

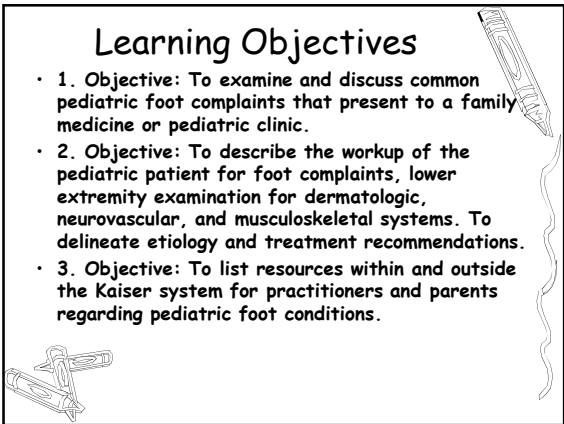
Disclosures

- None. Full time Surgical Podiatrist, Kaiser Permanente.
- I have no actual or potential conflict of interest in relation to this program/presentation.



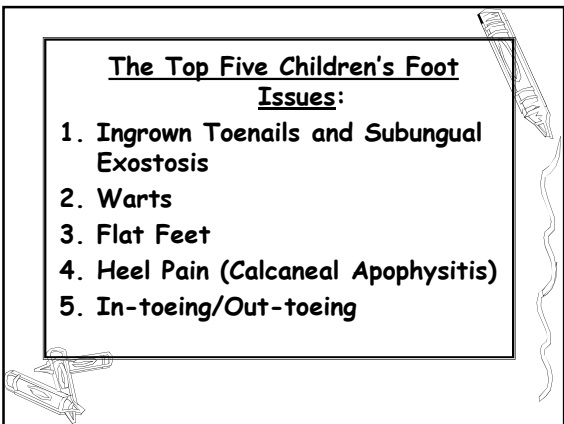
Learning Objectives

- 1. Objective: To examine and discuss common pediatric foot complaints that present to a family medicine or pediatric clinic.
- 2. Objective: To describe the workup of the pediatric patient for foot complaints, lower extremity examination for dermatologic, neurovascular, and musculoskeletal systems. To delineate etiology and treatment recommendations.
- 3. Objective: To list resources within and outside the Kaiser system for practitioners and parents regarding pediatric foot conditions.



The Top Five Children's Foot Issues:

1. Ingrown Toenails and Subungual Exostosis
2. Warts
3. Flat Feet
4. Heel Pain (Calcaneal Apophysitis)
5. In-toeing/Out-toeing



Lower Extremity Examination in Children

- Best if child is in diaper or shorts. Young children may be more comfortable sitting in the parent's lap.
- Start with a thorough history:
 - Main presenting complaint?
 - Type of birth, any abnormalities or delayed milestones? Age when first walked?
 - Any significant illnesses or injuries?
 - Family history, parents or siblings with lower extremity abnormalities?
 - Previous treatments/surgery/orthotic devices?
 - Any pain, tripping, falling? Any neurological issues?
 - What current sports? What shoe gear used?

- Prepare to observe standing, walking and sitting if any musculoskeletal issues.
- Proceed to dermatologic, neurovascular, and musculoskeletal examinations.



Dermatologic Examination

- Socks and shoes off both feet, pants rolled up above knees. Comparison to normal side important.
- Begin by examining the dorsal foot and ankle. Move to the medial foot, then plantar. Examine the lateral foot. Finish by examining the toes, nails, and interdigital webs.
- Make note of any color, texture or temperature changes.
- Observe and note rashes or eruptions, cutaneous masses, sign of infection or injury.



Neurologic Examination

- Test reflexes, patellar, Achilles and plantar.
- Most young children will have a very strong plantar withdrawal.
- Note bilateral muscle strength. Is it symmetrical and full?
- Test light touch, plantar dorsal and at toes bilaterally.

Musculoskeletal Examination

- Test sitting for range of motion, hips, knees, ankles, subtalar joint and digits.
- Especially look for any Achilles contracture. Test with knees extended, and then flexed and note difference.

