Ankle and Foot: Mobility, Movement, and Squats

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The Presenters

- Chloe Hallyburton, PT, DPT
  - Women's health specialist
    - Pre, peri, and post-partum, post-menopausal care
    - Sports emphasis – return to running, lifting, impact sports
  - Orthopedic manual therapist
    - Special interest in foot and ankle mechanics

- Kjell Mann, PT, DPT
  - CSCS training
    - Anticipated completion Nov, 2020
  - Sports-specific focus
  - Selective Functional Movement Assessment (SFMA)
  - Movement expert
    - Hockey, Soccer, Track

Foot and ankle[1,2]

- Anatomy of the Foot/Ankle
  - Distal tibiofibular joint
  - Subtalar joint
  - *Talocrural joint*
  - Midtarsals
  - Forefoot

- Muscles/Ligaments/Tissues Involved
  - Anterior Talofibular Ligament (ATFL)
  - Posterior ankle muscles
    - Calf muscles
  - Anterior ankle
    - Tibialis Anterior
  - Foot intrinsics
  - Peroneals

Biomechanics of the ankle and the surrounding joints[1,2]

- Ankle mechanics
- The ankle joint has a total of three degrees of motion
  - Forward/backward, side to side, rotational

Pronation
(eversion, dorsiflexion, abduction)
Mobile

Supination
(inversion, plantarflexion, adduction)
Rigid/Stable

How does this all relate to how we function and squat?[2,4]

- The ankle is our first contact with the ground reaction forces
- How it interacts will often affect the entire kinetic chain above it
  - Knee, hip, low back
- Squats
  - Limited ankle dorsiflexion can lead to compensations
    - Wider hip stance
    - More load into adjacent joints
    - Lack of depth in our squatting

Let's Look At The Overhead Squat[4,5,6]

-The overhead squat shows us all of the moving parts.

- Optimizing your position is key
- Stacking joints on top of each other
- This includes the shoulder, hips, and ankle

-To achieve this stacked position:

*Keep an upright torso

*Knees over toes

*Have those shoulders in hyperabduction

WHENEVER IT COMES TO A SQUAT, WE NEED TO ALWAYS LOOK AT THE FIRST CONTACT….. THE FOOT/ANKLE!

“To reach an ideal deep squat you will need ankle mobility and maintain knees over toes”

You have probably heard of the phrase: “never bring your knees in front of your toes”…… let’s talk about why this idea is false

What's the research and history behind the fear of knees coming over toes?[3]

- 1978 Duke University Study first made this claim
  - Undue stress could be placed into the knees was the underlying case
  - Limited evidence to refute this statement
- In 2003, research confirmed that knee stress increased by 28% when the knees moved past the toes
  - HOWEVER: Hip stress increased nearly 1,000% when forward movement of the knee was restricted.
- Better advice:
  - Keep your knees aligned over your second toe

Squatting Form

- What is this person doing right?
  - How could he increase the force into his ankles?
  - What ways could he bias his:
    - Ankle
    - Hips
    - Back

What do we look for to recognize when our ankle/foot mobility is lacking?[4,5]

- Athletes may be inclined to lean TOO FAR FORWARD with their torso
  - Back Squat this is fine
  - Front/Overhead Squat is a big NO

- Other compensations include:
  - Heels lifting off the ground, creating an unstable foundation for lifting
  - Feet spinning outward during the performance of the squat

