Pedorthic Management of Foot Disorders

Case Studies
1.) QL, a 55 year-old male postal carrier, presents to the pharmacy and asks for help regarding worsening pain in his big toe. According to QL, pain increases with activity, and is worse at the end of the day. Softer, more flexible shoes seem to cause more discomfort than shoes with thicker, firmer soles. Upon examination you notice limited motion in the 1st MTP joint and a bony type prominence on the top of the 1st MTP joint.

Which of the following best describes QL’s most likely condition?
   a.) Hammer toes
   b.) Achilles tendonitis
   c.) Hallux rigidus
   d.) Post tibial tendinitis

Explanation:
Limited motion in the 1st MTP joint is a key definitive finding in Hallux Rigidus diagnosis. There is no mention of short shoes or a small toe box thereby eliminating hammer toes. Achilles tendinitis would likely present with contour shoe wear and tendon pain. QL does not present with these symptoms. QL does not complain of heel or arch pain thereby ruling out PTT. The correct answer is C.

Which of the following recommendations would best address this deformity?
   a.) Toe spacer
   b.) Rigid Morton’s extension platform
   c.) Hallux Valgus night splint
   d.) Metatarsal bar
Explanation:
Since the great toe is unable to dorsiflex, patients will often shift weight to the outer border of the foot in order to prevent motion in the big toe, which may cause pain. A rigid Morton's extension extends under the first toe the distal tip of the hallux and limits movement and pain. A toe spacer, or hallux valgus night splint or metatarsal bar will not improve dorsiflexion or limit movement in the hallux. The correct answer is B.

2.) MP, a 61 year-old female patient presents to your pharmacy complaining of severe pain on the outside of her foot that is much worse in higher-heeled dress shoes than in comparison to running shoes. MP works as a sales person in a retail-clothing store and must dress appropriately for work. She experiences pain constantly when wearing shoes, but little to no pain when walking barefoot. Upon examination, MP has redness and callus formation laterally at the base of the 5th toe, and there is apparent wear and tear through the lining of the shoe at that site. At presentation, this area of her foot was painful to the touch since she had worn shoes throughout the day.

Which of the following best describes MP’s most likely deformity?
   a.) Hallux valgus
   b.) Claw toe
   c.) Sesamoiditis
   d.) Bunionette

Explanation:
A bunionette is a bony prominence at the base of the little toe. The pressure on the little toe caused by toe box crowding not only forces the toe inward, it puts pressure on the toe joint to move outward, where it presses and rubs against the shoe. Hallux Valgus is limited to the great toe. While claw toe may be suspected due to the need to wear appropriate shoes at work, it is eliminated due to the lateral wear patterns and calluses on the inside lining of the shoe. Sesamoiditis causes pain in the ball of the foot, most pronounced in the area under the 1st MTP joint especially on the inner (medial) side. MP is describing a bunionette. The correct answer is D.

Which of the following recommendations would best address MP’s deformity?
   a.) Shoe with wide toe box and spot stretching
   b.) Extended steel shank
   c.) Heel elevation
   d.) Excavation in the insole

Explanation:
An extended steel shank or excavation in the insole will not relieve lateral pressure on the fifth toe. Heel elevation will force toes deeper into the already
tight toe box. A wide toe box and spot stretching at the bony prominence will eliminate pressure on the little toe. The correct answer is A.

3) JD, a 28 year-old female runner, presents to your pharmacy complaining of severe pain on the bottom of both feet, most pronounced in the area under the 1st MTP joint. The pain has continued to increase daily to the point where it is impossible to run anymore. JD has purchased several pairs of new shoes, none of which have helped ameliorate the pain. Upon examining the worn shoes, there is a pronounced deep depression under the region of the 1st MTP joint. When examining the foot it seems to be a pes cavus type and the 1st metatarsal joint is very prominent.

Which of the following best describes JD's most likely deformity?
   a.) Sesamoiditis
   b.) Hallux rigidus
   c.) Hallux limitus
   d.) Hallux valgus

**Explanation:**
Hallux valgus refers to joint changes leading bunion formation at the great toe. Although hallux valgus is occasionally accompanied by inflamed tissue called bursitis, associated with a bump on the big toe, it would not lead to the pain JD is experiencing. Hallux limitus and hallux rigidus, the same condition at different stages of development, describe the limitation or lack of motion of the big toe joint. Sesamoiditis causes pain in the ball of the foot, most pronounced in the area under the 1st MTP joint especially on the inner (medial) side. Upon physical examination, JD does not present with hallux ROM conditions, however this patient does present with a deep depression under the 1st MTP joint. The patient is describing Sesamoiditis. Sesamoiditis is painful inflammation of the two sesamoid bones located under the 1st MTP joint. It is a common condition that typically affects physically active young people. The correct answer is A.

