Shoe Construction and Modification

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• Shoe anatomy
• Shoe construction
• Shoe component design properties
• Shoe modification
• Effects of modifications.

Shoe Construction Types

• Although there are many different shoe construction types we are going to examine the five most common types used today
• We will also identify all the shoe upper components
Construction Types
- Cement Process
- Goodyear Welt
- Stitch-down Process
- Genuine Moccasin
- Heat-Sealing Process

The Last comes First!
- The fit of a shoe depends on the design, shape and volume of the Shoe Last. The shoe last must represent the anatomical information of the foot, at the same time giving the finished shoe a pleasing and fashionable appearance.

Shoe Style
- Each "shoe last" is designed for a particular heel height, toe shape, and type of footwear.
Types of Lasts

- Manufactured Lasts can be made of wood or plastic.
- Custom made lasts are most commonly made of plaster.

Cement Process

- Most simple type.
- The sole is bonded or cemented on.
- Easy and Economical
- Common in inexpensive shoes

Goodyear Welt

- This construction type is more complicated.
- What is the welt? The welt is a narrow strip of leather sewn to the insole and holds it all together.
- Acts as a gasket between the upper and sole
**The Welting Process**

- The welt is attached by sewing through the welt, vamp, vamp lining to the insole. So when the four layers are sewn together it creates the “inseam”
- It is called the inseam because when the outsole is attached you can no longer see it.

**Types of Welting**

- There are several types of welt as shown here. The Ridge welt is sometimes called a Storm welt or Goodyear welt. It is designed to make a shoe more water resistant.

**Attaching the Outsole**

- Notice here the two seams; the chain stitch inseam we looked at before and now the Lockstitch outseam is attaching the outsole by sewing through the extended welt
- This is normally achieved with a Curved Needle Stitcher
Welted Shoe Bottoms

• Once the welt is attached a filler material is put in place to fill the void created by the welt. It will also serve to make the shoe more comfortable by providing some cushion and insulation.
• Filler is often made of cork or a foam material.

Welted Shoe Bottoms

• A shank or shankpiece is utilized to reinforce the bridge from the shoes heel to the ball of the foot. It is not there to be an arch support but rather it is a technical part of the shoes construction.

Stitchdown Process

• The Stitchdown is the only construction type where the uppers turn out instead of under the shoe.
• The uppers are turned out and are sewn down to the midsole.
• This is not a true welt on this shoe
Single Sole Stitchdown

- This child’s shoe has the upper turned out and sewn directly to the outsole. There is no midsole making this a single sole stitchdown.

Two sole Stitchdown

- In this shoe the uppers are turned out and sewn to the midsole then the outsole is bonded on concealing and protecting the stitching.

Genuine Moccasin Construction

- A genuine Moccasin simply means the vamp creates the insole.
- The vamp wraps under the foot creating the insole with no other insole needed.
Moccasin Style

• Not all genuine moccasins are made the same. This shoe is a true moccasin.
• The vamp creates the insole is the deciding factor. This style is also called a McKay.

Heat-Sealing Process

• There are several ways of making this construction type. Many of the Orthopedic shoes are made this way for comfort, light weight and cost effective.
• Soling materials will include polyurethane, thermo plastic rubber, PVC and Latex.

Injection Molded & Vulcanized

• Each of these types are heat molded to the uppers.
Orthopedic Footwear

- Each of these shoes are of a Heat Sealing Process

Shoe Uppers

- The uppers are only the parts you see, not internal parts. They are not present on all shoes, various styles use different upper parts as you will see

  - Vamp
  - Quarter
  - Heel
  - Foxing
  - Toe Cap
  - Saddle
  - Backstay
  - Tongue
  - Vamp Plug

Vamp

- The front part of the shoe.
- All closed toe shoes have a vamp
Quarter

• The back part of a shoe or boot

Heel Foxing

• Foxing goes over the quarter and can be decorative or plain
• Sometimes it will have perforations or a different colors creating a two tone shoe

Foxing

• The foxing can be over the quarters or the quarters can be cut away and the foxing in its place.
• A toe cap is to the toe what foxing is to the quarter.
• It can be plain or decorative.
• Toe caps normally go over the vamp but the vamp can be cut away and the toe cap in place of it.

