to choose the design"
- "fabricator to choose materials"
- not providing a work order
- writing fabrication instruction on the foam box or cast rather than a work order
- providing a work order on scrap paper/Post Its!
- not writing the name of the patient on the cast

Exercise 6.0

Completing a C. Ped (C) Work Order

Using the list below, what poor industry habits would a C. Ped (C) avoid when completing a work order?

Poor Habit	Risk	Best Practice
"Post to Lab Evaluation"	The clinician is delegating responsibility to the manufacturer as to how much "correction" to add to the orthoses. Using this instruction could suggest that the dispensing clinician does not have the competency needed to make this decision.	As the clinician has the best vantage point on the patient, the responsibility lies clearly on the clinician thus they should be competent to complete the task or avoid dispensing foot orthoses.
Fabricator to choose the design	Adding plaster to the positive cast at that Navicular	Creates a plantar "bump out" of the orthotic shell
"Fabricator to choose materials		
Not providing work order		
Writing fabrication instruction on the foam box or cast rather than a work order		
Providing a work order on scrap paper/Post Its!		
Not writing the name of the patient on the cast		

Please note: Compare your answers with the answer key at the back of the workbook.

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.
- Ask their opinion as to what they would change about your answer (if anything) and why?
- Ask about their successes/failures when using different pedorthic device(s) in similar real life cases.

OBJECTIVE SEVEN

Foot Orthoses Manufacturing

When you complete this objective you will be able to…

Outline the various stages of foot orthoses manufacture and how the stages influence the final device.

NOTE:
See the "Sample Assessment Form"

LEARNING MATERIAL

In PEDS6014 we read a quote from Dr. Jeff Root:

- A good orthosis can't be made from a bad cast
- A good orthosis can't be made from a good cast if done by a bad lab/tech process
- A good orthosis can only be made from a good cast and good lab/tech process

Your Fabrication Practicum experience is invaluable to provide you the greatest perspective on how each stage of foot orthoses can influence your patient results. It is beyond the scope of this workbook to provide the "how-to", "hands-on" skills needed to build orthoses however the candidate may find benefit to review their lessons from PEDS6014. Although both skills complement each other, the "hands-on" ability to manufacture foot orthoses must be differentiated from the fabrication knowledge needed to be proficient at designing foot orthoses.

As a C. Ped (C), if you understand manufacturing, the actual making of an orthotic, you are much better equipped to design orthoses. Clinically, you must understand how the design elements of the orthotic address the assessment findings and the orthotic goals. And in order to understand those things you need to understand the way materials act, the way a cast needs to be modified to achieve the requested design features and elements that go into an orthotic design. An excellent understanding of how to build orthoses typically translates to competency in designing orthoses. Whether one chooses to build their patient devices on their own or using the assistance of a fabricating technician, a C. Ped (C) who has the expertise of being able to manufacture orthoses will likely maximize potentials and better recognize limitations of the orthotic device for their patient.

Manufacturing Foot Orthoses: A Quick View
https://www.youtube.com/watch?v=Yzjeie11Ubo&feature=em-upload_owner

Negative Cast:

To fabricate custom foot orthoses, the C. Ped (C) needs to take a negative cast of the patient's foot. The negative cast captures the 3-dimensional shape of the patient's foot and has a goal to:

- capture the most desired position
- reflect the anatomy
- establish a proper starting point for fabrication

We've previously discussed negative casting in Objective Four where the importance of honing the skill to take the cast was stated however the skill of evaluating the negative cast taken of your patient's foot can never be overlooked. Your negative cast should include:

- appropriate depth of cast
- bisection and accommodation lines transferred
- defined 1st and 5th MTPJ
- defined heel
- defined MLA, LLA and transverse arch
- should replicate documented rearfoot to forefoot relationship
- no air pockets (if plaster casting)

Videos for review:

Plaster Slipper Negative Casting Video
https://www.youtube.com/watch?v=faEo4LDbL3w&feature=em-upload_owner

Foam Casting Negative Casting Video
https://www.youtube.com/watch?v=5moi83NY6ag&feature=em-upload_owner

Positive Cast:

To manufacture a custom foot orthosis, it is necessary to produce a positive cast derived from a negative cast of the patient's foot. This procedure involves a harmonious blend of technical skills together with certain empathy for the foot and its comfort when wearing orthosis. It requires as much artistic feeling as technique and takes thought and much practice to master.

The positive cast can be modified in order to:

- allow for soft tissue spread during weight bearing
- effect redirection of forces throughout the foot
- make allowances for foot anatomy
- make allowances for normal foot function
- improve architecture of the shell
- blend transitions and provide steady contours of the shell against the plantar aspect of the foot reducing iatrogenic injury
- improve inside footwear interface (i.e. heel height)
- reduce negative casting errors

Potential areas to add plaster to a positive cast to accommodate soft tissue expansion or a lesion/bony prominence are:

- medial longitudinal arch (allows needed arch flexibility for rearfoot motion and soft tissue deformation in weight)
- perimeter of the heel (allows fat pad expansion)
- medial/lateral border of the foot (reduces shoe pressure)
- rigid first ray (reduce distal border shell irritation)
- ulcerations (i.e. for Diabetic ulcer)
- bony prominences (i.e. Accessory Navicular)
- painful/sensitive areas (i.e. Plantar Warts)

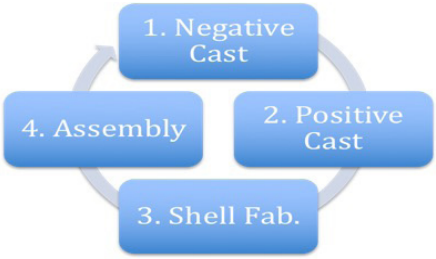
Areas where plaster may need to be removed are:

- lateral longitudinal arch (support midtarsal joints)
- first ray (supports hypermobile first ray)
- heel (to compress fat pad)
- when narrow cut shells are requested
- footwear interface (high heels)

Videos for review:

Plaster Positive Cast Video
https://www.youtube.com/watch?v=Ad7opVaNgVM&feature=em-upload_owner

CAD/CAM Positive Cast Video
https://www.youtube.com/watch?v=xK95jmgHbT8&feature=em-upload_owner



Shell Fabrication:

Custom foot orthoses are fabricated by vacuum forming a heat-mouldable material over the positive cast, once the material is cooled, it is shaped with the use of a grinding machine to address the specific directions of the work order and fit the patient's footwear. The shell of the orthoses serves as the frame onto which posts, additions and covers are attached thus mindful consideration by the clinician is needed to best determine how shell shape, material choices and orthotic additions will influence the final orthoses.

Molding:

Once removed from the press the material of the thermoformed cast/shell should:

- be approximately room temperature
- have a tight grip on the positive cast
- demonstrate no air pockets or gapping
- demonstrate consistent material thickness throughout
- encompass all positive cast modifications
- demonstrate no wrinkling of material in areas not to be removed

Shaping/Grinding:

- an anterior border of the shell 10mm and 5mm proximal to the 1st and 5th MTPJs respectively
- an anterior border of the shell that creates a parabolic curve that matches the natural cascade of the 2nd-4th MTPJs
- the medial and lateral margins of the anterior shell being slightly medial to the bisection of the 1st ray and slightly lateral to the bisection of the 5th ray respectively OR to the interior width of the footwear
- a heel cup of 10-15 mm (or as requested on work order)
- smooth, relatively straight transitions throughout the medial and lateral walls from the heel cup to the medial and lateral margins of the anterior shell
- smooth transitions that come in contact with the foot
- no sharp edges or undesired drops
- bevelled shell sidewalls and posterior heel cup to improve side to side shoe interface
- appropriate plantar skiving through longitudinal arches to improve midfoot / shoe interface
- appropriate plantar grinding through rearfoot to forefoot to improve heel height interface
- desired shell modifications
- extrinsic posting maintained in desired position

Videos for review:

Shell Fabrication Thermoforming Video
https://www.youtube.com/watch?v=fYJ4wHmnLMI&feature=youtu.be

Shell Fabrication Shaping Video
https://www.youtube.com/watch?v=D8G3lAGeyJE&feature=youtu.be

Assembly:

Once the shell is complete, the final assembly of device manufacture includes the application of:

- additions
- extensions
- covers

As touched on in Objective Five, there are literally thousands of combinations that are available to help improve our design. Adding to the diversity available is the countless combinations of material densities and thicknesses that we can utilize. Before a clinician decides to add external additions and/or extensions to the orthotic design, one must respect how these additions influence the shape of the orthotic shell against the patient's foot. At this point of designing orthoses one needs to keep in mind that the shell, ready for additions and extensions has already been "corrected" via the negative casting technique, the positive cast processes and the incorporation of shell modifications. A clinician that arbitrarily adds cushions, paddings and extensions can easily "over correct" the foot resulting in unneeded discomfort for their patient, inconvenient adjustments and poor outcomes.

Videos for review:

Assembly of Foot Orthoses Video
https://www.youtube.com/watch?v=MXBtC6V_S30&feature=youtu.be

Exercise 7.0

Orthotic Manufacture Scenario's

Acknowledging the quote: "A good orthoses can only be made from a good cast and good lab/tech process", complete the table in which a real-life scenario at the basic stages of foot orthotic manufacture can influence outcome. Not all scenarios affect all stages of casting and fabrication so be aware that not every scenario needs an answer in every category. Consider how the scenario can be improved, achieved or implemented at the various stages of fabrication.