Which of the following recommendations would best address JD’s deformity?
   a.) Rigid Morton’s Extension
   b.) Shoe with higher heel
   c.) Hallux valgus night splint
   d.) Insert or orthosis with elevation laterally and proximal of 1st MTP joint

**Explanation:**
A Rigid Morton’s extension, a shoe with a higher heel, or a hallux valgus night splint will not decrease pressure on the sesamoid bones. An insert or orthosis with elevation laterally and proximal of 1st MTP joint is a noninvasive treatment for sesamoiditis. It is simply a modified shoe, insert, or a shoe pad with a cutout to reduce pressure on the affected area and is the best conservative treatment choice. The correct answer is D.
4.) RB, a 34 year-old factory worker presents with severe pain and burning in his lateral forefoot. When asked to describe the quality of the pain, he described it as a shooting type pain that extends into the toes, and hurts primarily when he is wearing shoes. He states that when walking barefoot, he is fairly comfortable. Examination shows that his present shoes are too narrow and short. He does not seem to have pain under the metatarsal area, but more of a pinching sensation in-between the metatarsal heads, which caused the shooting pain to reproduce on palpation.

Which of the following best describes RB’s most likely condition?
   a.) Tailor’s bunion
   b.) Morton’s neuroma
   c.) Claw toe
   d.) Morton’s toe

**Explanation:**
Narrow shoes and an inadequate shoe toe box can exacerbate all four choices. In addition, all four choices improve in bare feet. Morton’s Neuroma is an enlarged nerve that usually occurs in the third interspace, between the third and fourth toes. The shooting pain upon palpation in between the third and fourth metatarsal heads differentiates Morton’s Neuroma from the other choices. The correct answer is B.

Which of the following recommendations would best address JD’s condition?
   a.) Heel extension
   b.) Lateral heel wedge
   c.) Metatarsal pad between 3\textsuperscript{rd} & 4\textsuperscript{th} metatarsal shafts
   d.) Morton’s toe extension on foot orthoses

**Explanation:**
A metatarsal pad positioned over the heads of the central three metatarsals may reduce symptoms by helping to preserve intermetatarsal space, reducing neural irritation. A heel extension, lateral heel wedge, or Morton’s toe extension provide biomechanical support to the heel and/or hallux. The correct answer is C.

5.) JC, a 32 year-old computer salesperson presents with complaints of pain at the back of the heel up through the back of the leg. The pain started Sunday after playing baseball on the weekend. Upon your examination of JC’s heel, you note that there is no prominence, but that there is pain and tenderness toward the top of the calcaneus that shoots up the back of his leg which is accompanied by some warmth and swelling.
Which of the following best describes JC’s most likely disorder?
   a.) Haglund’s deformity  
   b.) Hammer toes  
   c.) Achilles tendinitis  
   d.) Plantar Fasciitis

Explanation:
Achilles tendonitis is a painful inflammatory condition of the Achilles tendon. It can make walking almost impossible. Repeated or continued stress on the Achilles tendon increases inflammation and can lead to tendon rupture if not addressed. The condition develops in people who exercise infrequently and those who are just beginning an exercise program, because inactive muscles and tendons have little flexibility because of inactivity. Plantar fasciitis is eliminated since the pain does not originate at the distal-medial aspect of the plantar calcaneus and radiate toward the arch. In addition, JC does not complain about pain under the heel upon arising. Haglunds’s deformity may be ruled out since no bony prominence was discovered behind the heel. Hammer toe deformities are commonly caused by a muscle imbalance in the foot as a result of flat feet, traumatic injury, or disease of the toe joints. JC is describing mild achilles tendonitis. The correct answer is C.

Which of the following recommendations would best address JC’s condition?
   a.) Metatarsal pads  
   b.) Heel Lift  
   c.) Heel-less shoe  
   d.) Deep toe box

Explanation:
A heel lift shortens the tendon making it the conservative treatment of choice however the patient is also encouraged to do stretching exercises to gradually lengthen the Achilles tendon. Neither metatarsal pads, heel-less shoes or deep toe box shoes shorten the Achilles tendon.