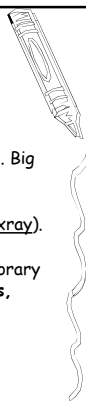


Observe stance both in and out of shoe gear.

- Observe the gait pattern and appearance of the feet and arches in stance. If flat footed, have raise on toes to see if arch reconstructs.

Ingrown Toenails

- **Ages:** Newborns to young adults.
- **Gender:** Usually equal M=F. May be inherited.
- **Presentation:** Acute or chronic; erythema and pus. Big toes most often affected. May be bilateral.
- **Differential:** Subungual exostosis (if round hard nodule is under or near the nail, get a lateral toe xray). Common.
- **Treatment:** Soaks, partial wedge resection (temporary procedure), topical and oral antibiotics. **If recurs, refer to podiatry for partial permanent edge removal/matrixectomy.**



Ingrowing nail edge with local redness, pus and pain.

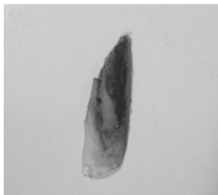


Photo 7



Photo 6

Removal of nail edge





Ingrowing Toenails: when to refer for Permanent Removal?

- **Good Nail Cutting Technique:** Trim nails straight across, do not pick or tear. Nails generally do NOT need to be trimmed more than once a month. Better to leave them slightly long than too short. 2-3 mm of white is good.
- Avoid constricting or too short socks and shoes in children. **"Rule of Thumb":** there should always be a thumb width between the longest toe and the end of the shoe! Avoid socks or "bunny feet" pajamas on children at night.
- If the ingrowing nail recurs twice or more, then referral to Podiatry for permanent nail removal Matrixectomy is appropriate.

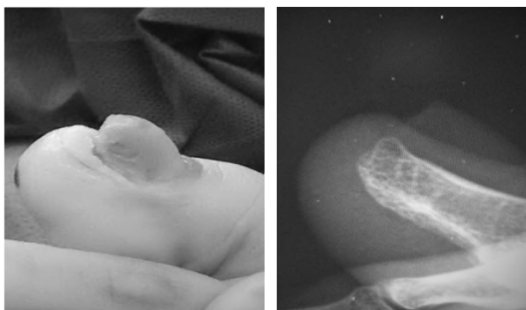
Photo 15

Subungual "Exostosis"

- **Ages:** 8-20. **Gender:** F>M.
- **Presentation:** Firm round mass next to painful red nail area. Often diagnosed as an ingrown nail. Any nail.
- **Differential:** Ingrowing nail, Granuloma.
- **Treatment:** Typically an enchondroma or osteochondroma of the distal phalanx. Refer to Podiatry for Surgical removal of the bone spur in the OR, and nail bed repair.

Subungual Exostosis: Xrays

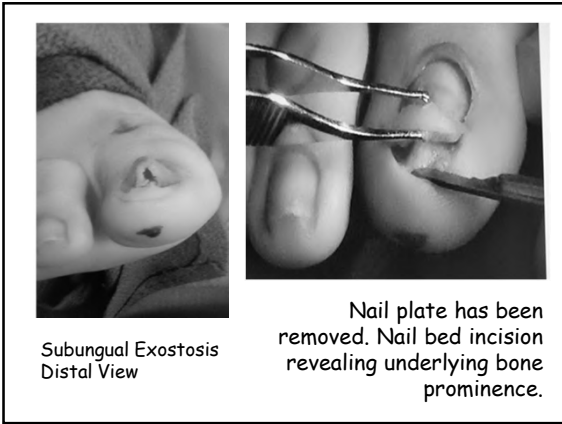
- Round, hard, discrete mass, non-movable, under the nail or edge.
- **Get Xrays, 3 views.** Include note to technologist to include distal toe tufts.
- May appear faint due to cartilaginous nature.
- Get normal side for comparison.
- Removal of the nail alone will **not** control the symptoms. The abnormal cartilaginous bone must be removed.
- Referral to a podiatrist.