Scenario	Negative Cast	Positive Cast	Shell Fabrication	Assembly
The clinician takes a NWB plaster slipper cast of the patient's foot that is too shallow (2.0 cm).	The cast could be quite fragile and apt to distort easily during removal.	The final cast may be too thin to capture proper anatomy such as the medial longitudinal arch height.	If a traditional plaster positive cast is made, it would be quite thin and susceptible to breaking from pressure of vacuum forming. If the positive breaks during this stage, it will affect the final shape of the shell material.	Not applicable.
Positive cast does not have heel expansion and the design needs deep heel cups.				
The shell material was not heated to proper temperature before vacuum forming.				
The interface of the shell with a high heeled shoe.				

Please note: Compare your answers with the answer key at the back of the workbook.

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.
- Ask their opinion about what they would change about your answer (if anything) and why?
- Ask about their successes/failures when using different pedorthic device(s) in similar real-life scenarios.

OBJECTIVE EIGHT

Fitting Pedorthic Devices

When you complete this objective you will be able to…

Identify key considerations when fitting and dispensing pedorthic device(s).

NOTE:
The break in period will vary from patient to patient but generally it is suggested that the patient gradually get used to the orthoses by increasing wearing time by one hour each day up to 8 days then wear the foot orthoses whenever they have footwear on. (day one…1 hour and by the time they reach day eight…8 hours). By the end of the eight days the patient should be able to wear the foot orthoses without discomfort.

LEARNING MATERIAL

Successful orthotic therapy will include reduced/eliminated pain, increased activity level, the orthoses will be deemed comfortable and worn for most of the patient's day. Performing an assessment, taking a cast, designing and fabricating orthoses is not enough to ensure successful orthotic therapy for your patient. An often- undervalued aspect of orthotic therapy is the actual dispensing of the device. To do this we must:

- verify orthotic design
- arrange fitting appointment
- educate
- verify orthotic fit
- follow up

Verify Orthotic Design:

Prior to the fitting visit, the clinician should verify that the orthoses they plan to dispense to their patient matches the orthotic design (name, materials, modifications, lengths, widths and thicknesses) documented in their original work order.

Fitting Appointment:

In normal circumstance the fitting visit should follow the foot orthoses assessment and casting no later than 2-3 weeks. At which time a visit of 15-30 minutes is allotted to do a proper fitting. A skilled clinician should recognize the complexity of each patient thus some will require more fitting time than others. Arrangements should be made for the patient to bring in the footwear that is intended for use.

Education:

The best patient success/compliance is achieved when the patient fully understands the clinician's orthotic goals. Generally, the specific orthotic goals are discussed during the initial assessment, but the fitting visit provides an excellent opportunity to reinforce our treatment goals. Education also includes establishing a "break in" period for the patient.

Verify Orthotic Design:

The pedorthist needs to verify that the technical work completed on the orthoses matches the original design from the work order. A well designed orthotic device must be observed from various vantage points before a pedorthist can properly authenticate a good match. These vantage points include:

- non-weight bearing
- full weight bearing
- footwear/orthoses interface
- dynamic

Follow Up:

Your patient must leave your fitting visit knowing that they should communicate to you about their progress when wearing their orthotic devices. Each clinician must evaluate how they follow up with their patients, some set up appointments, some make phone calls, and some leave it to the patient to follow up. Whatever system is used the patient needs to know that the prescribed product they are wearing may need to be "fine tuned" for their subjective comfort and maximum advantage. Long term follow up varies as per patient need, durability of product etc. however it is commonly accepted that custom foot orthoses should be replaced or refurbished every 2-3 years.

Exercise 8.0

How would you answer some of the common questions patients ask during the fitting appointment?

- How long before the orthotics feel less "lumpy and bumpy"?
- How long will it take for the orthotics to work?
- Is it possible to get new pain because of orthotic therapy?
- What happens if the orthotics don't work or are not comfortable?

Sample Answer:

How long before the orthotics feel less "lumpy and bumpy"? This is a question that relates to your goal of comfort of the devices. In many cases, the orthoses you fit may literally have strategic "lumps and bumps" in their design. The clinician needs to rely on their suggested patient break in period that should be designed to address each patient scenario. In normal circumstances, it would be considered a reasonable goal to expect the foot orthotics to be comfortable within two weeks or less.

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 about their successes/failures when using different pedorthic device(s) in similar real-life cases.

OBJECTIVE NINE

Pedorthic Adjustments

When you complete this objective you will be able to…

Identify the problem solving process of determining when/if adjustments are needed to the pedorthic device(s) dispensed and the best approach for addressing the issues.

LEARNING MATERIAL

Adjustments:

"The ability to manufacture, adjust and modify onsite gives C. Ped (C)s an advantage and sets pedorthists apart from other orthotic providers who don't have the training, expertise or capacity to modify their product onsite or at all." (InTouch March 2011)

We have learned that foot orthoses are influenced by assessment knowledge, casting skills, orthotic design, fabrication technique and the footwear it will be fit into. However even when the clinician can demonstrate competence in all these aspects, they can still not guarantee patient success, comfort or pain relief!

Our patients are human beings that have subjective opinions about pain and comfort, however, before declaring failure of treatment, the clinician needs to draw from the principles learned throughout their training and evaluate each area of influence. It is beyond the scope of this workbook to discuss all the fine tuning and adjustments that will be experienced during a typical day of a C. Ped (C) however a clinician may benefit by considering the following influences when problem solving:

- Was something missed during the assessment?
- Was the right type and quality of cast taken?
- Is there an area of the orthotic influencing problem?
- Is the footwear a contributing factor?
- Does the patient wear them enough?
- Are there social or financial influences?
- Were other therapies started at the same time?

Summary

In summary, the ability to properly address adjustments to foot orthoses is an expected skill of a C. Ped (C). It serves to build patient confidence in orthotic therapy, ensures we are providing the best opportunity for our patients to feel better and be more active. Due to the unique nature of adjusting foot orthoses, the C. Ped (C) needs to rely on their education, training and draw from their fabrication experience to evaluate how their orthotic design choices affect patient outcomes. A lack of comprehensive understanding of how orthoses work will make it virtually impossible for a clinician to responsibly adjust orthoses thus putting their patient at undue risk of failure. Ignoring this important point is ultimately ignoring the needs of your patient.

Exercise 9.0

Mini Case Study, Mrs. Stephens

Mrs. Stephens was provided with custom orthoses for bilateral plantar fasciitis, right much more painful than left, she has been wearing her orthoses regularly for about 6 weeks, diligently complying with your suggested break in period. She made a follow up appointment to happily report that the plantar fascia pain has been relieved in her left foot and reduced in her right. However, although the heel pain in her right foot has reduced she is now experiencing discomfort in the transverse and medial longitudinal arches of the foot and a new pain in the patellar area of the same side knee. She also reports no lifestyle changes however she did buy a new pair of sneakers. On review of your initial assessment you documented that her feet are symmetrically hypermobile and excessively pronated, you took a NWB plaster slipper cast with the forefoot aligned perpendicular with rearfoot and designed the following orthoses:

Shell: Functional 3 mm Polypro Shell
RF Posting: Extrinsic Right: 6 degrees, Left: 2 degrees
FF Posting: Intrinsically balanced to offset Rearfoot Extrinsic post
Additions: Bilateral intrinsic heel cushions, met pads
Top Cover: Full length, 3 mm Neoprene.

Using the problem-solving questions and history found in the case study above to complete the table:

Was something missed during assessment?	First and foremost: Great job on getting your patient back in your office! Obviously, the communication and education with your patient has done well to ensure they came back and let you know the orthotic therapy is not working as planned.
Was the cast taken the right type and quality?	
Is there an area of the orthotic influencing problem?	
Is the footwear a contributor?	
Does the patient wear them enough?	
Are there social or financial influences?	

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 about their successes/failures when using different pedorthic device(s) in similar real-life cases.

OBJECTIVE TEN

Occupational Health and Safety

When you complete this objective you will be able to…

Identify casting and measuring protocols associated with utilizing pedorthic device(s) in the treatment plan.

LEARNING MATERIAL

It is extremely important for each pedorthist, whether an employer or employee, to take the safety of the lab seriously in order to minimize all health risks. There exist various areas of risk/responsibility in the pedorthic lab that need identification and management. Some areas of hazard include:

- Ventilation
- Maintenance
- Ear protection
- Eye protection
- Heat and Fire

Risk Management include:

- Common Sense
- Cleanliness/Prevention
- Knowledge/Preparedness
- Culture
- Utilization of your local Occupational Health and Safety Department

A pedorthist needs to utilize Risk Management habits to insure they minimize known and unknown hazards. Recognition of individual responsibility is foremost to keep oneself safe. Under government regulation, the employer is required to provide a safe environment for their employees however this does not let the employee “off the hook” in regard to taking care of themselves. Common sense needs to be practiced. For example, it would be reasonable for an employer to expect that their employee would avoid wearing a hoodie with loose drawstrings while using a belt sander. Ensuring your lab is organized and clean reduces the chances of tripping or slipping. For example dust on the floor in the plaster room can make this quite slippery, keeping your lab clean would reduce and possibly prevent the slipping hazard and reduce particulate in the air.

Risk can be reduced by Knowledge/Preparedness obtained through utilization of your local Occupational Health and Safety Department which contributes to a successful culture in the workplace. The optimal level of safety culture in a workplace includes an employer that provides the best conditions for their team and an employee that not only takes responsibility for their own personal safety but also seeks to identify areas of safety for their fellow team members.

Exercise 10.0

Health and Safety in the Lab: Using the above identified areas hazard, discuss some everyday scenarios that could be managed/ prevented. Complete the following using the above chart as an example: Equipment/lab Maintenance; Ear Protection; Eye Protection; Heat and Fire.

