



A LOOK AT FEET (for people with the late effects of polio)

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Many people with the late effects of polio demonstrate foot problems. Some are mild problems, while some are more severe.

Harley [1] said that Polio may have affected some, but not all, of the muscles of the lower extremities. This partial paralysis can therefore create a muscular imbalance between opposing muscle groups of the foot and ankle, often leading to a Pes Planus (flat foot), Pes Cavus (high arched foot), abnormal pronation, abnormal supination, and gait abnormalities. Various other problems can then ensue, such as calluses, corns, Hammer toes, or Hallux Valgus.

Muscular imbalance and/or ligament laxity can also contribute to changes in postural alignment. This can lead to not only problems in the feet, but can place abnormal stress on other areas of the body, such as the knee, hip, shoulder, and trunk musculature.

Proper fitting, supportive footwear and/or foot orthoses are designed to compensate for this imbalance or laxity. According to McCalpin [2] footwear is accommodative and not corrective. He said that we cannot correct deformities after the foot as stopped growing, but in most of the cases we can make the client more comfortable.

According to Rutherford [3] the shoe should cover the foot, conform to the foot, but never compress the foot. The foot needs to fit the shoe, i.e. a "straight" foot must fit into a shoe that was constructed from a straight last (a block used to form shoes).

As outlined in "Foot Notes"[4] which is included in this educational kit, (please see it for reference) a supportive shoe should (a) be one that laces up, so as to prevent the foot from sliding in the shoe thus decreasing stability; (b) provide good arch support; (c) have a long firm heel counter which stabilizes the foot when turning and pivoting; (d) have a firm crepe or rubber sole to act as a shock absorber when walking; (e) have a low heel, ¾" to 1" heel maximum (with a higher heel a greater percentage of your body weight is placed on the metatarsal heads, causing such conditions as metatarsalgia or calluses); (f) have a broad heel to increase stability; (g) have a wide enough toe box so that the toes are not cramped together; (h) have enough depth in the toe box so that the toes will not be irritated by the tops of the shoes; and (i) be wide enough to fit your foot.

Proper fitting, supportive footwear and custom-made foot orthoses can alleviate many of the problems seen with the feet, such as calluses, corns, plantar fasciitis, metatarsal problems and bunions.

SOME COMMON FOOT CONDITIONS: [5]

Plantar Fasciitis:

This is an inflammation of the fibrous band of tissue where it originates on the calcaneus (the heel bone). The function of this fibrous band of tissue is to maintain the longitudinal arch of the foot and to help push off when walking. Clients feel a tremendous amount of pain when required to walk after being stationary for a while, such as after a night's sleep or sitting for long periods of time. The pain diminishes with routine activity and increases again after a full day of weight-bearing.

The plantar fascia is attached to a heel spur, and if you support the fascia and stop the repeated trauma to the spur, you alleviate the spur pain and fasciitis. To treat this, the shoe must be carefully chosen. It should have a strong, well-fitting heel counter. The heel of the shoe should have a shock absorbency to it and the shoe should not be flat.

Semi-rigid insoles may be needed that will form a cup around the heel and consolidate the fat pads under the heel while supporting the longitudinal arch of the foot. The plantar fascia is kept from constantly pulling on the heel spur by the insole and a slight heel elevation.

Metatarsal Problems:

With increased age and various conditions, the ligaments holding the metatarsal shafts and heads together may become lax and the foot "spreads" or "splays". Metatarsal heads then drop, either together or one at a time. The fat padding over the metatarsal heads atrophies with age, leaving the heads very close to the skin, so calluses form to protect the skin. When choosing a shoe, remember that the shoe should contain and protect, but never compress. Therefore, the forefoot area of the shoe should be as wide as the foot. However, with a wide forefoot area the heel of the shoe may be too wide, in which case the heel would have to be modified to narrow it. The heel height should not exceed 1" as this would put more stress on the metatarsal area causing metatarsalgia and, again, painful calluses. A jogging shoe with forefoot impact absorption is considered very good.

Metatarsal pads can also be constructed. They can be constructed in such a way to take the load off the affected metatarsal head(s).

Metatarsalgia is a dispersed, non-specific pain in the metatarsal region. This may accompany Pes Cavus or Pes Planus, Gout, or Rheumatoid Arthritis. Associated with metatarsalgia are calluses (skin thickened due to pressure and friction) which would show uneven or restricted areas of weight-bearing. The callus will usually form over a prominent or already tender metatarsal head.

Hallux Valgus:

This is the angle formed by the first metatarsal and the phalanges of the great toe. This can lead to a medial prominence of the head, called a *Bunion*. Shoes chosen should be wide, square lasted ones, with no pointed toes.

If the shoe is compressing the first metatarsal head and causing pain, it should be stretched out at that point. A shoe repair shop could probably handle this, or they can "balloon patch" the shoe over the first

metatarsalphalangeal bunion and replace it with deerskin or glove leather (single layer) to stop the friction and pressure.

If the Hallux Valgus is flexible, that is you can move it back into place (into a straight position), a night splint can be used over that toe in an attempt to bring it into a normal alignment. This may be used in conjunction with commercially available toe spacers or, if these toe spacers are too thick, silicone putty can be molded between the first and second toes to progressively separate them. The Hallux Valgus must be flexible, as only surgery can help a fixed Valgus deformity.