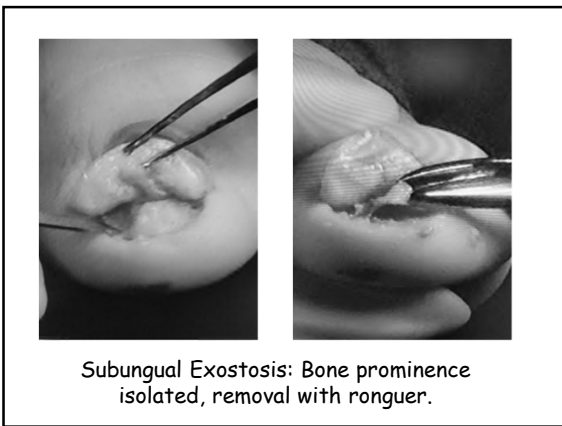


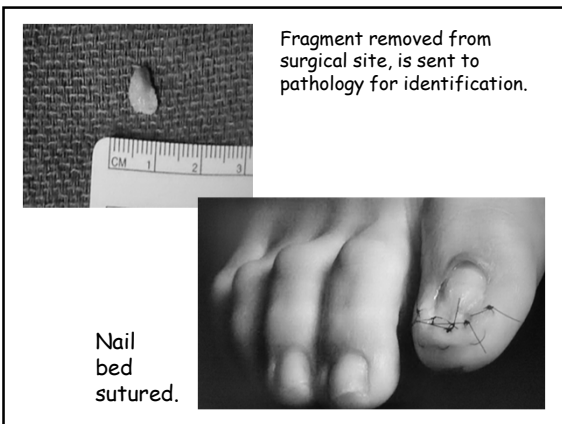
Appearance from Side

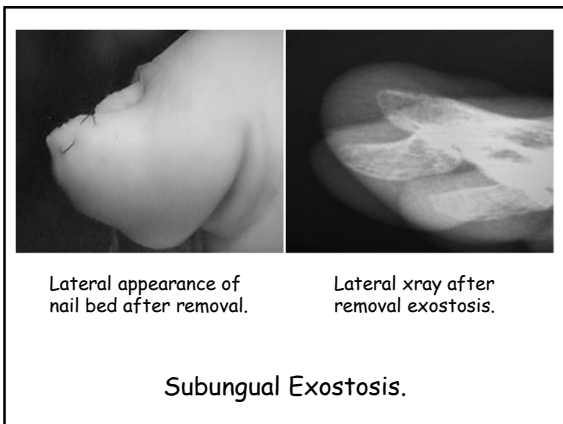
Xray View Distal Toe

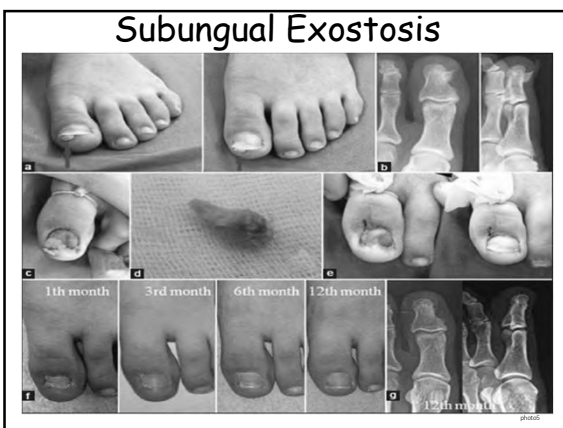
Subungual Exostosis











Plantar Warts/Verruca

- **Ages:** Any. Typically **teens and young adults**. Increased risk from dorm and gym showers and pedicures.
- **Gender:** M=F
- **Presentation:** Usually gradual. May complain of the **feeling of foreign body** having "stepped" on something. Round, may have small black spots (oxidized blood vessels) and a "cauliflower" texture. Tender with medial to lateral palpation. Single, multiple (mosaic) or bilateral. Punctate bleeding on debridement.
- **Differential:** Foreign Body; Granuloma; Dermatitis; Callus
- **Treatment:** **Conservative first**, including hygiene, control of hyperhidrosis, topical 40% sal acid plaster, liquid N2, aseptic debridement. Do Not File or Pumice (spreads virus). Cantharidine, Candida injections, Topical chemotherapy.
- **If no response:** **Surgical excision**. Permanent scar possible. May recur despite excision or other treatments.