Risk Management Technique	Hazard: Adhesive (contact cement) Fumes (Venting)
Common Sense	When using adhesive, do not position yourself between the glue pot and ventilation system!
Cleanliness/Prevention	The simple act of putting the covers back on solvent containers when they are not in use is often overlooked in a fast-paced setting.
Knowledge/Preparedness	Workstation based systems, such as downdraft table and/or personal protective equipment such as respirators are the means of managing potential workplace inhalation risks. As venting air out of the lab is not enough to ensure safety, the pedorthist needs to utilize the expertise of a ventilation expert to ensure the ideal balance of air intake vs. output.
Culture	An office worker walks by your work station while you are gluing top covers on a set of orthoses and complains about the odors. Are they being sensitive or are you desensitized? Collaborative thinking combined with common sense should encourage the team to remember the analogy of the "canary in the coal mine."
Utilization of your local Occupational Health and Safety Department	Material Safety Data Sheets (MSDS) that are provided by the manufacturer will help identify properties of the adhesives we use, for example, many cement vapors are heavier than air thus a downdraft system works best.

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.
- Ask their opinion as to what they would change about your answer (if anything) and why?
- Ask about their good and bad experiences with workplace safety.

OBJECTIVE ELEVEN

Final Case Study

When you complete this objective you will be able to…

Demonstrate an improved ability to design and communicate a treatment plan/custom foot orthoses work order.

LEARNING MATERIAL

As demonstrated throughout Workbook Four, a systematic approach when providing pedorthic devices to our patients is hardly linear, in fact the combinations of orthotic designs available in our pedorthic toolbox is mathematically incredible! We can however use a linear approach to encourage critical thinking. Below you will find a Flow Chart that is designed to replicate the internal conversation that a C. Ped (C) has with themselves during a typical patient assessment. The Flow Chart is not designed to be exhaustive however it could be used as a useful "double check" to ensure the C. Ped (C) gathers the appropriate information to justify their patient treatment plan.

Consider using this Flow Chart on your own patients, adding and subtracting from it as needed.

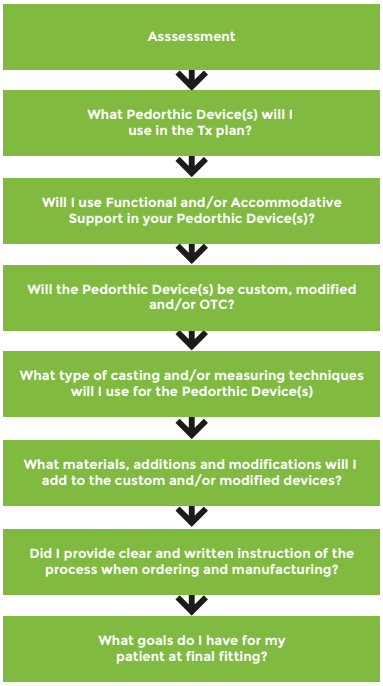


Fig. 5, A strategic approach when utilizing Pedorthic devices in patient care.

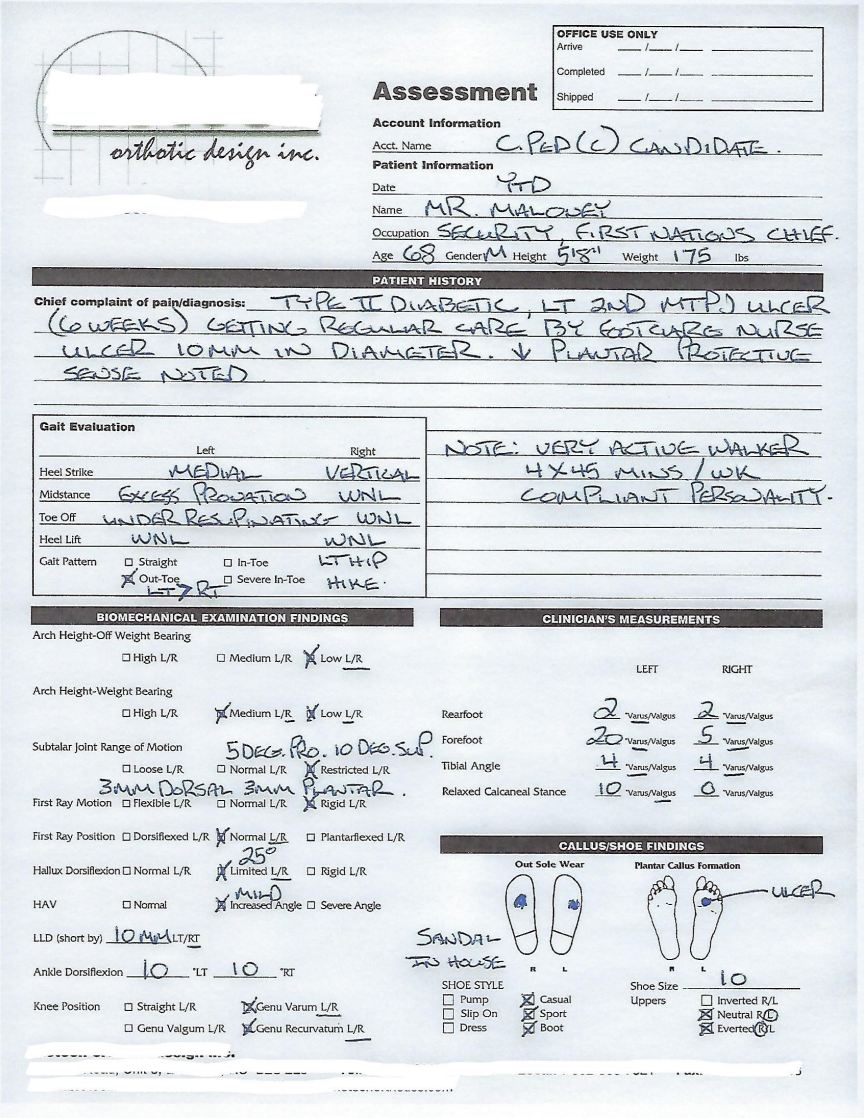
Final Case Study-Mr. Maloney

Remember the Benchmark Case Study regarding Mr. Maloney that you completed before you started Workbook Four? Let's do it again! Based on the knowledge you have acquired in Workbook 4, write up a new treatment plan and custom foot orthotic work order for Mr. Maloney as per the unchanged case study is listed below. Hints: presume the custom foot orthoses you are designing will be fabricated by a C. Ped (C) who you don't know.

Self Test: Once you complete your case study, compare it to the original Benchmark Case Study on Mr. Maloney that you "parked" at the beginning of this workbook.

- Was your second attempt at the case study more detailed?
- Can you justify each decision made during the process?
- Was the second attempt more technically sound?
- If reviewed by a peer, would they be able to understand your systematic approach?

Please note: After reviewing your own notes with your mentor you will find a sample work order at the back of this workbook under, Exercise 11.0: Final Case Study-Mr. Maloney.



orthotic design inc.

Assessment

OFFICE USE ONLY
Arrive ___/___/___
Completed ___/___/___
Shipped ___/___/___

Account Information
Acct. Name C.PED(C) CANDIDATE.

Patient Information
Date 7TD
Name MR. MALONEY
Occupation SECURITY, FIRST NATIONS CHIEF.
Age 68 Gender M Height 5'8" Weight 175 lbs

PATIENT HISTORY
Chief complaint of pain/diagnosis: TYPE II DIABETIC, LT 2ND MTP(.) ULCER (6 WEEKS) GETTING REGULAR CARE BY FOOTCARE NURSE. ULCER 10MM IN DIAMETER. ↓ PLANTAR PROTECTIVE SENSE NOTED.

Gait Evaluation

	Left	Right
Heel Strike	MEDIAL	VERTICAL
Midstance	EXCESS PRONATION	WNL
Toe Off	UNDER RESUPINATING	WNL
Heel Lift	WNL	WNL
Gait Pattern	☐ Straight ☐ In-Toe ☒ Out-Toe LT>RT ☐ Severe In-Toe	LT HIP HIKE.

NOTE: VERY ACTIVE WALKER 4X45 MINS/WK COMPLIANT PERSONALITY.

BIOMECHANICAL EXAMINATION FINDINGS

Arch Height-Off Weight Bearing ☐ High L/R ☐ Medium L/R ☒ Low L/R

Arch Height-Weight Bearing ☐ High L/R ☒ Medium L/R ☒ Low L/R

Subtalar Joint Range of Motion 5 DEG. PRO. 10 DEG. SUP. ☐ Loose L/R ☐ Normal L/R ☒ Restricted L/R

First Ray Motion 3MM DORSAL 3MM PLANTAR. ☐ Flexible L/R ☐ Normal L/R ☒ Rigid L/R

First Ray Position ☐ Dorsiflexed L/R ☒ Normal L/R ☐ Plantarflexed L/R

Hallux Dorsiflexion ☐ Normal L/R ☒ Limited L/R 25° ☐ Rigid L/R

HAV ☐ Normal ☒ Increased Angle MILD ☐ Severe Angle

LLD (short by) 10MM LT/RT

Ankle Dorsiflexion 10 °LT 10 °RT

Knee Position ☐ Straight L/R ☒ Genu Varum L/R ☐ Genu Valgum L/R ☒ Genu Recurvatum L/R

CLINICIAN'S MEASUREMENTS

	LEFT	RIGHT
Rearfoot	2 °Varus/Valgus	2 °Varus/Valgus
Forefoot	20 °Varus/Valgus	5 °Varus/Valgus
Tibial Angle	4 °Varus/Valgus	4 °Varus/Valgus
Relaxed Calcaneal Stance	10 °Varus/Valgus	0 °Varus/Valgus

CALLUS/SHOE FINDINGS

Out Sole Wear

Plantar Callus Formation ULCER

SANDAL IN HOUSE

SHOE STYLE ☐ Pump ☒ Casual ☐ Slip On ☒ Sport ☐ Dress ☒ Boot

Shoe Size Uppers 10 ☐ Inverted R/L ☒ Neutral R/L ☒ Everted R/L

Sample

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.

