Rebuilding the Foot: an algorithm for building a runner’s contact point

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Running demands that the body (including the foot) functions appropriately during gait

- Dicharry, J. Clinical Gait Analysis. Textbook of Running Medicine, 2nd Ed. Healthy Learning, 2014

Running Demands That All Feet Work

1. Allow forward progression of COM
2. Torsional displacement and support through stance phase
3. Proprioceptive contact on the ground. Sensory input = output

Let’s not get bogged down with foot types
Feet move more similar than differently

Optimize the foot type they have

- You aren’t treating a research average, you are treating an individual foot.
- We see
  - high stiff arches
  - high mobile arches
  - low stiff arches
  - low mobile arches
  - And everything in between
- All feet need to work. You can improve the function of any foot in front of you
1. Allow forward progression of COM translation: can you move enough?

**Talar/cruetal mobility**
- 30 deg
- 0 cm on wall test for runners
- 4-6 cm if doing squat lifts

**Limiters:**
- tib/fib mechanics and talar glide
- Gastrosoleus complex
- Soft tissue tension resolution
- Altered proprioception

**MTP mobility**
- 30 deg with flexed knee and ankle at 10 deg of DF
- Limiters:
  - MTP arthrokinematics
  - PF tissue length

2. Torsional displacement and support through stance phase

**How is COP path affected by?**
- Rearfoot mobility
- Lateral column hypomobility
- Medial column hypomobility
- Soft tissue adaptations
- Poor stabilization (wait for it)
- Hint: calus patterns have stories to tell

3. Propriopceptive contact on the ground. Sensory input = output

- Does your foot even work?
- Blocks in sensory input compromise OUTPUT
- Restore COORDINATION for CONTROL

3. Proprioceptive contact on the ground. Sensory input = output

**Balance is altered in people with ankle sprains**

**Fatigued feet move more and fail to stabilize the same capacity to function normally**

**Attempts to strengthen the feet ARE successful, and more importantly that improving foot strength results in an INCREASE in performance**

When does max pronation DEFORMATION occur?

**Architecture Demands Control**

- Remember, joints don’t “do” anything. Their architecture biases axis of movement, not create motion.
- Joints are passive and move when forced to by external load or internal control. If your exercise goals + sport demand high loads on your body, then you better show up READY for it.
- More stability within the foot = less stress in the foot and up the chain.
Train the foot to work as a system

What if the system breaks?

So then balance training, right?

unstable?

Orthotics?

footwear research + changing vocabulary

Holding rigid object in place ≠ Using an adaptive lever

Rigid Lock Hold Stabilize → Adapt Conform Match Support

To up-regulate NM system
Which environment is best?
Orthotics: What do I do?
Mostly influenced by thousands of individual lab gait analysis put the foot in the best environment to work

- Standing STJN / forefoot adaptation test

Assessment
Good Foot Function
1. Identify and improve blocks that restrict the big toe to get firmly down to the ground for COM progression and torsional stability within the foot
2. Build a solid NM program to control available mobility

Good Foot Function
the big toe is responsible for 80-85% of the stability in the foot
HELP IT WORK!
1. Look for blocks that restrict big toe from getting to ground

Manual Exam:
1. Wall test
2. Talar mobility
3. Tib-fib mobility
4. MTP DF ROM
5. Calc eversion / inversion
6. Forefoot planar torsion test
7. Segmental Lateral column assessment
8. Segmental Medial column assessment