Plantar Warts: Cause

- Human Papilloma Virus. Dozens of types. HPV 1, 2, 4, 7, 27, 57, 60, 65, and others. HPV 2 is seen most frequently when viral typing is done.
- HPV types cause common warts, which grow in keratinized epidermis.
- A DNA Virus. Variable onset after inoculation (weeks to years). Contagious.

Toad verdict:
Innocent!


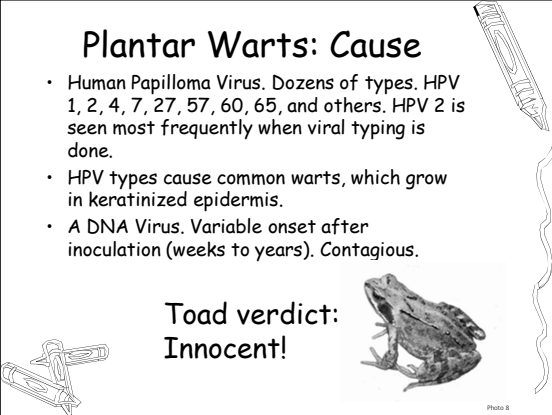


Photo 8

Plantar Wart: Singular

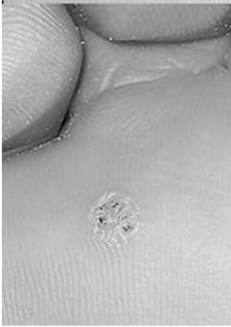



Photo 10

Single wart, round, small blood vessels that appear black from oxidation. **Disrupts skin lines** (good way to tell if it is a callus or wart!).

Photo 9

Mosaic Plantar Warts

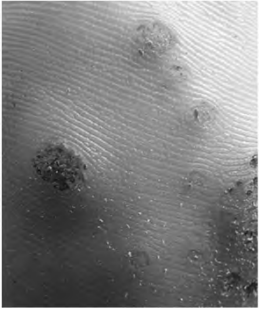
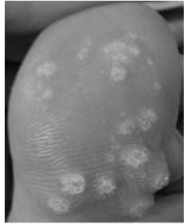


Photo 11

May appear separate, or as one large mass.

Photo 12

Folk "Cures" for Warts:

- An early method of wart removal was in ancient Rome, where individuals could be paid to bite these growths off the feet.
- 30 A.D. Aulus Cornelius Celsus described cauterizing treatments for warts in his writings "On Medicine."
- Per Mark Twain (Tom Sawyer, Chapter 6):
 "Say -- what is dead cats good for, Huck?"
 "Good for? Cure warts with."
 "No! Is that so? I know something that's better."
 "I bet you don't. What is it?"
 "Why, spunk-water. . . You got to go all by yourself, to the middle of the woods, where you know there's a spunk-water stump, and just as it's midnight you back up against the stump and jam your hand in..."



Plantar Warts: Modern Treatments



- Liquid Nitrogen
- 40% Salicylic Acid
- Cantharidine
- 5-FU*
- Candida Skin Allergen*

Almost all topical wart treatments cause blistering and peeling of the wart tissue. Can be painful for varying times after treatment.

*generally not indicated in children



Surgical Removal Wart



- Local Anesthetic (depending on age of patient).
In Office vs. OR.

- Crutches and non-weight bearing until healed.
- Can cause permanent scarring.



Flat Feet

- **Ages:** Any. Rigid in Newborns, checked at birth. Flexible type often in young teens as they increase sport activities.
- **Gender:** M=F. Depends on activity level.
- **Presentation:** Rigid rocker bottom type seen at birth. Flexible (most common type) with achy arches, "tired" feet after sports activity and walking, older kids.
- **Differential:** Calcaneal apophysitis "Sever's"; Stress fracture or Injury; Tendinitis; Coalition; Neuromuscular.



Rigid "Vertical Talus" Infantile Flat Foot

- **Work-up:** Screening at birth.
- Very Rare.
- "Rocker" Appearance of foot.
- May need serial casting and/or surgical correction.
- Examine for coexisting neuromuscular deformity, spina bifida.
- Orthopedist Referral.