- Make sure to discuss with your mentor that this final exercise may need some extra time.
- Provide your mentor your completed assignment: Exercise 11.0: Final Case Study-Mr. Maloney
- Provide your mentor Exercise 11.0: Final Case Study-Mr. Maloney Rubric found at the back of Workbook Four.
- Ask your mentor to compare the Rubric to your assignment.
- Ask their opinion as to what they would change about your answer (if anything) and why?

Conclusions

"the gap between advanced clinical knowledge and superior technical application is filled with creativity that is balanced with innovative thought"

A C. Ped (C) is in the business of making people feel better, the work we do has the ability to make a huge impact on patients lives. Dedication and commitment to the certification process set out by the College of Pedorthics of Canada equips us with a "pedorthic toolbox" which the pedorthist uses to appropriately design an effective treatment plan but also to critically evaluate what needs to be done if adjustments and modifications to the treatment plan need to be implemented.

As discussed throughout Workbook Four, a C. Ped (C) must be able to gather the appropriate clinical information that is required to assess the patient's needs, translate those clinical findings into orthotic design elements that meet the needs of that patient and possess the skillset needed to manufacture the devices and fit them into sound footwear. Your training, education and testing as a C. Ped (C) provides a balance between these relationships that is unique to our industry.

In summary, we hope the reader embraces the importance of understanding that the gap between advanced clinical knowledge and superior technical application is filled with creativity that is balanced with innovation. It is common that a C. Ped (C) may discover a path of specialization throughout their careers, these pathways may have a high focus on clinical, design and/or manufacturing expertise however no matter which direction is taken, the continued quest to develop critical thinking is paramount in your evolution as a C. Ped (C) and industry leader.

Note from Author:

The human body is an amazing machine, even after more than 20 years in the Pedorthic industry, over a decade as an instructor at Western University a dozen or more years as a PAC, CPC and PFOLA Board Member, I find myself humbled by what I really don't know about Pedorthics! This fact continues to drive me as a Pedorthist in a career long journey of continual improvement.

Even more humbling is that certification alone does not make us a great Canadian Certified Pedorthist…it simply signifies that we have surpassed the minimum Core Competencies to ensure public safety. Whether you are starting your Pedorthic journey as an Exam Candidate or you are a keen clinician seeking to improve your skillsets, the fact that you have read this Workbook is evidence of your commitment to the profession.

Keep up the great work. Keep up the lifelong learning.

Recommended Reading:

Biomechanics of Sport Shoes: Nigg. In this text, Dr. Nigg scientifically explores the concepts and effects of various footwear and orthotic materials used in our daily practices.

Clinical Biomechanics of the Lower Extremities: Valmassy. An overall great textbook allowing the clinician to better understand lower extremity function and how it's influenced by pedorthic devices. Chapter 14 is a must read for clinicians wanting to improve critical thinking regarding orthotic materials.

Clinical Practice Guidelines: The Pedorthic Association of Canada. This text is authored by C. Ped (C)s across Canada, discusses many of the "real life" scenarios found in today's practice.

Code of Ethics and Standards of Practice: The College of Pedorthics of Canada. Developed by its members, serves as a guide for everyday professional practice. The standards outlined are performance baselines against which professionals may be measured if their practice is called into question.

Contemporary Pedorthics: Decker, Albert. A unique text written by pedorthists to assist the training of pedorthic students and clinical reference by practicing pedorthists in their daily care of patients.

Human Locomotion: Michaud. A staple text used in the Diploma in Pedorthics program. An excellent text regarding lower extremity biomechanics and anatomy however Chapter 6 contains useful information about foot orthoses design and adjustment troubleshooting.

Pedorthics: Baumgartner, Moller, Stinus. The objective of this book is to provide a comprehensive presentation of pedorthics. One of the more recent texts available for our study, the reader will be challenged to find a text that discusses more about Assistive Devices anywhere else.

Recent Advances in Orthotic Therapy: Scherer. This text is a great example of the justification needed by the clinician when designing orthoses for their patient treatment plan. The text suggests pathology specific approaches that you can utilize for your patient.

The Functional Foot Orthoses: Philps. A staple text book for "old school" fabricators of foot orthoses. The information inside has a "how-to" approach that can be utilized by today's C. Ped (C) as a benchmark of understanding when communicating orthotic design and fabricating orthoses.

ANSWER KEY

Mini Exercise 1.0 Answers

(the reader always needs to acknowledge that this list is not exhaustive and that there is more than one way to approach treatment, the following are samples only)

AILMENTS	PEDORTHIC TOOL
Hallux Valgus	Toe Aligner Splint
Ankle Sprain	ASO Ankle Brace
Haglund's Deformity	Achilles Heel Pad
Patellofemoral Syndrome	Neoprene J-Brace
Hammer Toes	Dorsiflexion Night Splint

Exercise 1.0 Answers

(the reader always needs to acknowledge that there is more than one way to approach treatment, the following are samples only)

Case Study 1: Joshua Madore

1. Is the patient's foot/ankle ailment acute or chronic?

Joshua has had this pain for about a year thus it would be considered chronic.

2. Are your recommendations going to be used short or long term by the patient?
Once the pedorthist has ruled out the obvious self-help options for their patient such as stretching, cold therapy, behavior modification and footwear, they would need to consider using external devices that will provide a "stepped up" approach to treatment. The traditional self-help approaches have not been successful thus it would be safe to presume that a long term approach would be warranted.

3. Is there a device(s) in our pedorthic toolbox that can be of assistance to treat this patient? What device(s) is it?
Custom foot orthoses with varus posting would be a traditional approach however the clinician could reasonably justify the use of component foot orthoses as an alternative. It is important to note that not enough information was provided in the case study to differentiate the specific recommendation of component or custom made orthoses. A full biomechanical assessment would be needed to fully justify the pedorthist's final recommendations.
For the purpose of this case study, we'll use custom foot orthoses.

4. How does the device(s) you choose apply to the foot/ankle ailment you are treating?
A key consideration is the excess rearfoot pronation noted at midstance. It is a common belief that midstance pronation results in a torsional and tractional pull on the Plantar Fascia which in turn creates stress on the medial calcaneal tubercle which then contributes to pain. Using foot orthoses to control this pronation could help reduce the biomechanical fault that is contributing to Josh's pain. Essentially if we take the source of irritation away, the body should heal itself.

5. Are you recommending more than one device? If so, how will these devices work in association with each other?
In addition to foot orthoses, the Pedorthist should consider the use of a Plantar Fasciitis Night/Resting Splint for the right foot only. In non-weight bearing most feet sit in a plantarflexed position allowing the Plantar Fascia to shorten, however when the patient stands, the fascia is quickly elongated which in turn results in pain upon rising for the patient. When worn, the splint will resist plantarflexion preventing the fascia from shortening when in non-weight bearing thus also reducing the micro-tearing of the fascia as it elongates upon weight bearing. Also, when dispensing custom foot orthoses there is often a time gap of up to three weeks between the day you cast your patient to the day you fit the orthoses. Adding to this delay in treatment is the traditional orthotic break in time which can easily add another two weeks. It would be reasonable to suggest a Plantar Fasciitis Resting Splint which would start treatment immediately. The splint can also be worn when the patient is not wearing their custom orthoses. Typically, the use of the splint is short term and is discarded once the patient symptoms desist.

6. Does the device(s) that you recommend fit into the patient's lifestyle?
After a short break in period, it is reasonable to expect that the use of custom foot orthoses would not interfere in a negative way with your patient's lifestyle. However, a major complaint of some when using the standard Plantar Fasciitis Resting Splint is disruption of sleep and the potential for slips/falls if walking on the brace. The design of this brace is often thought to be intrusive to the patient thus patient selection is important, as Josh's compliance is noted, consideration of using this brace is warranted. You may also consider a different design of resting night splint, for example a dorsal night splint, if patient compliance is an issue.

ANSWER KEY

7. Can the device(s) you recommend be put on by the patient or will they need assistance? Do they have assistance? Can they financially afford it?

Putting custom foot orthoses in footwear and fitting a Plantar Fasciitis Resting Splint is relatively easily understood by our patients once demonstrated properly. As per finances, custom foot orthoses are expensive however the brace is reasonably priced, both are often covered under extended medical plans. It is always important to discuss this with the patient before proceeding.

8. How would you summarize your orthotic treatment plan in language that the patient would understand?

Plantar Fasciitis is considered an overuse injury resulting from the misalignment of the patient's foot. This misalignment (pronation in this case) results in the Plantar Fascia being overworked over an extended period. The theory behind using custom foot orthoses is that we are removing/reducing the stresses that result in pain (the excess pronation) allowing the body to heal itself. The Resting Splint simply keeps the Plantar Fascia in a stretched position.

Case Study 2: Mya Lynn

1. Is the patient's foot/ankle ailment acute or chronic?

Confirmed diagnosis of severe Left Hallux Abductovalgus, chronic.

2. Are your recommendations going to be used short or long term by the patient?

It is reasonable to expect this will need a long term solution.

3. Is there a device(s) in our pedorthic toolbox that can be of assistance to treat this patient? What device(s) is it?

This one is easy as the Orthopaedic Surgeon has prescribed custom foot orthoses and Mya asked about a splint to help straighten her toe.