Intervention: unblocking blocks

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>FIX</th>
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</thead>
<tbody>
<tr>
<td>Restriction in front</td>
<td>arthrokinematics</td>
</tr>
<tr>
<td>Restriction in back</td>
<td>Post chain soft tissue length</td>
</tr>
<tr>
<td>Can hit, but stiff</td>
<td>Soft tissue mobility work</td>
</tr>
<tr>
<td>No hardware block, but compensating movement</td>
<td>Software issue – train stab</td>
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<tr>
<td>MTP block</td>
<td>Arthrokinematics of MTP / sesmoids / PF</td>
</tr>
<tr>
<td>Rearfoot adaptation</td>
<td>Calc g64e / medial retinaculum</td>
</tr>
<tr>
<td>Torsion Test: Lateral column mobility</td>
<td>Joint glides / ST mob</td>
</tr>
<tr>
<td>Torsion Test: Medial column mobility</td>
<td>Joint glides / ST mob</td>
</tr>
<tr>
<td>Torsion Test: soft tissue forefoot varus</td>
<td>Soft tissue mobility</td>
</tr>
<tr>
<td>Foot Segmental Asymmetry / stiffness</td>
<td>arthrokinematics</td>
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**Intervention: unblocking blocks homework**

**Good Foot Function**
the big toe is responsible for 80-85% of the stability in the foot
HELP IT WORK!

2. Build AP + torsional control through available ROM

**Functional Exam:**
1. Squat
2. Unilateral Stance / COP question
3. Uni-lateral squat
4. Closed chain torsion
5. Functional Plantar flexion test
6. Tib Post break test
7. TOGA

**Intervention: Build Control**

<table>
<thead>
<tr>
<th>GOAL</th>
<th>Corrective</th>
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<tbody>
<tr>
<td>Interdigit coordination</td>
<td>TOGA bilateral</td>
</tr>
<tr>
<td>Digit coordination + balance</td>
<td>TOGA unilateral</td>
</tr>
<tr>
<td>Post tib endurance</td>
<td>Foot sweep</td>
</tr>
<tr>
<td>INTRINSIC Torsional control</td>
<td>Closed chain pro/sup</td>
</tr>
<tr>
<td>Torsional integration of limb</td>
<td>Foam Roller Drill</td>
</tr>
<tr>
<td>First ray isolation</td>
<td>Foot Band Twist</td>
</tr>
<tr>
<td>AP foot postural awareness</td>
<td>Overhead press</td>
</tr>
<tr>
<td>Torsional control</td>
<td>Long bar (Water Jug) Pass</td>
</tr>
<tr>
<td>Torsional control of limb</td>
<td>Tippy Twist</td>
</tr>
<tr>
<td>Dynamic Control work</td>
<td>Rocker training</td>
</tr>
<tr>
<td>Impulse Control</td>
<td>Impulse training</td>
</tr>
<tr>
<td>Integrate kinetic chain</td>
<td>Rocker SLD</td>
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<tr>
<td>Torsional rearfoot on forefoot</td>
<td>Foot Screws</td>
</tr>
<tr>
<td>Load Tolerance for Sport</td>
<td>Pipa / Loading</td>
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**Intervention: Build Control**

TOGA bilateral
Corrective Interdigit coordination
TOGA unilateral
Corrective Digit coordination + balance
TOGA bilateral
Corrective Post tib endurance
TOGA unilateral
Corrective Interdigit coordination + balance
TOGA bilateral
Corrective Post tib endurance
TOGA unilateral
Corrective Dynamic Control work
TOGA bilateral
Corrective Impulse Control
TOGA unilateral
Corrective Integrate kinetic chain
TOGA bilateral
Corrective Torsional rearfoot on forefoot
TOGA unilateral
Corrective Load Tolerance for Sport

Don’t smear the arch
Progress from bilateral -> unilateral support

**Intervention: Build Control**

FOOT SWEEP
Reed Ferber says postural muscles respond well to High Volume

**Intervention: Build Control**

CLOSED CHAIN PRO/SUP
Use INTRINSICS, not the HIP
**Intervention: Build Control**  
**FOAM ROLLER DRILL**  

INTRINSICS drive motion \(\rightarrow\) HIP follows  
Or  
Hip drives motion \(\rightarrow\) foot follows

**FOOT BAND TWIST**  
Isolate and integrate first ray

**Intervention: Build Control**  
**OVERHEAD PRESS**  
AP Postural awareness

**LONGBAR (water jug) PASS**  
Intrinsic Torsional Control

**Intervention: Build Control**  
**TIPPY TWIST**  
Torsional Control of Limb

**ROCKER Band Pulls**  
OTIS