Rigid Flat Foot:
Congenital Vertical Talus
1 year old girl



"Flexible" Flat Foot

- Very Common.
- Arch may look normal when sitting.
- Arch collapses and ankle rolls medially (pronates) on weight bearing.
- Raising up on the toes or passive dorsiflexion of the big toe reconstitutes the arch.



Flexible Flat Foot on Exam



Photo 19

Jack's and Heel Raise Tests for Flexible Pes Planus

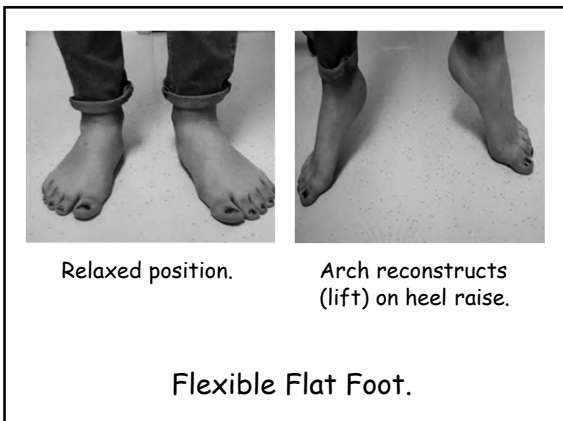


Passive dorsiflexion of the great toe reconstructs the medial arch.



Toe raises reconstruct the medial arch.

Photo 24



Treatment of Symptomatic Flexible Flat Foot

- **Work-up:** Xrays usually not necessary unless question of rigid deformity. Clinical observation .
- Supportive shoes. Avoid flats, slippers or sandals for extended periods of time.
- Understand that up to age 5, most normal children will have "Fat, Floppy Feet."
- OTC orthotic arch supports (Superfeet, Dr. Scholl's, the Walking Store, etc.)
- Foot strengthening exercises and Physical Therapy.
- If not helpful, referral to Podiatry to consider Rx for Custom Orthotics.

Orthotics

- Custom Orthotics are made from a custom mold of the foot.
- Most often they are made in pairs.
- They help to support the arch, decrease abnormal forces, and improve the structural mechanics of the foot.
- In most cases, they are not covered by medical insurance.
- Children may outgrown orthotics every 2-3 years and need new.

Photo 25

Heel Pain in Children: Sever's Calcaneal Apophysitis

- **Age:** Boys 10-12 years; Girls 8-10 years.
- **Gender:** M>F; obese and/or active kids.
- **Presentation:** Acute or subtle posterior-plantar heel pain. May limp. Worse with walking and activities.
- **Cause:** The immature heel bone, calcaneus, originates as two separate growth centers. At this age, the two begin to fuse. Initially the separate pieces rub against each other due to tendon pull with activity. Eventual fusion causes symptoms to resolve.
- **Differential:** Tarsal Coalition; Plantar Fasciitis (rare in this age group); Calcaneal fractures.

Calcaneal Apophysitis: Sever's

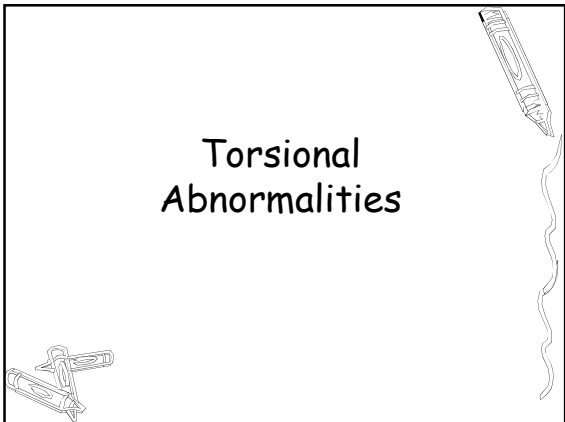


Sever's Apophysitis Treatment:

- **Work-up and Treatment:** Xrays bilateral to rule out fracture or structural abnormality. RICE, Children's nsaid, Heel lifts/pads, Brace or Splint, occasionally crutches and casting 4 weeks. Rest from sports. Stretching and Physical Therapy.