4. How does the device(s) you choose apply to the foot/ankle ailment you are treating?

It is also safe to presume that the doctor has prescribed custom foot orthoses due to the severity of the malalignment and excess rearfoot pronation noted thus a full biomechanical assessment needs to occur before the device can be designed. The pedorthist needs to gather more applicable information such as body weight, ranges of motion, alignments and tolerance levels before they can specifically choose casting method and design the custom foot orthoses. Theoretically, by reducing the excess rearfoot pronation with varus posting on the foot orthoses, we hope to create a more stable foot that reduces the tendency of the 1st Metatarsal to deviate medially resulting in the Hallux abducting as compensation. In regard to a splint, unfortunately, only surgical intervention will straighten severe Hallux Valgus however there are many different types of toe splints that can be worn with or without footwear that pulls the hallux medially and can theoretically delay the progressive angulation of the hallux.

5. Are you recommending more than one device? If so, how will these devices work in association with each other?

A clinician could also consider suggesting bunion pads to reduce internal shoe pressure, interdigital toe spacers to pad areas of tenderness between the toes, well fitted footwear is a must and possibly shoe modifications as discussed in Study Guide 3.

6. Does the device(s) that you recommend fit into the patient's lifestyle?

When it comes to footwear, the pedorthist needs to respect the perceived social pressure of working in a stereotypical business environment. However, the clinician cannot ignore the functional importance of proper fitting footwear as it relates to her diagnosis. It would however be safe to say that the custom foot orthoses would need to be made of materials that are low profile and the design would need to control pronation. In regard to the splint, it is essential that the clinician choose a device design that best fits the patient's lifestyle requirements and that they properly measure/fit this device to ensure patient compliance.

7. Can the device(s) you recommend be put on by the patient or will they need assistance? Do they have assistance? Can they financially afford it?

Putting custom foot orthoses in footwear and fitting a Hallux Valgus Splint is relatively easily understood by our patients once demonstrated properly. As per finances, custom foot orthoses are expensive however the brace is reasonably priced, both are often covered under extended medical plans. It is always important to discuss this with the patient before proceeding.

8. How would you summarize your treatment plan in language that the patient would understand?

In this situation, one cannot ignore the importance of well fitted footwear to work with as ill fitted footwear will sabotage the potential gains of any treatment plan. As per the custom foot orthoses, we are simply trying to reduce the mechanical fault (pronation) which the doctor has deemed the primary abnormality that results in the foot and toe bones deviating in the unwanted directions. As per the splint, it is designed to physically pull the toe to a more straightened position. Unfortunately, footwear, custom foot orthoses and splints will not straighten the toe however our goal is to manage the symptoms by reducing the external factors that are mechanically contributing to the pain. It is also expected that proper use of the recommended Pedorthic devices will delay the progressive angulation of the hallux and 1st metatarsal. This conservative approach to treatment still applies even if the patient eventually decides on surgical intervention thus it is recommended they follow up with you post-surgery.

ANSWER KEY

Exercise 2.0 Answers

Variable	Effect
Body weight	Orthoses made of 3 mm polypro may feel "hard/rigid" under the foot of a patient who weighs 60 lbs. however "soft/flexible" under the foot of a patient who weighs 250 lbs.
Arch height	The strength of a structure is not just a function of the kind of material it is made of, but how it is shaped -- the distances involved. For example: Take three 1/8 inch thick boards 2 ft long and 3 inches wide. If you were to place them flat on top of each other and support them on the ends only, you could easily snap them by stepping on them with one foot. However, if you were to construct a triangular beam out of them, they would probably support your whole weight. The same thought process can be applied to a flat piece of 3 mm polypro that will be much more flexible than the same material that has been molded on a positive cast that captures the anatomy of the foot. The higher the arch of the patient (same applies to other prominent anatomy), the higher the parabolic curve of the shell material thus the increased strength of the final orthotic device in the vertical plane.
Patient tolerance levels	Oxford Dictionaries defines this as "the capacity to endure continued subjection to something such as a drug or environmental conditions without adverse reaction." During your patient assessment you should gain valuable insight into how much discomfort and change your patient can tolerate. In the above example, in the eyes of your patient, the 3mm polypro orthotic with a full length 3mm neoprene top cover could be considered "softer" than the same device made with a met length vinyl top cover even though the functional control would be considered the same. Looking back at the pictures of the Diabetic and Sport design devices in Objective 2 consider the deceptive perception of "softness" of the Diabetic design when felt by the hand of the patient as compared to the "firmness" of the Shaffer style.
Foot/ankle ROM	In simple terms, accommodative devices "cushion" while functional devices "control". Your material choices will be influenced by your goals of control. For example, if your patient presents with a Triple Arthrodesis that happens to be set in inversion, the clinician would need to be very mindful of the potential for iatrogenic injury caused by trying to functionally control a foot that has no range of motion available to it. In this situation, the clinician may want to accommodate around the deformity using a more accommodative material e.g. 45 durometer EVA, rather than attempt to reposition it. Using 3mm polypro for this patient may not be the best choice however with careful consideration of the other clinical and technical factors we are discussing, it is possible.

Variable	Effect
Cast techniques	Although there exist many ways to take a cast of a patient's foot/leg the physical task of taking the cast can only be captured in one of three ways: Non-weight bearing (NWB), Semi-weight bearing (SWB), Full-weight bearing (FWB). Clinicians will continue to debate as to which method and position is best for the patient however one typically cannot deny that a NWB negative cast of the patient's foot captures a more defined anatomy as compared to the FWB method that would capture the same foot in a compressed/flattened position. As the negative mold creates the foundation on which the orthoses are fabricated, the position in which the cast is taken cannot be ignored. Adding further to the subjectivity of this factor is the lab process of modifying the positive mold that was derived from the negative mold. (This will be addressed further in the Workbook).
Shell additions	Simply put, the more stuff you add to the orthoses the stronger you make it. For example, the aforementioned 3 mm polypro orthoses will become more functional if we were to add an EVA rearfoot stabilizer to it and more functional again if we were to add EVA extrinsic forefoot and rearfoot posts.
Shell modifications	This goes back to the principle we previously learned about how "Arch Height" affects the control level of the device. ie. Arch height affects function directy and indirectly as well as affecting the rigidity of the device. Shell mods such as deep heel seats and lateral clips result in additional material being left on the shell and more curves to that material which in turn creates a higher level of functional control due to the increase integrity of the material.
Footwear interface	As taught in PEDS6014, it is commonly accepted that the Shaffer style of device is considered more rigid while the Philps style of device is more accommodative however recent studies by Dr. Nigg have challenged this viewpoint stating that harder orthotics allow for greater variation of motion and do not force the foot into a preset movement pattern. Looking back at the pictures of the Diabetic and Sport design devices in Objective 2 consider: -the Diabetic design would have a more intimate interface with the inside of the shoe it is fitted into, this would result in the device not being able to flex or torque in the same fashion as the Sport design -the Diabetic design will be a lot more influenced by the interior contours of the shoe while the Sport design would tend to override the internal shoe contours -the Diabetic design demands grinding down a minimum 10-12 mm of sheet material (EVA, Black Plastazote, NickelPlast etc.) to be strong enough to maintain support and still capture the needed contours of the foot however for the Sport design, sheet material (graphite, polypropylene, copolymer) can be as thin as 1.5 mm and still be strong enough to maintain support and capture the needed contours of the foot. In turn the Shaffer design creates better opportunity to produce lower profile devices thus increasing the potential for better patient compliance.

Please note: Compare your answers with the answer key at the back of the workbook.

ANSWER KEY

2.1 Answers

7
5
9
10
2
8
1
4

Exercise 3.0 Answers

(the reader always needs to acknowledge that this list is not exhaustive and that there is more than one way to approach treatment, the following are samples only)

Guiding Factor	Type/Modality	Justification
Urgency	OTC OTC/Component Custom	As OTC devices are often inventory items they can be dispensed to your patient within minutes thus can be an excellent tool to provide initial and immediate relief in acute cases such as plantar fasciitis or a diabetic requiring immediate offloading. The clinician's access to lab facilities dictates the time needed to provide OTC/Component and Custom Made Foot Orthoses, this time could range between hours to weeks.
Temporary Need Timing	OTC Modified OTC	As a first step, some patients may require substantial mechanical assistance to allow their foot to function more "normally" yet they may not be able to tolerate this assistance. Sometimes an OTC product can be used to provide insight into how a patient will respond to and tolerate a more aggressive support. Other examples of temporary needs include women who experience foot pain during the weight changes of pregnancy, the diabetic client who is awaiting permanent orthoses or a child who is growing rapidly. The duration of your patient's complaint is also important to consider, for example, it could be deemed as overkill if you dispensed custom foot orthoses to a patient who complained of pain for 1 or 2 days.

Guiding Factor	Type/Modality	Justification
Biomechanical Abnormalities	-Custom -Modified OTC	Custom made orthoses should be considered the better choice when major biomechanical defaults are observed as they are specifically manufactured to address each patient's specific needs.
Activity Level	-Custom -OTC -Modified OTC	A client who only bears weight while transferring from their bed to a chair or other types of transfers may only require an OTC product that protects their feet from injury during these activities while an active marathon runner may require Custom Made Foot Orthoses specifically designed to address the increased need for device durability.
Different Shoe Styles	-Custom -Modified OTC -OTC	One style of orthosis does not fit into every shoe. The client can purchase a cost-effective OTC to fit in other shoe styles that are not worn as often but they could use some support.
Cost	-OTC	Clients are sometimes hesitant or unable to pay for the cost of custom-made orthoses thus an OTC or Modified OTC/Component device may provide some relief to the client at a lesser cost. An important consideration about cost when utilizing extended medical plans is to be aware that most plans only reimburse for custom made orthoses that are derived from a 3D negative cast thus foot orthoses manufactured utilizing a 2D image/computer scan and/or modifying an OTC device cannot be deemed as custom made and do not qualify for financial reimbursement. Ignoring this could result in unplanned financial hardship for your patient.

