

Common Faults with Barbell Back Squat



Implications for Injury & How to Address Them

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Objectives

At the end of this powerpoint, learners will be able to:

- Identify common ankle, knee, and hip errors in barbell back squat technique
- Describe potential causes of barbell back squat technique errors
- Understand the importance of proper barbell back squat technique from an injury-prevention point of view
- Be able to employ treatments and cueing to facilitate improvements in barbell back squat technique
- Identify other professionals who may be involved in the health and fitness of patients who engage in barbell strength training

Case Study

Presenting to the clinic is a 15 year old male high school track athlete complaining of knee pain in his barbell back squat. His primary event is the 200m sprint, and he is currently participating in a weightlifting class to prepare for his upcoming track season in 2 months.

Upon observation of his barbell back squat, the following was observed:

- Highbar squat style
- Bilateral foot pronation
- Bilateral dynamic knee valgus
- Left sided hip shift at bottom and during concentric phase

Evidence for Addressing the Above Observations

Foot Pronation - Causes

- Weakness of the medial gastroc, tibialis anterior, and tibialis posterior decrease stability of the foot and ankle and will lead to foot pronation subsequently cause knee valgus and medial column collapse under load (Myer, 2014)
- Decreased subtalar joint dorsiflexion ROM (Lee, 2015)
- Pes Planus: more pressure in forefoot in bottom half of squat compared to non pes planus group (Koh, 2015)



Foot Pronation - Common Injuries

Creates internal rotation stress and potential medial column collapse leading to injuries of the following soft tissues (NASM)

- Achilles tendon, plantar fascia, patella tendon, IT band

This motion will also cause compressive forces on the following

- Subtalar joint, patellofemoral joint, tibiofemoral joint, iliofemoral joint, sacroiliac joint



Foot Pronation - Treatment / Cueing

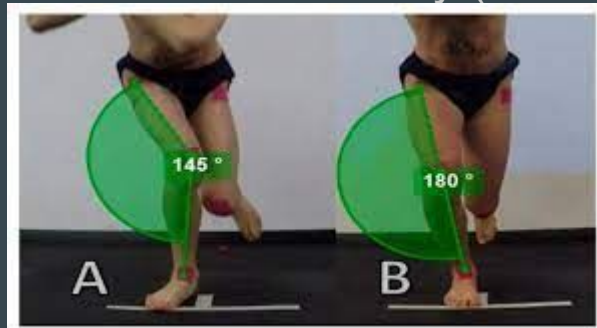
- Foot intrinsic, gastroc, tibialis anterior, tibialis posterior strengthening (Sanchez-Rodriguez, 2020)
- Increase ankle dorsiflexion (Lee, 2015)
- Hip abductor, gluteus medius, strengthening (Engkananuwat, 2023)
- “Grip the ground with your foot”
- “Press your big toe into the ground”
- “Use three points of contact”



Dynamic Knee Valgus - Causes

The main causes come from muscle weakness and range of motion deficits at the hip and ankle that lead to uncontrolled motion at the knee

- Weakness of hip abductors external rotators to control eccentric hip adduction and internal rotation (Bell, 2013)
- Weakness of foot supinators to control eccentric pronation
- Decreased hip external and flexion range of motion
- Decreased dorsiflexion and midfoot mobility (Wilczynski, 2013)



Dynamic Knee Valgus - Common Injuries

- ACL: directly resists tibial internal rotation and knee valgus (Kianifar, 2017)
- MCL: Directly resists knee valgus and medial tibiofemoral joint gapping
- Meniscus: tibiofemoral rotation causes a shearing force on both menisci but especially the lateral
- Patellofemoral: Causing tracking malalignment increasing compressive stress on the lateral patella and medial edge of lateral femoral epicondyle
- Greater trochanteric pain syndrome: Increased compression of tendons of glute med, glute min, glute max, and TFL on the femoral greater trochanter
- Pes anserine pain syndrome: increased compression on pes anserine bursa

Dynamic Knee Valgus - Treatment / Cueing

The main treatment consists of muscle strengthening the impaired areas and improving range of motion deficits.