6.) CL, a 47 year-old nurse, presents with a complaint of tightness and aching in her heel, especially when she gets out of bed in the morning or after she has been sitting for long periods of time. It usually improves after walking for a minute or two, but then hurts significantly at the end of a long day. Standing for long periods of time is difficult. Upon examination of her foot, you find that the pain originates at the distal-medial aspect of the plantar calcaneus and seems to radiate toward the arch. The shoes are extremely worn down on the medial side and fit CL too short.

Which of the following best describes CL’s most likely condition?
   a.) Pes cavus foot  
   b.) Diabetes  
   c.) Claw toes  
   d.) Plantar fasciitis
Explanation:
The most common cause of heel pain is plantar fasciitis, with causes including inadequate flexibility in the calf muscles, lack of arch support, being overweight, suddenly increasing activity, and spending too much time on the feet. Plantar fasciitis and the associated heel pain is typically associated with pes planus feet versus pes cavus foot. Nothing in CL’s physical examination or medical history indicates diabetes. Claw toes can be caused by a muscle imbalance in the foot as a result of flat feet; however the patient’s chief complaint is heel pain especially upon arising and relief as the day progresses. The correct answer is D.

Which of the following recommendations would best address CL’s expected condition?

- a.) Extra depth shoes
- b.) Arch support orthoses / heel lift
- c.) Soft flexible shoes
- d.) Toe spacers

Explanation:
Arch support orthoses with additional heel lifts serve to shorten the plantar fascia, relieving pain. CL likely has flat feet, which would also be improved with arch supports. Extra depth shoes would lengthen the tendon increasing the pain. Flexible shoes do not support the arch and spacers serve biomechanical functions at the toes. The correct answer is B.

7.) ZL, a 65 year-old retired seamstress presents to your pharmacy complaining of pain and discomfort in the medial arch of her foot that occasionally extends up the inner side of her leg. She states that the pain is present almost all the time, and gets worse when she is on her feet for longer periods of time. She claims that her shoes do not fit as well as they used too, that they seem too short now. Upon examination, you find the pain to be localized to the medial side of the foot, more proximally in the longitudinal arch. ZL also mentions that she has increased discomfort when trying to rise to her toes especially one foot at a time. She is having a hard time exercising now, and is upset because her doctor told her she should exercise daily.

What is the most likely cause for ZL’s pain?

- a.) Peroneal tendonitis
- b.) Metatarsalgia
- c.) Posterior tibial tendonitis
- d.) Morton’s neuroma

Explanation:
Posterior tibial tendonitis causes pain along the inner side of the lower leg, ankle or foot and occurs from overuse of the tendon. This tendon attaches to a bone in the foot called the navicular and helps stabilize your arch. If your arch flattens out
more than normal when you walk or run it is called over-pronation. The pain localization is the differentiator. Peroneal tendonitis is associated with sprained ankles. Metatarsalgia is inflammation at or near the MT joint. Morton's neuroma is localized in the third interspace, between the third and fourth toes. Pain along the inner side of the lower leg, ankle or foot and ZL's inability to raise her toes without pain typify posterior tibial tendonitis. The correct answer is C.

What recommendations could you make to help with ZL's expected condition?

a.) Lateral heel wedge  
b.) Soft flexible shoes  
c.) Metatarsal bars  
d.) Semi-rigid to rigid orthotics

Explanation:
Semi-rigid to rigid orthotics are useful because they support the arch and help relieve stress to the tendon. None of the other suggested biomechanical devices take pressure off the posterior tibial tendon. The correct answer is D.

8.) JR, a 55 year-old office manager comes into your pharmacy complaining of severe pain in the back of his heel. He states that he cannot lace up his shoes because it puts too much pressure on the heel. His heel hurts him constantly while sitting, standing, and while walking with his shoes on. The only time it is somewhat comfortable to walk on this foot is when he is walking barefoot. Upon examination, you see that the lining of the counter has a hole worn in it posterior and laterally. The foot has a fairly large prominence in the same area where the shoe lining is worn, and the prominence is extremely painful when touched.

