Al-Mustaqbal University

Collage of Engineering

Prosthetics and Orthotics Engineering

Second Stage

ORTHOTICS I

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APPROPRIATE FOOTWEAR AND ROCKER

ENG. HUSSEIN DHAMEER HUSSEIN

FOOTWEAR

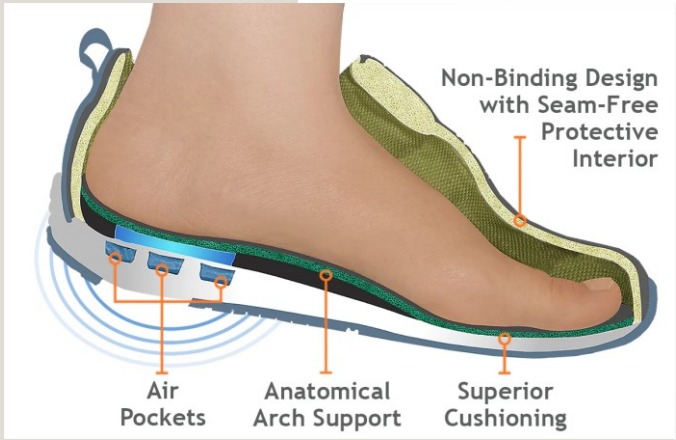
- Footwear is a “first-line orthotic” because it can:
  - Reduce pain by redistributing plantar pressure
  - Improve stability by increasing friction and controlling motion
  - Protect skin (especially in neuropathy/diabetes)
  - Improve gait efficiency by optimizing rollover and push-off

CLINICAL GOALS (DIAGNOSTIC THINKING)

- When selecting footwear, define the goal:
  - Protection (skin / ulcers / neuropathy)
  - Stability (balance, wide BOS, slip reduction)
  - Motion control (hindfoot/midfoot control)
  - Offloading (metatarsal heads, heel, forefoot)
  - Accommodation (deformity: bunion, claw toes, Charcot)
  - Functional support (orthosis compatibility, AFO space

SHOE FIT (MOST IMPORTANT)

- Fit rules:
  - Length: ~ 10–12 mm space in front of longest toe
  - Width: no squeezing at forefoot; toes can "spread" slightly
  - Depth: adequate toe box height (no dorsal rubbing)
  - Heel: snug (minimal heel slippage)
  - Try shoes at end of day (swelling is highest)