The most well known toe cap would be the wing tip. In a true wing tip the toe cap goes all the way back to the quarters.

This would also be called a wing tip

This would be a straight tip
Saddles

- A piece of leather that goes over the instep
- A saddle can be the same color as the shoe but it is normally a contrasting color

Backstay

- A narrow strip of leather that covers the seam where the quarters come together

Conventional Backstay

Backstay

- This backstay is decorative. More commonly they are a straight strip of leather.
Tongues

- There are several types of tongues to explore.

- The dress tongue is most common.
- The apron tongue is often called a Kiltie. Kilties were popular on golf shoes to keep the grass out of the shoe.
- Today Kilties are more commonly used as decoration.

Bellows Tongue

- The Bellows tongue is required in some trades as a safety tongue.
- It is stitched up the sides of the tongue so objects such as metal shavings can not get inside the boot.
Vamp Plugs

• A piece of leather sewn into the top of a vamp.
• A vamp plug is often used on moccasin style shoes.

Other Shoe parts and Terms

What makes a shoe a Depth Shoe?
• The shoe must have at least 3/16 removable inlay.
• Some shoes today have ¼ removable inlay or have two removable layers.

Internal Stiffeners

• The Counter is the stiffener in the heel area to provide grip for the heel and to retain the shape of the shoe.
• The Toe Box is the stiffener in the toe of the shoe. It retains the shape and provides protection for the toes.
Oblique Toe
- Anatomically shaped toe style.
- Oblique toes are often used to provide more room for the forefoot and accommodate toe deformities.

Heels
- Heels come on all different styles and sizes
- The breast of the heel is the front area
- The toplift is the part that hits the ground

Heel Pitch
- Heel pitch is the vertical line of the heel.
- Correct pitch is vital for the shoe to tread or walk correctly.
Topline / Outsole

- Notice the Topline in this illustration.
- The sole that hits the ground is the Outsole.

Midsoles

- Midsoles are in between the insole and the outsole.
- Midsoles are common in wingtip shoes, work boots and athletic shoes.

Insole Verses Inlay

- The insole is a technical part of the shoes construction. It is glued, stapled or sewn into place.
- The Inlay goes on top of the insole and is removable.
Heel Pads / Sock Linings

- Some shoes especially if they have a nailed on heel will have a heel pad glued on top of the insole to protect the foot from the nails.
- If it is full length it is then called a sock lining.

Balmoral

- The Bal as it is sometimes referred to is when the vamp over laps the quarters.
- This produces a smaller opening for donning and doffing.

Blucher

- In Blucher the quarters overlap the vamp creating a wide opening shoe.
- Often prescribed for patients with limited dorsiflexion and limited foot flexibility.
Shoe Modifications

• Basic rocker sole
• Stabilizers, Flairs & Wedges
• Elevations & Lifts

Basic Rocker Soles

• Forefoot Rocker
• Mild Rocker
• Heel to Toe Rocker
• Negative Heel Rocker
• Severe Angle Rocker
• Double Rocker
• Rocker Bar

Basic Rocker Soles - Forefoot Rocker

• Designed to load the weight bearing area of the foot proximal to the metatarsal heads so there is less time spent on them.
• Provides a stable midstance and reduces shock on toe-off.
• Indications:
  - Hallux Rigidus
  - Post-op, surgical fusion of MP or IP joint.
  - Extreme metatarsalgia
  - Offloading of healing ulcer occurring distally to the metatarsal heads
  - Relieve callosities on distal portion of toes (claw, hammer etc)
• May include an extended steel Shank if required.
Basic Rocker Soles - Mild Rocker

- Provides metatarsal relief, reduce forces at the ankle and midfoot and increase propulsion.
- Many manufacturers have build this mild rocker into the shoes.
- The design will assist gait and reduce energy expended during ambulation.
- Indications:
  - Simple metatarsalgia
  - Maintenance of healed ulcer
  - Pes Cavus foot
  - Minor ankle pain
  - Toe amputation
  - Painful flat foot
  - With an AFO
  - Hallux Limbatus
- May be used with extended steel shank if required.