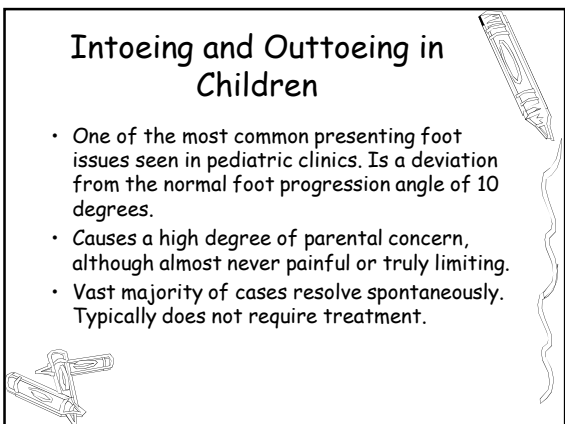


**Torsional
Abnormalities**



**Intoeing and Outtoeing in
Children**

- One of the most common presenting foot issues seen in pediatric clinics. Is a deviation from the normal foot progression angle of 10 degrees.
- Causes a high degree of parental concern, although almost never painful or truly limiting.
- Vast majority of cases resolve spontaneously. Typically does not require treatment.



Intoeing: "Pidgeon-Toed"

- Three main causes based on location and age:
 1. Metatarsus Adductus "Varus" (foot; infant)
 2. Internal Tibial Torsion (lower leg; toddler).
 3. Femoral Anteversion (hip; older children to age 10yr.).

Metatarsus Adductus

- **Age:** Newborn to Toddler. Most resolve spontaneously by the time a child walks. Most common congenital foot deformity, seen in about 7% of babies.
- **Gender:** F>M.
- **Presentation:** Toes of the forefoot are deviated medially toward the big toe. The bottom of the foot has a "C" shape. The legs and hips are normal. May be **flexible** (reducible by hand) or **rigid** (not reducible).
- **Cause:** **More common in first born.** Position in utero? Congenital? Hip dysplasia may be associated?
- **Differentials:** Internal Tibial Torsion; Femoral Anteversion, TEV/"Clubfoot".

Metatarsus Adductus:

"C"
shaped
foot



- Flexible :** C-Shaped foot, can be manually straightened. Treatment: Observation and reassurance. Stretching and Reverse-last shoes are NOT effective. If not improved by 6 months, may need pediatric orthopedist evaluation for serial casting.
- Rigid:** Cannot be manually straightened. Get Xrays, refer to pediatric orthopedist.

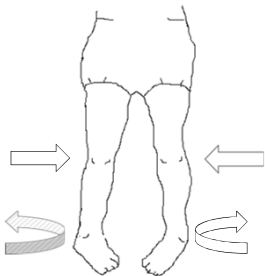
Internal Tibial Torsion

- **Age:** 2-3 years initially, when child begins walking, toddler stage. It is the most common cause of intoeing overall.
- **Gender:** M=F. Left>Right. Common.
- **Presentation:** Intoeing, but foot itself is straight and knee caps are forward. It is caused by an internal rotation of the tibia.
- **Cause:** possible in utero positioning?
- **Differentials:** Metatarsus Adductus; Femoral Anteversion.




Internal Tibial Torsion

- On clinical exam, hips and knees will be straight ahead.
- The bisection of the malleoli will be angled medially.
- The long axis of the foot will be straight.



Internal Tibial Torsion

Malleoli internally positioned compared to knee and thigh.



Prone exam: foot-thigh angle
Internal tibial torsion


Foot-Thigh measurement:
Average at infancy is 5 degrees
internal rotation
Average at adulthood is about 10 degrees
external.

Treatment: Observation and reassurance. 95% spontaneously resolve by age 8. Bars, stretching, and casts have not been shown to be effective and are seldom used now.
If not resolved by age 8-10 years, and if causing pain or functional symptoms, may be referral to pediatric orthopedist to consider tibial osteotomy.