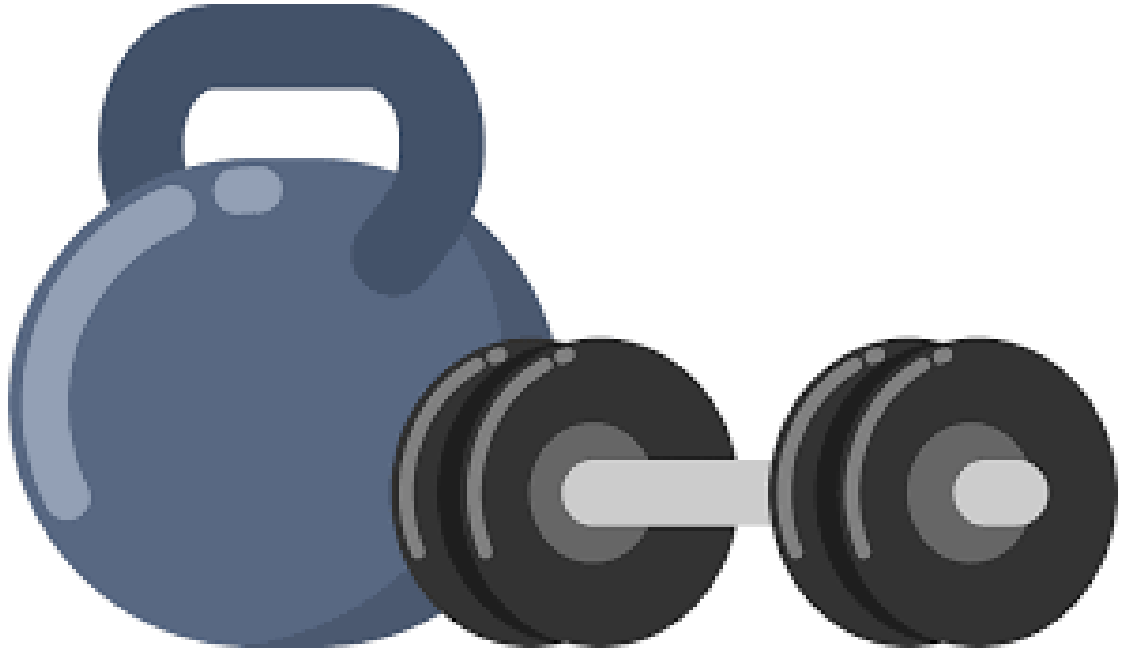
- Looking up the chain to see if you are compensating
  - Knees caving in
  - Hip or pelvic shifts that are asymmetrical

Self-assessment of our ankle motion[5,6]

- Dorsiflexion: Use a wall and go into a half kneel position
  - Move your body back one hand length
  - While in the half-kneel, attempt to bring your front knee over your toes
    - Be sure the heel on the front foot does not raise up
  - The knee should be able to touch the wall without difficulty

Tibial internal rotation assessment

4 useful exercises to assist with squatting and ankle mobility[5]



- Eccentric Calf Raise
  - Both single leg and double leg
- PAILS/RAILS (Isometric Calf Loading)
- Goblet Squat with Dorsiflexion Emphasis
- Split Squats with a Forward Knee Emphasis

Exercise #1: Eccentric Calf Raises

- The focus is on the slow lowering of the calf
  - Eccentrics work on “lengthening” the muscle
- Begin with both legs
  - Progress to lowering with one leg at a time when you have the necessary strength
  - Adding weight or height can increase the demand

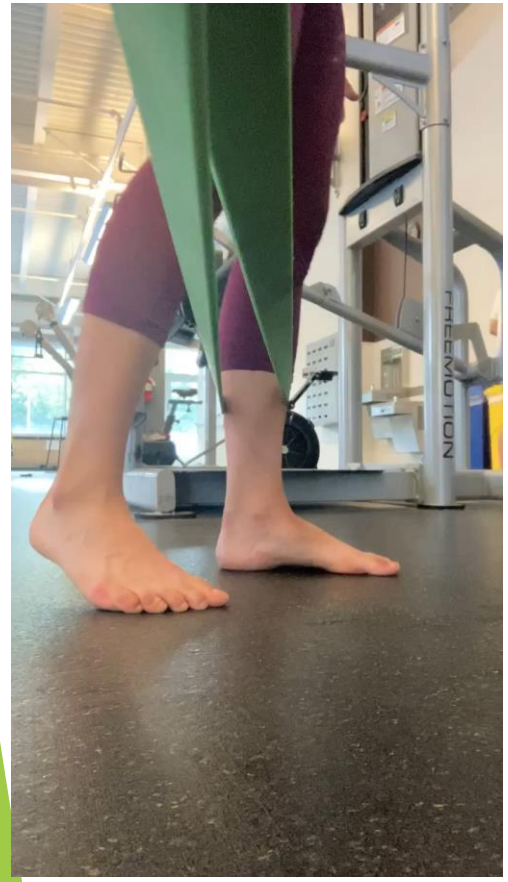
Exercise/Mobility Drill #2: Dorsiflexion Isometric Loading (PAILS/RAILS)