Basic Rocker Soles - Heel to Toe Rocker

- Most common variation. This design replaces lost motion at ankle and will determine midstance time.
- The floor reaction forces on the calcaneous are reduced and it increases propulsion at toe off.
- Indications:
  - Fusion or limited motion at ankle, knee or hip
  - Calcaneal fracture, ulcer, skin graft or muscle flap
  - Severely painful arthritic ankle or foot
  - Rigid claw or hammer toe deformity
  - Pes cavus foot
  - Midfoot amputation

Basic Rocker Soles - Negative Heel Rocker

- The negative heel rocker will unload the midfoot and forefoot.
- Distal toe ulcers will benefit from the heel weight-bearing. This style is not recommended for ladies used to pumps, the achillies tendon will be too short.
- Indications:
  - Forefoot ulcers
  - Prominent metatarsal heads
  - Extreme callusng
  - Ankle fixed in dorsiflexion
  - Patient must be able to dorsiflex the foot and tolerate the transfer weight bearing to mid and hindfoot.
  - Discontinue if there is discomfort in achillies tendon.
Basic Rocker Soles - Severe Angle Rocker
• The severe angle rocker will eliminate weight-bearing forces on the metatarsal heads.
• Indications:
  – Extreme relief of ulcerated or high-risk metatarsal heads
  – Not indicated for problems at distal ends of toes, shock on toe off is increased. This rocker decreases stability, changes gait and is not recommended for the patient with proprioception problems.

Basic Rocker Soles - Double Rocker
• The double rocker will relieve a specific problem area or prominence on the plantar surface of the foot.
• This rocker increases propulsion at toe off and reduces shock at heel strike.
• There will be a shortened midstance.
• Indications:
  – Mid-foot prominence maintenance
  – Nodules on bottom midfoot (arthritis) to de-weight.
  – Charcot joint

Basic Rocker Soles - Rocker Bar
• The rocker bar transfers body weight during locomotion and shortens gait cycle.
• This style is a longer metatarsal bar with a convex shape that is added to the sole bottom.
• For metatarsal or tarsal bone fractures: the rocker should begin closer to the anterior portion and continue forward to stiffen the sole with a long rocker effect.
• The neuropathic or hypersensitive foot requires the high point proximal to the metatarsal head to shorten gait and provide a quick toe off.
Stabilizers

- Stabilizers are additional pieces of crepe or foam material that is add to either the medial or lateral side of the shoe in order to increase the base of support and provide a reinforcement against the foot rolling over the side of the shoe.
- Stabilizers are indicated for severe pronation or supination.

Sole Flairs

- Sole Flairs are additional pieces of crepe or foam material that is add to either the medial or lateral side of the outsole in order to increase the base of support.
- It does not provide a reinforcement against the foot rolling over the side of the shoe.
- Sole flairs are indicated for lateral or medial ankle instability without severe pronation or supination.

Heel & Sole Wedges

- Heel & sole wedges are used to compensate for rearfoot and forefoot valgus and varus deformities.
- A wedge of material is place either on the bottom of the outsole or the outsole is split and the wedge placed inside the outsole.
- This modification may also be indicated for over pronation and over supination.
Elevations & Lifts

• The heel lift is a common addition for a mild pump bump, tight achilles tendon, irritation of the malleoli and ¼” or less of a leg length discrepancy. Following an achilles injury a heel lift will be decreased as the patient can tolerate the stretching.

• Elevations are used to compensate for leg length discrepancies greater than ¼ inch. Elevations can be put between the sole and shoe or under the sole. They are usually made from crepe or two part foam to reduce weight.