Excessive Femoral Anteversion

- **Age:** 4-10 years. Older Children.
- **Gender:** F>M. Often bilateral.
- **Presentation:** Commonly seen as children enter sports, may be pointed out by teacher or coach. Clumsy gait, tripping. Child sits in "W" pattern. Patella points inward in gait, "kissing kneecaps." Internal hip rotation increase of >70° (normal is 20-60°).
- **Cause:** May be familial. Deformity based on degree of anteversion of femoral neck in relation to the femoral condyles. Tight hip ligaments and muscles.
- **Differential:** Metatarsus Adductus, Hip Dysplasia, Internal Tibial Torsion.

10 y/o female with femoral anteversion.



Excessive Femoral Anteversion



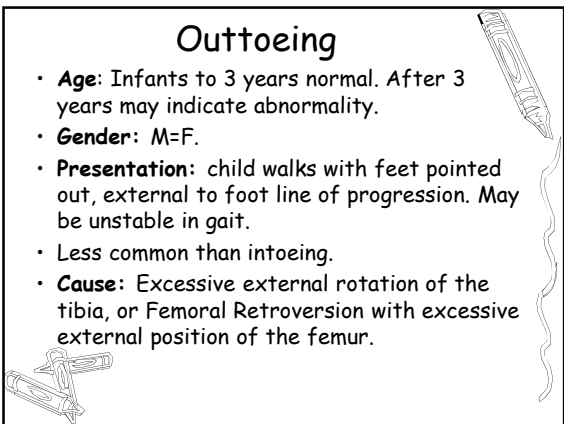
Common sitting pattern in excessive femoral anteversion, inverted "W".

Photo 2

Treatment: Observation and reassurance. Stretching exercises, bike riding, physical therapy. If not resolved by age 10 may need referral to pediatric orthopedist for possible femoral osteotomy, but reserved for severe cases only.

Outtoeing

- **Age:** Infants to 3 years normal. After 3 years may indicate abnormality.
- **Gender:** M=F.
- **Presentation:** child walks with feet pointed out, external to foot line of progression. May be unstable in gait.
- Less common than intoeing.
- **Cause:** Excessive external rotation of the tibia, or Femoral Retroversion with excessive external position of the femur.



Outtoeing



Infants typically begin walking at about 9 to 14 months. Beginning gait may initially be out-toed for stability. The legs should begin to face forward as the child become stronger in stance. By age 3 years, the feet should be in a more forward position.

Outtoeing Treatment:


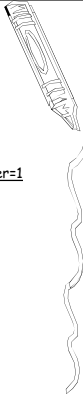
- Both external tibial torsion and femoral retroversion should resolve by 3 years of age.
- As both may be associated with future arthropathic conditions such as slipped capital epiphysis and patellofemoral instability, referral to a pediatric orthopedist is recommended for persistent or severe cases.

Summary:

- **Ingrown toenails** and **warts** are very common. Most can be addressed with local treatments. Persistent cases should be referred to podiatry for further care.
- **Flat feet** for the most part are asymptomatic and do not require treatment. If symptomatic, orthotics and supportive shoe gear are helpful.
- **Heel pain** in children is usually due to apophysitis of the calcaneus, and responds to rest, time, and local care. Xrays are recommended to rule-out stress fractures or bone abnormalities. Heel lifts, stretching and rest from sports usually resolve symptoms. Occasionally physical therapy, rest cast or orthotics may be necessary.
- **Torsion problems** in children arise from the hip, tibia, or foot. Almost all resolve in time. Observation and reassurance are key. Should abnormalities not resolve, then referral to podiatry or orthopedics is recommended.

Resources for Parents

- American Academy of Family Physicians:
<http://www.aafp.org/afp/2009/0215/p311.html>
- American Podiatric Medical Association:
<http://www.apma.org/Learn/FootHealth.cfm?ItemNumber=1522>
- KaiserPermanente:
<https://healthy.kaiserpermanente.org/>
- American Academy of Orthopedic Surgeons:
<http://orthoinfo.aaos.org/topic.cfm?topic=a00046>



The End



Photo 30

Thank you!



Questions?





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