KEY SHOE PARTS

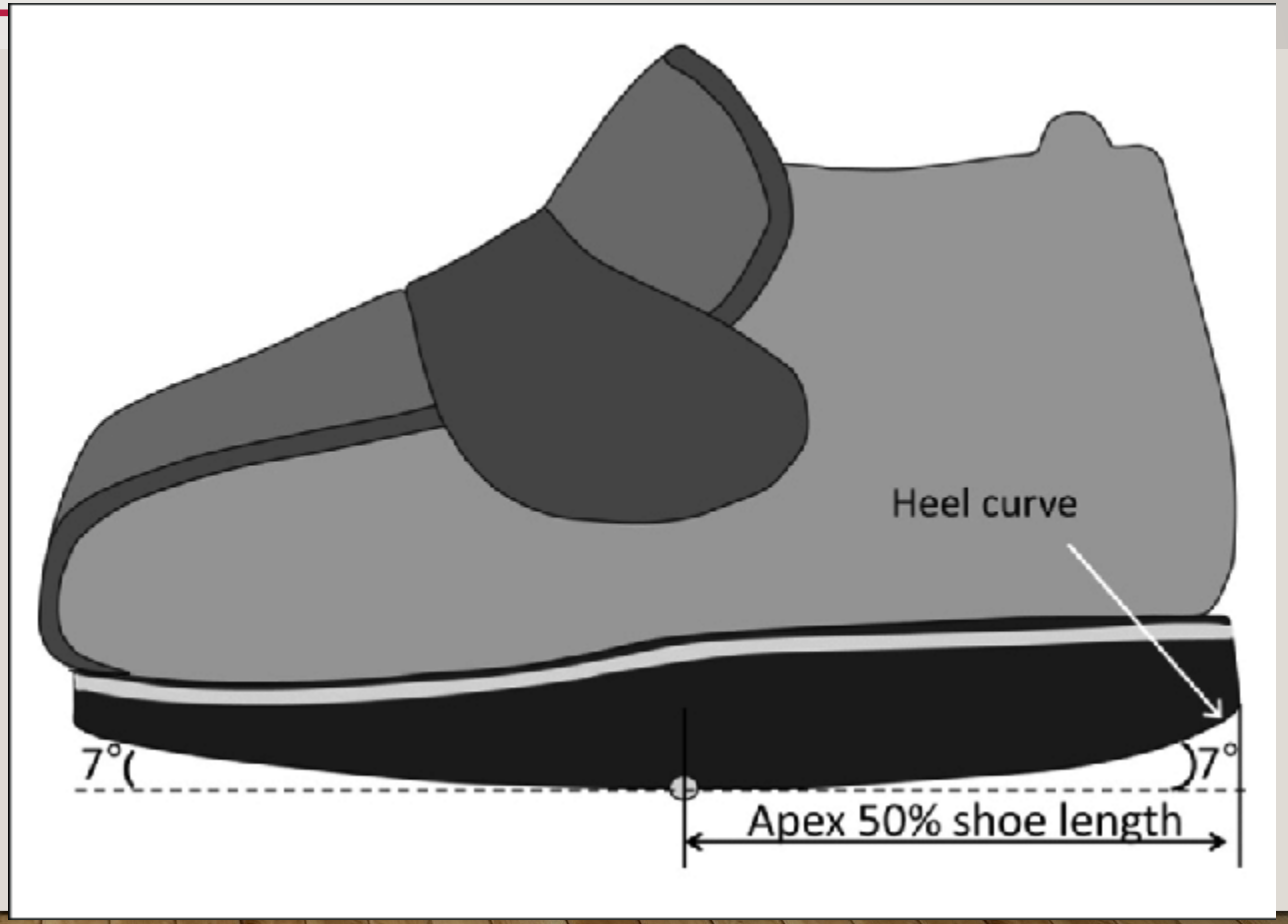
- Upper: holds the foot; affects comfort and shear
- Toe box: space for deformities and toe clearance
- Heel counter: rearfoot stability (stiff counter = more control)
- Midsole: cushioning + energy absorption
- Outsole: traction + durability
- Shank: stiffness under midfoot (controls bending)
- Insole/liner: pressure and shear management

CUSHIONING VS CONTROL (TRADE-OFF)

- More cushioning → less impact, but can reduce stability
- More stiffness/control → more stability, but may feel "hard"
- Choose based on: pain vs instability vs deformity vs endurance.

WHAT IS A ROCKER SOLE

- A rocker sole is a curved outsole design that:
  - Promotes "rollover" during stance
  - Reduces required joint motion (ankle/MTP)
  - Offloads pressure from painful regions
  - Can shift the effective pivot point under the foot