ANSWER KEY

Exercise 4.0 Answers

(the reader always needs to acknowledge that this list is not exhaustive and that there is more than one way to approach treatment, the following are samples only)

Mini Case Study One: Ms. Jade
SWB foam casting should be avoided as the process of taking the cast traditionally requires the clinician to put direct pressure on the dorsum of the patient's foot as they push the foot into the foam. We know that Ms. Jade's foot is very painful thus we would not want to create more pain for during the casting process. Slipper, wax and direct mold casting methods taken in most positions could all be considered a reasonable approach however computer-generated casting requires much less physical contact with the foot in comparison thus it could be deemed as the most ideal.

Mini Case Study Two: Mr. Logan
Due to the absence of on-site manufacture, computer generated casting would be the most ideal method. As the clinic does not build orthotics on-site, turn-around time is the challenge however computer-generated casting allows for the clinician to get the cast to the central manufacturing lab within seconds, giving the lab ample time to build and expedite return shipping to meet the one week deadline. In this scenario, onsite manufacture would allow for any casting method to be utilized to meet the patient's schedule.

Mini Case Study Three: Mr. Cole
In this case, foam, computer generated, wax and direct mold casting would not qualify for financial reimbursement thus the clinician should respect the dictated terms to avoid undue financial hardship for the patient. Slipper casting would obviously be the best/dictated choice however the clinician should not proceed if they suspect the dictated casting method could bring physical harm to their patient. In such a scenario, it would be important for the clinician to work with the medical plan provider to justify the medical need of using an alternative casting method based on their biomechanical assessment.

Added considerations:
- Can patient lie prone?
- Can patient lie supine?
- Can you apply dorsal pressure to the foot?
- Can you apply plantar pressure to the foot?

Points 1-4, unless medically necessary, a clinician would want to avoid any position or process that causes their patient undue pain. Utilizing alternative methods of casting will allow the clinician to avoid this undue hardship for their patient.

Does the patient have attention disorders/issues with staying still?
Active children, patient's with Autism or uncontrollable spasms may not have the ability to stay still for extended periods of time thus a casting method that is quick, such as Biofoam casting could be considered an excellent resource.

How does the cast method influence the final device?
As noted in PEDS6014, negative casting methods yield different positive casts. For example, a cast captured in a NWB position is notably different from one casted in WB as it will yield a positive cast that is narrower, has higher arches and more defined plantar contours as compared to the same foot captured in FWB. Since the negative cast serves as the starting point from which the final device will be manufactured, it serves to greatly influence its final shape. The "best" casting method can only be justified after a full assessment of the patient.

How fast does this patient need their devices?
Discussed in sample.

What is the cost of taking the cast?
This is a business discussion rather than patient-need issue however it is important to acknowledge as it directly influences the clinician's ability to provide sustainable treatment to their patient. Materials/equipment needed, time taken to inventory/physically cast/clean up afterwards and possible associated shipping expenses can vary dramatically thus consideration is needed by the clinician to ensure their chosen casting methods are viable as compared to the price they charge to their patient for services.

Does patient medical plan demand specific cast methods? Discussed in sample.

Does the patient have any specific abnormality that lends itself more readily to a specific casting method (ie fixed deformity, hypermobility, sensitivity, deformity)
A cautionary thought about casting: It is important to understand that there are many casting approaches that can be used to address the same pathologies and/or deformities however one can never ignore "best practices" that justify opinion through education, guidance, experience and understanding. For example, scanning software the autocorrects a fixed forefoot equinus deformity may be contraindicated as it will put the forefoot and rearfoot in the same plane resulting in an orthotic device that does not replicate the anatomy of the fixed deformity.

ANSWER KEY

Exercise 5.0 Answers

Stage	Process	Result	Rationale
Negative Cast			See Objective Four
Positive Cast	Adding plaster to the positive cast at that Navicular	Creates a plantar "bump out" of the orthotic shell	A great technique used to accommodate a prominent Navicular
Shell Base	Choice of durometer and thicknesses of material	The lower the durometer and thinner the material, the more accommodative the final device	A clinician needs to decide on the level of control they wish for their patient
Shell Modification	Adding a deep heel seat to the shell	Modification will help "cup" and contain the calcaneal fat pad under the heel bone	A useful way to increasing shock absorption capabilities.
Postings	Utilized to put the foot into a different functional position.	Varus posting will invert the foot, while valgus posting will evert the foot	For example: Functional Hallux Limitus due to excess pronation could benefit by adding varus posting to orthoses. The varus posting will theoretically supinate your patient's foot, reducing the pronation suspected to cause the functional locking of the 1st MTPJ.
Additions	Can be utilized to offload areas of pressures. Example: Met pad	A properly placed met pad can transfer pressure from a painful MTPJ	The utilization of a met pad on orthoses could be used to the benefit of a patient diagnosed with Pressure Metatarsalgia as it functions to vertically unload the corresponding met head via the shift of pin point pressure from the met head to the longer surface of the met shaft.
Covers	Length of device can be full, sulcus or met length	A properly placed met pad can transfer pressure from a painful MTPJ The footwear the device will be worn in is highly influential on patient outcome and compliance levels	Your patient works in a professional environment requiring business attire thus insists on wearing dress footwear. The use of met or sulcus length top covers will yield lower profile orthoses that will fit better into low volume footwear, increasing patient compliance thus wearing time thus successful pain relief.

Exercise 6.0 Answers

(the reader always needs to acknowledge that this list is not exhaustive and that there is more than one way to approach treatment, the following are samples only)

Poor Habit	Risk	Best Practice
"Post to Lab Evaluation"	The clinician is delegating responsibility to the manufacturer as to how much "correction" to add to the orthoses. Using this instruction could suggest that the dispensing clinician does not have the competency needed to make this decision.	As the clinician has the best vantage point on the patient, the responsibility lies clearly on the clinician thus they should be competent to complete the task or avoid dispensing foot orthoses.
Fabricator to choose the design	The clinician is delegating responsibility to the manufacturer to make decisions such as shell style, additions, modifications, etc. Using this instruction could suggest that the dispensing clinician does not have the competency needed to make these decisions.	As the clinician has the best vantage point on the patient, the responsibility lies clearly on the clinician thus they should be competent to complete the task or avoid dispensing foot orthoses.
"Fabricator to choose materials	The clinician is delegating responsibility to the manufacturer to decide which types of materials to use in devices. Using this instruction could suggest that the dispensing clinician does not have the competency needed to make these decisions.	As the clinician has the best vantage point on the patient, the responsibility lies clearly on the clinician thus they should be competent to complete the task or avoid dispensing foot orthoses.
Not providing work order	The lack of a work order can easily result in presumptions and/or lack of understanding by the fabricator thus leading to manufacturing error resulting in a device that could harm your patient.	A proper work order documents and records the definitive manufacturing instructions directed by the C. Ped (C) and provides clear communication to all involved. The work order puts clear accountability and responsibility on the shoulders of the clinician.
Writing fabrication instruction on the foam box or cast rather than a work order	Traditionally the negative cast gets destroyed in the manufacturing process thus any instructions that are written on a cast are at risk of being missed and lost. At that point, it would be the same as not providing any work order.	A proper work order documents and records the definitive manufacturing instructions directed by the C. Ped (C) and provides clear communication to all involved. The work order puts clear accountability and responsibility on the shoulders of the clinician.

ANSWER KEY

Poor Habit	Risk	Best Practice
Providing a work order on scrap paper/Post Its!	As mentioned above regarding not providing a work order or writing instruction on the negative cast only, now add a higher level of disrespect and lack of professionalism for your patient.	A proper work order documents and records the definitive manufacturing instructions directed by the C. Ped (C) and provides clear communication to all involved. The work order puts clear accountability and responsibility on the shoulders of the clinician.
Not writing the name of the patient on the cast	Consider 10 pair of plaster slipper casts sitting on a table with no names on them…they all look the same! Now consider the challenge of matching these casts with work orders! This guesswork can cause harm to your patient.	It is imperative that the C. Ped (C) provides clear communication to all involved.

Exercise 7.0 Answers

(the reader always needs to acknowledge that this list is not exhaustive and that there is more than one way to approach treatment, the following are samples only)

Scenario	Negative Cast	Positive Cast	Shell Fabrication	Assembly
The clinician takes a NWB plaster slipper cast of the patient's foot that is too shallow (2.0 cm).	The cast could be quite fragile and apt to distort easily during removal.	The final cast may be too thin to capture proper anatomy such as the medial longitudinal arch height.	If a traditional plaster positive cast is made, it would be quite thin and susceptible to breaking from pressure of vacuum forming. If the positive breaks during this stage, it will affect the final shape of the shell material.	Not applicable.
Positive cast does not have heel expansion and the design needs deep heel cups.	A cast taken in NWB yields a more prominent device than one taken in WB	Not applicable	Could result in a heel cup in which the superior edges will dig into the patient's foot.	Adding top covers will take up more room resulting in less space for appropriate heel fit.

Scenario	Negative Cast	Positive Cast	Shell Fabrication	Assembly
The shell material was not heated to proper temperature before vacuum forming.	Not applicable	A wet cast can influence cooling times of materials during vacuum forming.	If the shell is underheated, material could create wrinkles, or not form tightly to the cast. If it's overheated, may result in a loss in material integrity, or a change in density of the material.	Poor molding processes can create prominent points on shells, reduce durability, affect shell fit and yield poor cosmetics
The interface of the shell with a high heeled shoe.	Capturing the foot in the desired position can result in less positive cast mods	A cast can easily be modified to address shoe interface at this stage	A shell can be shaped to accommodate shoe interface.	A device that is not interfaced properly with the foot will create a rocking effect in a shoe which will be uncomfortable for the patient

Exercise 8.0 Answers

(the reader always needs to acknowledge that this list is not exhaustive and that there is more than one way to approach treatment, the following are samples only)

When should the orthotics not feel so "lumpy and bumpy"?