What is the most likely cause for JR's pain?

a.) Hammer toes  
b.) Plantar fasciitis  
c.) Pes planus feet  
d.) Haglund's deformity

Explanation:
Haglund Deformity (also known as "pump bump" or "retrocalcaneal bursitis") is an enlargement of the back of the calcaneus, inherited or developed, that can become irritated by wearing ill-fitted shoes. Women tend to develop the condition more than men because of the irritation from rigid heel counters rubbing up and down on the back of the heel bone. The deformity frequently appears as a swollen red area located at the back of the heel, is aggravated by shoes, and can lead to worn counters. None of the other choices causes pain in the described location nor do the shoe wear patterns described indicate any of the other choices. Because JR presents with these complaints, the correct answer is D.

What recommendations could you make to help with JR's expected condition?

a.) Shoe with firm counter
b.) *Counterless shoes*

c.) Metatarsal pads
d.) Soft foot orthoses

**Explanation:**
Shoes with firm counters will only exacerbate the heel irritation. Metatarsal pads and soft foot orthoses are biomechanical strategies employed to correct conditions occurring elsewhere. Counter-less or open-heeled shoes will allow healing to take place. The correct answer is C.

**Terminology**

- **Ankle Foot Orthosis (AFO):** A mechanical device used to support and align the ankle and foot, to suppress ankle and foot muscles when overactive, to assist weak and non-functional muscles of the ankle and foot, to prevent or correct ankle and foot deformities, and to improve the functions of the ankle and foot

- **Ankle gauntlet:** Lace-up or velcro fastened ankle brace that helps resist inversion and eversion ankle injuries
• **Arch support**: Off the shelf or custom made orthotics used to support the transverse and longitudinal arches of the pronated foot

• **Back strap**: A piece of fabric or leather that is located atop the shoe at the upper back used to hold the shoe on the foot

• **Biomechanical strategies**: Methods of addressing physical forces that place wear and tear on the foot during the walking or running gait cycles

• **Bubble or balloon patch**: A permanent external modification made to the upper of the shoe via adding material to accommodate a bony prominence on the foot

• **Bunion shield**: A device that is placed on the foot and intended to comfort, protect, and moisten painful bunions by molding to the foot, realigning the big toe, and providing immediate relief

• ** Buttress**: A permanent external modification made to the midsole, outsole, and upper of the shoe, intended to bolster the support available through the midfoot

• **Clogs**: Shoes with no back (counter)

• **Corn pad**: Mechanical barrier product that limits friction between toes and shoes. Pads are sometimes medicated to wear away excess skin

• **Counter**: A stiff piece of leather or heavy material, placed around the heel of a shoe between the lining and the outside of the shoe, that is intended to strengthen the back of the shoe and keep its shape

• **Custom foot orthosis**: An internal foot device manufactured by the use of a 3-D foot image, intended to accommodate bony deformities, and/or modify movement patterns of the foot and lower extremity

• **Dispersion pad**: Pads that evenly redistribute weight in the foot

• **Doubler**: An interlining, cemented in place to the upper part of a shoe and located between the toe lining and the vamp, is used to provide additional padding to the forepart of the shoe, and to maintain the shape of the shoe

• **Flare**: A permanent external modification made to the shoe, especially at the midsole and outsole, intended to widen the base of support on the medial or lateral portions of the shoe

• **Hammer toe shield**: A mechanical barrier product that limits friction between toes and shoes

• **Heel cup**: Cup-like device that is used to relieve pain and reduce stress on the achilles tendon. The heel cushion and gel product absorbs heel strikes and helps relieve pain

• **Heel wedge**: Wedge designed to help align the calcaneous during ambulation to limit excessive pronation or supination

• **Inner sole**: A durable material, cut to conform to the size and shape of the last bottom that is attached to the outsole and insole of the shoe

• **Insole**: Also known as the inner sole, this is the part of the shoe that is in direct contact with the plantar surface of the foot. It lies between the midsole or outsole and the sole of the foot, is generally removable, allowing it to be replaced with orthotics

• **Intractable Plantar Keratosis (IPK)**: Type of callus on the ball of the foot having a deep core known as a nucleation. This particular type of callus can be especially painful to pressure
• **Last:** In shoemaking, the last is the solid form (like a cast) that is used to mold a shoe, and determines the fit of the shoe based on the design, shape, and volume of the last.
  - The combination of the insole, midsole, and outsole components of the sole of the shoe are also occasionally referred to as a last.
  - The solid form around which the shoe is molded.