- PAILS/RAILS (Progressive/Regressive Angular Isometric Loading)
- Get into position by going into a half kneel position with the focus of knees over toes
  - Lean forward into the stretch using either your bodyweight or a kettlebell for assist
- Hold for 1-2 min
  - Follow this up by contracting your calf muscles
  - Drive your toes into the ground (push as hard as you can without moving)
    - 15-20 sec
  - Follow this by engaging your anterior/tibialis muscles
    - 15-20 sec
  - Stretch/relax in position for 1-2 min
- Repeat 2-3x

Exercise/Mobility Drill #3 and #4

- #3: Goblet Squat with Ankle Dorsiflexion Bias
  - Get into a squat position
  - Rest your forearms inside your knees, then pry them out
  - The weight of the kettlebell should pull your knees forward
    - Rock back and forth to help with the mobility
- #4: Split Squat with Forward Knee Emphasis
  - Go down into a split squat with the legs spread apart
  - Squat down with an emphasis on bringing that knee forward
    - It should also help with thigh strength

Other Mobility Recommendations



- 3 Way Calf Drills
  - Forward soleus/calf stretches into wall with an mobility component
- Pistol Squat Progressions
- Ankle Mobilizations
- Lateral Tibial Glide
- Internal Rotation Motor Training

SMASHING THE ANKLE/FOOT

- Foam rollers
- Lacrosse Ball
- Kettlebell
  - Use the handle to press against the calf
- Barbell
  - Seated with your legs extended
- Suggestions:
  - 1-2 min with a slow and steady pressure

So what if you need compensations?[2,5]

- Always be sure to discuss your deficits/limitations with your coach
  - Past injuries, structural faults, etc.
- Variations or ankle repositioning may be ideal:
  - Hip mobility
    - Knees tend to pull out into a torso position
  - Use towels or padding behind the heels
    - Propping the heels up will provide a crutch for those limited in ankle dorsiflexion
  - Be careful with how you modify!!
    - Sometimes our bodies do find ways to assist our motion but not in ideal patterns

Summary

- The foot/ankle is a complex yet adaptable region of the body
  - Encourage proper movements and stretches into your routine
  - Be sure to check for faulty compensations that may be hindering your performance
- There are the BIG 3 that can lead to your movement impairments
  - Mobility (tissues, joint)
    - Motor control (coordination)
      - Strength/stability deficits

Pain and injury are a limiting factor

- Assessment of the impairment
- Education on the condition
  - Workout adaptations
  - Tissue relief techniques, management strategies
  - Better understanding of your injury
- Interventions
  - Soft tissue mobilization, cupping, taping, and pain reduction
  - Motor coordination, task-specific training
  - Exercises tailored to your condition

What Can Physical Therapy Do For You?

References

- 1. Smith MD, Lee DL, Russel T, Matthews M, MacDonald D, Vincenzino B. How Much Does The Talocrural Joint Contribute to Ankle Dorsiflexion During the Weight Bearing Lunge Test? A Cross-sectional Radiographic Validity Study. JOSPT 49(12): 934-941, 2019.
- 2. Bell D, Bolling M, Lewek M, Padua D. Effect of Limiting Ankle Dorsiflexion Range of Motion on Lower Extremity Kinematics and Muscle Activation Patterns During a Squat. Journal of Sports Rehab. 21:144-150, 2012.
- 3. Fry, A, Smith, JC, Schilling BK. Effect of knee position on hip and knee torques during barbell squats. J Strength Cond Res. 17(4): 629-633. Nov 2003.
- 4. Bird, SP, and Casey, S. Explore the front squat. Strength and Conditioning Journal 34(2): 27–33, 2012.
- 5. National Strength and Conditioning Association. Exercise Technique Manual for Resistance Training. (3rd ed.). Champaign, IL: Human Kinetics; 42-49, 2016.
- 6. Schoenfeld, BJ. Squatting kinematics and kinetics and their application to exercise performance. Journal of Strength and Conditioning Research 24(12): 3497–3506, 2010.