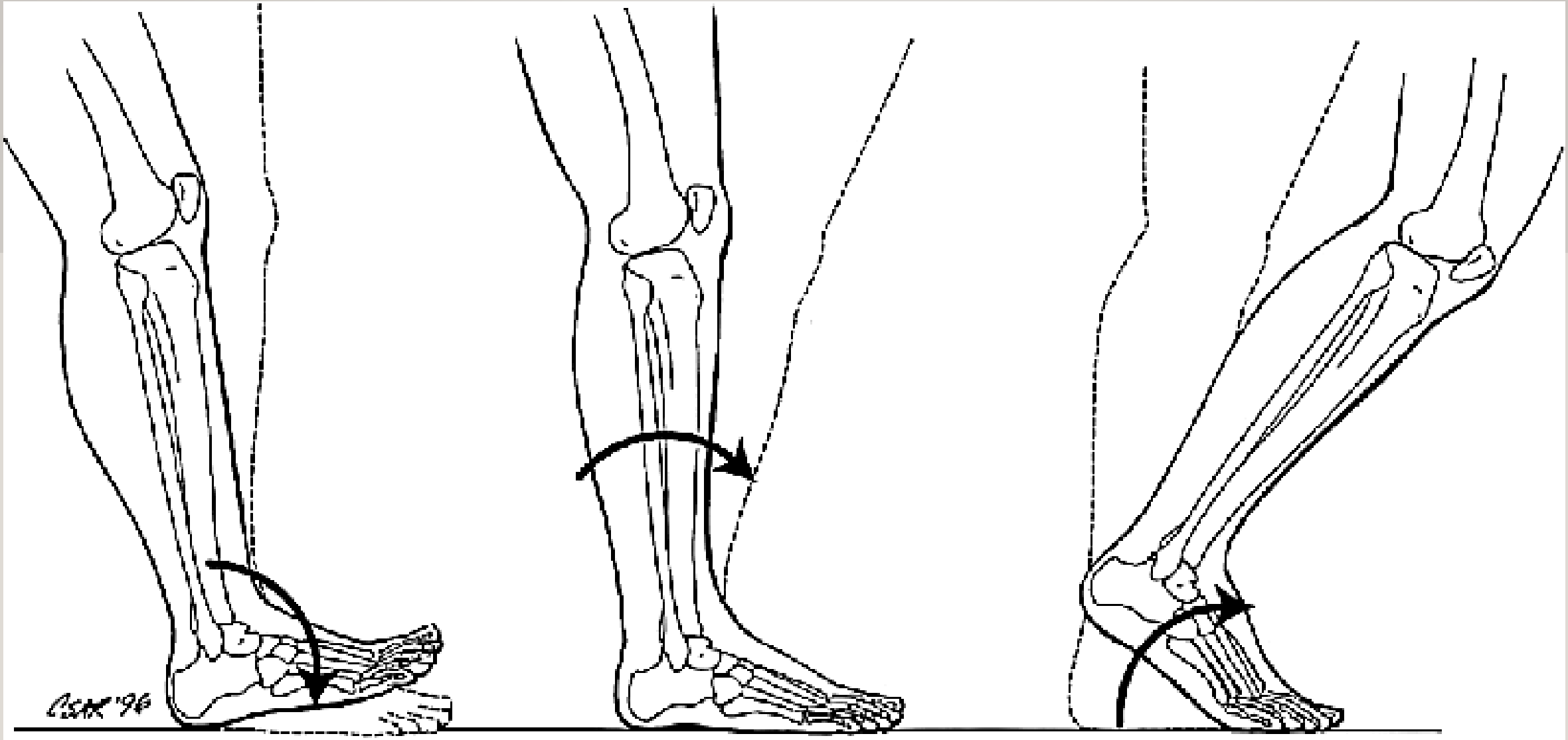


WHY ROCKERS WORK

- During stance, the body moves forward over the foot.
- A rocker changes:
  - Where the ground contact point "rolls"
  - The lever arm of GRF relative to joints
  - Bending demands on the forefoot
  - Result: less pain + easier progression (when prescribed correctly)

STANCE PHASE "ROCKERS" CONCEPT

- Rollover during stance can be described as:
  - Heel rocker (initial contact → loading)
  - Ankle rocker (tibia moves over foot in mid-stance)
  - Forefoot rocker (terminal stance → push-off)
- Clinical idea: If one rocker is limited or painful, footwear can assist.



(a) Heel rocker
(first)

(b) Ankle rocker
(second)

(c) Forefoot rocker
(third)

ROCKER TYPE

	Heel rocker	Ankle rocker	Forefoot rocker
Normal	• Smooth loading response • Reduce impact + improve stability at heel strike	tibia progresses forward over foot (needs ankle dorsiflexion)	MTP extension + forefoot bending
Abnormal	• Heel pain, poor shock absorption, cautious gait	• tight Achilles/ankle arthritis • Patient compensates (early heel rise, pronation, knee hyperextension)	hallux rigidus, metatarsalgia
Footwear design	• Slight heel bevel or rounded heel • Good heel contact + traction	• Rocker design that supports forward progression with less ankle DF demand • Appropriate stiffness to reduce midfoot collapse	• Toe rocker / rocker bottom to reduce MTP dorsiflexion demand • Offload metatarsal heads

INDICATIONS

- Metatarsalgia / forefoot overload
- Hallux rigidus (limited MTP extension)
- Diabetic foot (pressure offloading; with caution and follow-up)
- Midfoot arthritis (reduce painful bending)
- Post-op protection (surgeon protocol dependent)

PREFAB VS CUSTOM FIT VS CUSTOM MOLDED

- Prefab (off-the-shelf): standard sizes, minimal modification
- Custom fit: prefabricated base + adjusted to patient (heat/trim/pads)
- Custom molded: made from patient shape (cast/scan) for best match

Prefab	Custom fit	Custom molded
• Mild symptoms, mild deformity • Low ulcer risk • Goal is simple cushioning/support • Early trial to see response	• Moderate deformity or sensitive areas • Need better fit than prefab • Need modifications (pads, wedges, heat molding)	• High-risk foot (neuropathy, prior ulcers) • Significant deformity (Charcot, rigid deformities) • Need precise offloading and accommodation • Chronic recurrent symptoms despite prefab/custom fit