• **Lasting:** Shaping or molding of the upper of the shoe to conform to the contours of the last.

• **Linings:** Shoe lining materials such as leather, cotton, and fabricated synthetics, tricot and vinyl. Linings absorb foot moisture and can be bacteriostatic.

• **Long medial counter:** A long medial counter provides support and stability for high arched pes cavus foot.

• **Medial post:** A medial post provides stability and shores the midfoot during the gait cycle.

• **Metatarsal bar (external):** Permanent modification to the shoe wherein a bar of some material is added to the midsole beneath the ball of the foot intended to change the flex point of the shoe.

• **Metatarsal pad (internal):** Permanent modification to the shoe via the addition of material added to the area of the shoe proximal to the ball of the foot intended to support the transverse arch of the foot.

• **Midsole:** The midpart of the last of the sole of the shoe along with the outsole and insole. The midsole provides cushioning and stability to the foot.

• **Outsole:** The bottom part of the sole of a shoe that is exposed to external wear, thus comprised of extremely durable materials to withstand wear.

• **Point of maximum tenderness (PMT):** The time of greatest pain during physical examination and subsequent palpation of the foot.

• **Pump bump:** Also known as Haglund’s deformity, this condition is characterized by a pronounced bony prominence located at the back of the calcaneus. While it is often hereditary, this condition often arises as a result of the constant friction associated with a tightly fitted shoe rubbing against the heel of the foot.

• **Range of motion (ROM):** The extent to which a particular joint can be moved.

• **Rocker sole:** A permanent external modification of the shoe, applied to the midsole and outsole. Material is added to the shoe, modifying the shoe’s flex point in order to improve function or protection of the foot and ankle.

• **Shank:** The part of the sole of the shoe that is located between the heel and the ball, and reinforced with rigid materials intended to support.

• **Shoe heel:** The solid back part of the shoe that covers the foot to the sole of the shoe.

• **Short shoes:** Improperly fitted shoes that provide inadequate space in the toe box.

• **Sole bar:** A full-length bar made of steel or another rigid material that is applied to the sole of the shoe in order to eliminate dorsiflexion of the foot.

• **Sole:** The sole of the shoe is a combination region that is comprised of the insole, midsole, and outsole.

• **Splay foot:** Typically a flat foot causing toes to spread apart from each other.
- **Toe box**: The toe box of the shoe, intended to cover and protect the toes, promoting the shoe’s durability by stiffening the shoe, is the semi-circular area of the shoe that envelops the toes.

- **Toe cap**: A device made of a thin flexible fabric that is used to protect the toe from rubbing against the top of the shoe as well as comfort pain caused by friction, blisters, corns, ingrown toenails, and calluses.

- **Toe crest**: An elastic or gel device worn between the ball of the foot and the toes that is used to hold the toe(s) in a relaxed position, relieve pressure, and help relieve pain caused by painful toe conditions including hammer, claw, or mallet toes.

- **Toe separator/combo**: A soft cushioning device used to provide toe separation to keep toes from overlapping, and to provide relief from corns and friction.

- **Toe separator**: A soft cushioning device that is used to provide comfort from pain caused by a variety of foot conditions, including overlapping toes, soft corns, and friction between the toes.

- **Toe sleeve**: Aligns the big toe to reduce aggravation of bunions and absorb pressure and friction to relieve toe irritations, including blisters, corns, and calluses.

- **Toe spring**: Elevation of the undersurface of the sole at the toe, works to give a slight rocker effect to the shoe, is built into the last, and is dependent on the shoe style, thickness, and heel height.

- **University of California Biomechanics Laboratory at Berkley (UCBL)**: A foot orthosis used to stabilize a flexible foot deformity, usually a flexible flat foot. This product differs from other foot orthoses because it encompasses the heel with a molded heel cup which in turn holds the heel, in a neutral, vertical position, controlling the inside arch of the foot and the outside border of the forefoot.

- **Upper**: All of the parts that comprise the upper parts of the shoe, including the outside, counter, toe box, tongue and laces, and lining, that will be put together with the last and the bottom of the shoe.

- **Vamp**: The upper part of a boot or shoe covering the instep and sometimes extending over the toe; i.e., the complete front part of the upper of a shoe, including the area where the shoe laces are located.

- **Wedge**: A device incorporated into a shoe’s construction or inserted in the shoe sole to provide elevation to compensate for biomechanical instability.