Hallux Rigidus:

The first metatarsal phalangeal (MTP) joint may look to be thickened and there is often more of a prominence on the dorsal surface of the joint. Motion is then restricted in dorsiflexion and is painful. There may also be calluses under the great toe. Our goal is to immobilize the first MTP joint in "push-off" to reduce the pain that occurs with "push-off". However, if we do this a "rocker sole" is often needed to normalize the gait pattern as much as possible. With a "rocker sole" a SACH (solid ankle cushion heel) rubber wedge in the heel should be added as it cushions the shock of heel strike and accelerates rollover. In addition, a good insole or arch support will help unload the first metatarsal head.

Mallet/Hammer/Claw Toes:

Mallet Toe: This is a flexion contracture of the DIP joint. The other joints are basically normal. It is common for corns/calluses to develop under the toe tips with this condition.

Hammer Toe: This is a flexion contracture of the PIP joint with hyperextension of the MTP joint. Corns usually develop over the PIP joint and under the tip of the toe.

Claw Toe: This is hyperextension at the MTP joint and hyperflexion at the DIP and PIP joints. Painful corns may develop over the tops of the PIP joints, due to shoe pressures, and under the toe tips.

For all the above conditions the shoes chosen need to have a high (extra-depth shoes) wide toe box, or sandals can be worn. Moldable silicone putty can also be used to lift the weight off the painful toe tip corns as seen in mallet toes (the putty is placed under the toes proximal to the DIP joints). The silicone putty can also provide toe crest padding so that hammer and claw toes can be straightened as much as possible.

Pes Planus:

The pes planus foot can be fixed or flexible. If it is flexible, then in non-weight bearing the medial arch is present, but it disappears upon weight bearing. Something can then be done about this, where it can't be for a fixed pes planus (the arch does not change in weight bearing or non-weight bearing).

The best shoes to control and support a pes planus foot are jogging shoes. The shoes that are superior in rearfoot control usually control the arches of the feet best. An internal modification done is the addition of a long arch support. However, adding a long arch support is only good in a shoe that has a strong heel counter. In some shoes, the heel counter may be too shallow to hold an arch support. Therefore, it may be necessary to choose new footwear with higher heel counters.

Pes Cavus:

Pes Cavus, especially a rigid high arch, can cause as many, or more symptoms than pes planus. This is

because the entire body weight is placed on a small area of the foot. Metatarsal calluses are therefore common. When dealing with this condition, it is necessary to help more of the foot absorb some of the body weight. When deciding on the type of shoe, it is important to note that highly arched feet should rarely go flat. When they do go flat, the Achilles tendon pulls on the calcaneus (heel bone), which, in turn, pulls on the plantar fascia, and causes plantar fasciitis.

The insoles/foot orthoses constructed are similar to pes planus ones as they tend to support the lateral as well as the medial arch. The medial side, though, should not be so high as to encourage the foot to increase its supination.

Fused Ankles:

They respond very well to SACH (solid ankle cushion heels) heels, due to the shock absorbency effect, and rocker sole combinations. They replace the missing ankle movement.

SIGNS OF FAULTY FOOTWEAR: [6]

Finally, when assessing a client's feet and footwear, it is necessary to look at the wear pattern on their shoes. Normally soles of shoes will show an even wear pattern on both feet.

The postero-lateral part of the heel often shows the most wear, as that is where heel strike takes place. Then the wear is normally shown along the lateral side of the shoe, across the metatarsal heads and under the phalanges of the Hallux toe, where the foot pushes off. There is also some wear evident on the medio-lateral aspect of the sole, at the tip. If the shoes were too long for the client, the toes will be noticeably turned up and the MT "break" (the only part of the shoe that flexes) will not be in the correct place. This will be evident on the wear pattern.

If the shoes were fitted too long, you can notice (1) gaps between the upper and the sole at the widest part of the foot; (2) the impression of the great toenail pushing up against the end of the shoe; (3) the heel giving away at the seam; and (4) the shoe gaping at the sides in the area of the ankle.

In a *Pes Planus* foot the wear can be seen on the medial side of the sole up towards the tip and on the outer side of the heel. In severe cases, the entire medial heel border will be worn down. With a *Pes Planus* foot, the upper will bulge over the sole on the medial side.

In a *Pes Cavus* foot there will be tremendous wear under the Metatarsal heads. The back of the heel will also show excessive wear. The toe will be raised with more horizontal creasing and sometimes the lacing holes will have been torn away as they need to lace over the high midfoot.

When the foot has *splayed*, or the shoes are too narrow, bulging will occur medially and laterally over the sole. There will also be excessive wear under the first and second Metatarsal heads. The wear will appear the same with a *Hallux Valgus* but the shoe will usually just bulge over the prominent first MT head.

With a *Hallux Rigidus* there will be a great amount of wear under the PIP joint of the great toe and over the lateral border of the forefoot as the foot tries to unload the first MT head. The lateral border of the shoe will also hang over. On the dorsal surface of the upper, the horizontal creases normally seen will now appear oblique, due to a change in normal heel/toe progression.

With a *leg length discrepancy* there will be uneven wear shown on the sole and usually a circular whorl pattern can be seen over the MT heads on the short leg. This occurs because the normal heel/toe

progression does not occur and the client then swivels on the ball of the foot of the short leg. On the short leg side, there will usually be symptoms such as, callusing; knee, hip and low back pain.

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