This is a question that relates to your goal of comfort of the devices, in many cases, the orthoses you fit may literally have strategic "lumps and bumps" in their design. The clinician needs to rely on their suggested patient break in period that should be designed to address each patient scenario, in normal circumstances, it would be considered a reasonable goal to expect the foot orthotics to be comfortable within two weeks or less.

How long will it take for the orthotics to work?

This is a question that relates to your goal of pain relief, which is the main reason the patient is seeing you in the first place! Obviously, pain relief is subjective however the clinician needs to create a reasonable goal based on each patient scenario, a reasonable goal would be to expect pain relief within 4-6 weeks (or less) after being fit with orthoses. Do to the subjective nature of pain, the clinician needs to consider the difference between pain relief and successful orthotic treatment. For example: Is your patient still complaining of pain however is back to their running program? Does the painful ulcer still exist but it's getting smaller? Because they still have pain, at first glance your patient may not be able to identify the successes in orthotic therapy however if you have created benchmarks throughout your assessment and therapy, you will be able to demonstrate successes that in turn should help your patient "buy in" to the continued use of the orthotic devices.

Is it possible to get new pain because of orthotic therapy?

Unfortunately, yes, however we first need to trust the break in period protocol that has been designed for each patient scenario. Did the patient follow it? Presuming they did, the clinician would need to address the unique situation to rule out if the device is causing the new pain or is there some other circumstances (new work out

ANSWER KEY

program, new footwear etc.). Ruling out external circumstances, the clinician would need to rely on the training and education to understand the "domino" affect created by their orthotic design. For example, the addition of varus posting to an orthosis will invert the foot, however it will also externally rotate the tibia making changes to the knee joint…maybe creating new stress and pain, the clinician may consider reducing the varus posting.

What happens if the orthotics don't work or are not comfortable?

One of the largest contributors to orthotic therapy has to include lack of follow up by either the clinician and/or the patient. The clinician needs to educate the patient as per the expected comfort and pain relief goals as discussed in the previous comments however the onus is on the clinician to provide clear communication to the patient ensuring they aware that the orthoses can be adjusted and fine tuned if these goals are not accomplished. More discussion will follow regarding adjustments in Objective 9.

Exercise 9.0 Answers

(the reader always needs to acknowledge that this list is not exhaustive and that there is more than one way to approach treatment, the following are samples only)

Was something missed during assessment?	If the clinician has used the full skillset taught during their Pedorthic certification process they can be confident that they have done well for their patient. However, Mrs. Stephens could greatly benefit from getting her right orthosis adjusted. In particular, it would be reasonable to conclude that her right foot and knee are simply being overcorrected. Deduction from the information provided suggests the clinician may have added more correction/posting to the right orthosis because it was more painful than the left, although reasonable thought process, did not yield the desired results.

Was the cast taken the right type and quality?	If the clinician has used the full skillset taught during their Pedorthic certification process they can be confident that they have preformed a competent casting process no matter what technique they chose. However, the clinician needs to take into consideration the position they took the cast in. For example, Mrs. Stephen's cast was taken NWB using a plaster slipper technique, this cast will yield a much more "corrected" cast in comparison to a FWB foam cast. Most intriguing is that the cast was further "corrected" by manipulating the foot into a final position in which the rearfoot was physically twisted to create a parallel relationship with the tibia and the forefoot physically twisted to create a perpendicular relationship with the rearfoot. By physically twisting the foot to capture this end position in the negative cast, the clinician is effectively adding intrinsic posting (or correction) to the orthoses thus if this is not identified by the clinician during design stage, the final orthoses may contain more functional support than was clearly intended. In this case, the clinician needs to acknowledge the added intrinsic correction inherited through the negative cast position as it related with added extra extrinsic correction in the orthotic design. Mrs. Stephen's the clinician will need to address this overcorrection by first reducing the extrinsic posting however possibly even needing to recast the right foot in an entirely new position.
Is there an area of the orthotic influencing problem?	We have already discussed how the casting position and added extrinsic posting could theoretically "overcorrect" Mrs. Stephen's right foot causing additional strain to her medial longitudinal arch and poor patellar tracking of the knee. However, in addition to this, the clinician may also be guilty of over correcting the foot through their design choices, in particular the addition of a met pad. First and foremost, there is no information in this case study that can justify the clinician adding a met pad to the orthotic design. In the case of Mrs. Stephens, it would be reasonable that her forefoot strain is due to unneeded support via the met pad thus it should be removed. Another consideration includes what was discussed above, casting position and shell design, in this case, the clinician needs to account for the fact that the shell material alone will create added transverse arch support.
Is the footwear a contributor?	Mrs. Stephen's reported that she purchased new footwear, so the clinician would first want to assess the fit and function of that footwear as compared to patient need. For example, the patient may have purchased motion control footwear that when coupled with the foot orthoses you dispensed, overcorrect the foot. Secondly, the clinician would need to ensure the full-length foot orthoses fits the footwear properly and the plantar aspect of the orthoses interfaces with the inside of the shoes intimately. For example, the inside of the shoe may be too narrow for the orthosis thus it sits inverted in the footwear resulting in overcorrection.
Does the patient wear them enough?	Mrs. Stephens reported that she is wearing them diligently however the clinician needs to always investigate wearing time when patients report no pain relief from their orthoses. Simply put, orthoses don't work when they are not on thus the clinician needs to ensure proper wearing time. Successful wearing time for each patient will vary however it would be a reasonable goal to have your patient wear their devices 8+ hours per day. In situations where a patient is wearing the orthoses sporadically, it is imperative the clinician advise the patient of pedorthic solutions available to increase patient compliance. For example, a stay at home dad may forgo orthotic therapy because he prefers being barefoot in the house, the clinician may consider recommending sandals that have removable insoles. Although, the sandals may not provide the biomechanical advantage of running footwear, it will increase wearing time of the orthoses which will contribute to higher patient compliance thus better chance of treatment plan success.
Are there social or financial influences?	In the case of Mrs. Stephens, there is not enough information in the Case Study to make an informed comment. However, the clinician needs to acknowledge that such influences are better addressed during your initial assessment and subsequent design phase than at the follow up stage. For example, it would be unreasonable for the clinician to design bulky orthoses for a patient who is required to wear dress footwear at their workplace.

ANSWER KEY

Exercise 10.0 Answers

(the reader always needs to acknowledge that this list is not exhaustive and that there is more than one way to approach treatment, the following are samples only)

Risk Management Technique	**HAZARD - Maintenance**
Common Sense	You have noticed the leg on your workstation table is quite loose, by not tightening it right away, you are increasing the risk of an accident.
Cleanliness/Prevention	Debris on a lab floor is common and creates potential for tripping and slipping. Regularly scheduled sweep ups will reduce this risk.
Knowledge/Preparedness	Typical lab machinery utilizes moving parts that need replacing. An established maintenance schedule to replace these parts could reduce the chances of harm caused if the same part broke while in function. For example, many labs use CNC machines in their fabrication process, the drill bits in these machines can break and be propelled at a great velocity thus one could reduce these chances of failure with a scheduled replacement schedule.
Culture	A new lab worker is cutting raw materials on the bandsaw, you notice that their hands are precariously close to the material they are cutting…a team member with a good sense of safety culture will stop the new worker and show them a safer technique.
Utilization of your local Occupational Health and Safety Department	An environment of safety is a legal requirement of employers however no employee can undermine the importance of their own personal responsibility to ensure they are practicing safe processes. WHMIS (Workplace Hazardous Materials Information System) continues to be a great resource to keep us educated and remain safe in the workplace.

Risk Management Technique	**HAZARD - Ear Protection**
Common Sense	Because the lab is so noisy don't turn up the volume on your head phones, so you can hear your music!
Cleanliness/Prevention	For example, keeping a fresh sanding belt will a reduce lab noise as it will be better to remove more material at a quicker rate. Also note that the more rigid the material, the noisier it grinds. Compare the sound of grinding a soft 35 du EVA and firm 60 du Black Plastazote.
Knowledge/Preparedness	The measurement unit for noise is the decibel (dB). Normal conversation is between 50-60 dB thus exposure should not exceed 80-85 dB over and 8-hour period.

Risk Management Technique	**HAZARD - Ear Protection**
Culture	Make sure to turn off the equipment whenever it is not in use, when purchasing new equipment look for low dB rated equipment, maintenance of equipment is essential; a poorly operating machine tends to run louder than a properly maintained unit.
Utilization of your local Occupational Health and Safety Department	A site visit by your local OH&S can help you benchmark the present noise level exposure at your lab, they will also be useful to advise you on changes that can reduce sound and provide recommendations on hearing protection devices with appropriate Noise Reduction Ratings applicable for your environment.

Risk Management Technique	**HAZARD - Eye Protection**
Common Sense	It would be very unlikely that an employer would not provide safety glasses for their team however it is quite likely the team member doesn't wear them!
Cleanliness/Prevention	Obtain high quality, adjustable, comfortable safety glasses and replace them regularly as they do get scratched up making it hard to see out of. Team compliance is paramount, safety glasses only work if they are used.
Knowledge/Preparedness	Even in the best environments accidents still happen thus an eye wash station should be available to treat any foreign particles that come in contact with the eyes.
Culture	It seems obvious to use safety glasses when using machinery however one can also protect their team by encouraging eye protection when using cement thinners, cleaning machines, pouring plaster etc.
Utilization of your local Occupational Health and Safety Department	Depending on the size of your company, you may be required to have a specific type of eye wash station, a consult with your local OH&S would be an asset to ensure you follow government regulations.