- Quick fix for ankle dorsiflexion restriction is a heel raise
- The use of resistance bands during squatting should be avoided as this can increase the risk of knee injury (Reece, 2020)

“Drive your knees outwards”

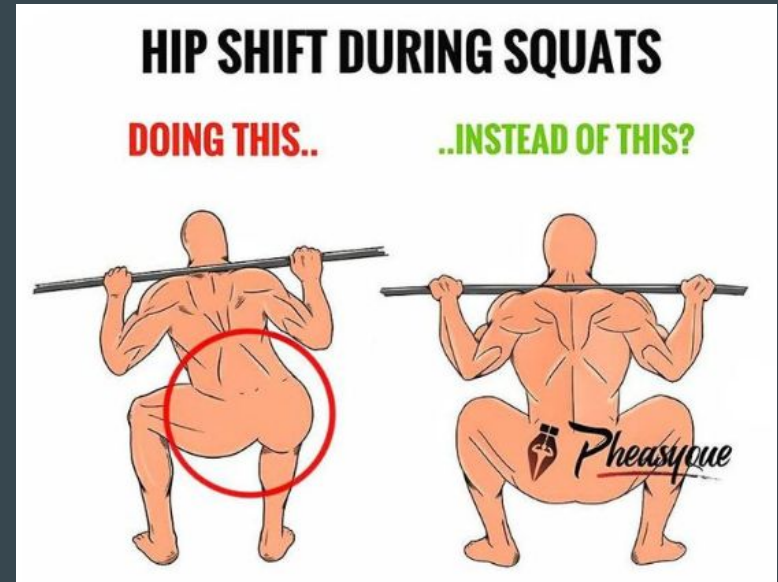
“Screw your feet into the ground”

“Open up your knees”



Hip Shift - Causes

- Hip muscle weakness / imbalance / instability (Myer, 2014)
 - Specifically in the gluteal complex
- Imbalance in unilateral range of motion at the hip or ankle (Myer, 2014; Barbell Rehab; Lally, 2016)
 - Decreased hip flexion or rotation
 - Decreased dorsiflexion
 - Femoral torsion
- Motor control issues (Barbell Rehab)
- Lack of postural control (Sato, 2012)
- Kinematic chain issues (Barbell Rehab)



Hip Shift - Common Injuries

Hip shift is both a result and cause of muscle imbalances and functional asymmetries. This creates poor alignment and increased energy expenditure due to decreased muscular efficiency. As a result, motor control and coordination may be altered — especially with increased fatigue (Hodges, 2011).

Fatigue can cause reduced knee proprioception and ligament mechanoreceptor function, potentially leading to knee instability and other kinetic chain implications (Schoenfeld, 2010). These implications can result in similar injuries to those discussed with dynamic knee valgus and foot pronation.

When a result of decreased hip flexion mobility, hip shifts are often accompanied by increased forward trunk lean and posterior pelvic tilt. These positions heighten lumbar stress and increase anterior/posterior spinal shear in addition to the potential lateral spinal shear from uneven weight distribution (Schoenfeld, 2010).

Hip Shift - Treatment / Cueing

- Identifying the cause of the shift and treat those impairments (Myer, 2014; Sato, 2012)
 - Mobility deficit, strength imbalance, balance deficits, etc.
- Other accessory training (Barbell Rehab; Schoenfeld, 2010; Sato, 2012)
 - Unilateral training
 - Neuromuscular retraining
- Cueing
 - Mirror feedback
 - Resistance band exaggerating hip shift
 - Placing preferred leg on a small step
 - Coach hand placement
 - “Shift hips to right/left”
 - “Spread the towel”



Special Considerations for Clinical Practice

Barbell strength training is common in the athletic population. When a patient comes to see us in the clinic, we need to observe their mechanics to address improper technique which may be the cause of or result in further injury.

After the rehab process (including correction of technique), it is important to communicate with other professionals who may be involved with the patient to ensure proper technique, monitoring for signs of injury, and adequate progressive load management.

Other Professionals may include:

- High school and/or private strength coach
- Track coach
- School AT

Additional Resources

Starting Strength¹⁶

- Articles, podcast, forums, online coaching, seminars
- Strength programming and barbell technique book

Barbell Rehab, LLC¹⁷

- Free webinars, e-books, blog posts, podcast
- CEU/CCU/CEC Approved Online courses

Squat University¹⁸

- Free youtube videos, social media posts, and articles
- Books: “Rebuilding Milo”, “The Squat Bible”

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Questions?