Risk Management Technique	**HAZARD - Heat and Fire:**
Common Sense	Don't take material out of an oven without gloves on!
Cleanliness/Prevention	For example: dust collection and fume collection systems should not be mixed. Dust in high concentrations is explosive and most solvents are flammable. The mix could be very unstable and could ignite.
Knowledge/Preparedness	For example: In your downdraft table system, a fan moves the air full of organic solvents to the outside. If the solvents reach a certain concentration, the spark from the fan motor could ignite the solvents. Explosion proof fans are available to avoid this situation.

ANSWER KEY

Risk Management Technique	**HAZARD - Heat and Fire:**
Culture	Orthosis fabrication often requires heating raw materials, sometimes with a coating of contact cement, in the convection oven. If forgotten and left for an extended time, the material could ignite. It is extremely important to watch the material closely while heating or use a timer to remind you when it is ready to mold. The whole team needs to be cognizant of this.
Utilization of your local Occupational Health and Safety Department	Your local OH&S can provide direction on First Aid requirements and fire code by-laws.

Exercise 11.0 Answers

(the reader always needs to acknowledge that this list is not exhaustive and that there is more than one way to approach treatment, the following are samples only)

Justification of Suggested Orthotic Design:

Negative Cast:

- Biofoam Semi-weight bearing
- Landmarked ulcer
- Casted in position of comfort

Justification: I utilized a FWB cast taken in the position of comfort as my goal is to create Accommodative Foot Orthoses. Other: As per cast evaluation: it is important that the landmarks of the ulceration site transfer to the negative cast, no cracks, deep enough to capture the vertical height of the MLA, MTPJS are plantar as compared to the heel, left>right forefoot varus alignment should be seen. Financial consideration: Mr. Maloney's foot orthoses will be paid through Non-Insured Health Benefits (NIHB) which traditionally requires plaster slipper casts to be taken unless otherwise justified. NIHB authorizes SWB Biofoam casting for Accommodative Foot Orthoses however it is important to acknowledge beforehand to avoid financial strain for your patient.

Positive Cast:

- No expansion through heels necessary
- Remove 2-3 mm of plaster from the left medial longitudinal arch
- Add plaster 2-3 mm to ulcer site landmarked in left negative cast
- Remove 1-2 mm of plaster proximal to the 2-4 MTPJS of the left foot
- Do not balance cast/add intrinsic posting

Justification:

- the FWB cast should have already captured the expansion necessary for WB
- the removal of plaster should increase MLA support/reduce pronation
- the addition of plaster should create a “well” in the orthosis shell to offload ulcer
- the removal of plaster should increase transverse arch support by loading the metatarsal shafts which in turn will offload the MTPJS
- the cast was already taken in the desired position, further modification would introduce more undesired correction

Shell Base:

- Philps design, All-in-one style
- 45-55 durometer EVA (or similar) material

Justification:

In this case, shell design was dictated by the type of material I wanted to use. My goal is to design an Accommodative Device to offload the ulcer site however also to create more even pressure throughout the plantar aspect of the feet. The use of an EVA or similar based material is more forgiving against the foot which will reduce the chances of skin breakdown especially since I will be adding a lateral clip to the orthotic design.

Shell Modifications:

- Material of left shell to be extended to sulcus
- 3 mm grind out under left 2nd MTPJ as marked in negative cast
- Fill grind out/accommodation with Poron
- Lateral clip on left orthosis

Justification:

Material on left shell is left longer as it will be utilized for extrinsic forefoot posting, will create a comfortable transition of the rearfoot and forefoot posting and will provide enough material to grind out an accommodative well under the 2nd MTPJ. The lateral clip is utilized to keep the pronating foot from deviating laterally off the orthosis.

Shell Additions:

- 1-2 mm met pad on left orthoses just proximal to grind out under 2nd MTPJ
- 2.5 mm lift on the right orthosis

Justification:

-met pad will transfer weight to the met shaft thus reducing pressure on the met head
-the foot of the long, left leg is pronating to shorten itself to balance the short right leg thus adding a lift to the right orthosis should reduce this need for compensation. Rule of thumb is to correct 50% of the LLD however in this case I wished to be conservative and start with 25%.

ANSWER KEY

Justification:

Extrinsic posting was chosen for this device as it does not interfere with the intimate interface between the foot and the orthosis. Extrinsic posting is also easier to adjust in comparison to intrinsic posting, as this is a high-risk patient, I expect adjustments, this will make my job easier. Varus posting was chosen as I wish to reduce the amount of pronation in the left foot. Rearfoot posting was added in an attempt to increase a lateral heel strike, forefoot posting was added to balance the rearfoot extrinsic post creating a smooth transition of the medial longitudinal arch. Forefoot posting was also added to offset the natural forefoot varus observed in the assessment. The quantity of posting is subjective, in this case, I wanted to conservatively add more pronation control to the orthosis as compared to what I already captured in the casting process. As the right foot is asymptomatic, there is little sense to "correct" it.

Covers:

- Top cover, full length, 1/8" Intuition Foam
- Bottom cover, full length, 1/16" PPT+
- Size 10 template or insole tracing

Justification:

I chose full length orthoses, fitted to shoe size as I feel it safe to presume with the information provided that the footwear contains enough volume to address the added bulk of the orthoses. Obviously, this can only be confirmed at fitting. The material chosen for the top cover (Intuition Foam) is designed to compress under high pressure areas in an attempt to reduce vertical pressure and is a moisture resistant closed cell foam. PPT+ has similar properties as Poron however it has a protective skrim on the outside which increases durability. Using PPT+ as a bottom cover is a great way to add cushioning to the device with minimal bulk. PPT+ helps resist vertical and shearing impact, it is also a great material for the repeated impacts of walking.

Fitting:

- RUSH ORDER: get these devices on the patient ASAP!
- Verify orthotic design-ensure the design is what you intended. This is a high-risk foot.
- Fitting appointment needs to be in person.
- Educate Mr. Maloney on the importance of his compliance is paramount to ensure the ulcer successfully heals.
- Verify orthotic fit both against the foot (ulcer site vs. accommodative site) and in-shoe (orthoses side bevels and plantar skives need to match shoe interface). On-sight min-lab will be especially valuable.
- Office should arrange a 1 week follow up after fitting, preferably just before he sees the Footcare RN again, that way you can observe ulcer sight healing, re-measure/document diameter of ulcer site with minimal disruption. Duration time between follow up visits can be lengthened as ulcer heals and all concerned are confident that treatment plan is working as expected. Clinician should only discontinue follow up once ulcer has healed.

Adjustments: Due to the nature of this problem, it would be hard to predict adjustments however the clinician would need to be cognizant that the patient has a reduced protective sense on the plantar aspect of his feet. Extra care would be needed by the clinician to observe new areas of redness, callus, blistering, temperature and pain.

Other Pedorthic Devices: Although the patient is wearing appropriate fitting footwear, one needs to consider temporary footwear on the left foot while wearing bandages/dressings thus a simple post-op shoe could be helpful to reduce added pressure caused by wearing a tight shoe. Another important consideration is his in-house footwear, consider recommending a sandal that has a removable footbed. This type of footwear will increase patient wearing time which in turn will reduce external dangers.

Exercise 11.0 Rubric For Your Mentor

Negative Cast

- **casting goal provided?** **(Y or N?)**
- **landmarks completed?** **(Y or N?)**
- **proper evaluation of cast?** **(Y or N?)**
- **decisions reasonably justified?** **(Y or N?)**

Positive Cast:

- **landmarks addressed?** **(Y or N?)**
- **direction on expansion?** **(Y or N?)**
- **direction on expansion?** **(Y or N?)**
- **direction on arch fill?** **(Y or N?)**
- **direction on intrinsic posting/balancing?** **(Y or N?)**
- **decisions reasonably justified?** **(Y or N?)**

Shell:

- **shell style chosen?** **(Y or N?)**
- **shell material chosen?** **(Y or N?)**
- **shell additions chosen?** **(Y or N?)**
- **direction on external posting?** **(Y or N?)**
- **decisions reasonably justified?** **(Y or N?)**

Assembly:

- **additions chosen?** **(Y or N?)**
- **addition materials chosen?** **(Y or N?)**
- **cover lengths chosen?** **(Y or N?)**
- **cover materials chosen?** **(Y or N?)**
- **decisions reasonably justified?** **(Y or N?)**

ANSWER KEY

Fitting:

- orthotic design verified? (Y or N?)
- fitting appointment arranged? (Y or N?)
- patient education discussed? (Y or N?)
- orthotic fit verified? (Y or N?)

Follow Up and Adjustments:

- follow up arranged? (Y or N?)
- input on adjustments? (Y or N?)

Bonus:

- Is the final design applicable for the patient? (Y or N?) *
- Is the final device durable for timeline needed? (Y or N?)
- Other pedorthic devices recommended? (Y or N?)
- Any discussion of tools? (Y or N?)
- Any discussion of safety? (Y or N?)

*N=Fail

Deductions:

- could choices create potential harm to patient? (Y or N?) *
- are there presumptions in design without explanation? (Y or N?) *
- is the work order hard to visualize? (Y or N?)
- does fabricator need to call for more information? (Y or N?)

*Y=Fail

THE COLLEGE OF PEDORTHICS OF CANADA

Study Guide

Workbook 4

Orthotic Theory

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