Effect of Foot Placement on Recruitment of the Gluteus Medius During a Barbell Squat …

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Background Information

- Previous studies
  - Activation of the trunk stabilizers (Bressels et al. 2009)
  - EMG activation during different squats (Miller 2019)
  - Activation of muscles of the lower limb due to variations in foot placement and squat depth (Clark 2012)
- Focus
  - Gluteal activation patterns and foot placement
  - Rehab and fitness protocols want to utilize ideal exercise form and position to target specific muscles

*The American College of Sports Medicine provides detail in appropriate loads and guidelines for performing squats.

Project Purpose

- Evaluate the effect variations in stance width has on gluteal and quadricep muscle activation during a barbell back squat
  - Specifically, we studied the muscle activation of the gluteus medius and rectus femoris muscles

- Determining a foot placement that targets the hip and quadricep muscles the most will give insight into the safest and most effective way to exercise these muscles

Subjects or Study Population

Requirements:

- College students -must be at least 18 years old
- Must have no acute injuries, lifting, or exercise restrictions
- No strenuous exercise training within 24 hours prior to participation
- Must wear gym shoes and gym shorts

Time commitment:

1-day commitment -approximately 30-minute session

Subjects will perform a variety of barbell squats while hip-muscle activation patterns are measured via surface EMG.

Study Design

- Cross-Sectional Study
  - Both empirical and quantitative
- Participants were asked to come in one time only
  - Performed all tasks in one visit
  - Roughly 30 minute intervention overall

Methods

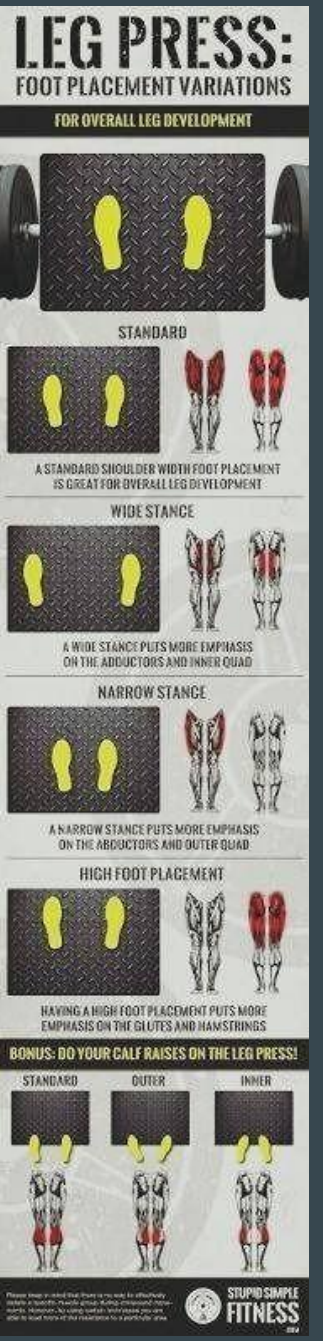
1. All subjects signed informed consent prior to participating
2. 5-minute warm-up
3. Surface EMGs on gluteus medius and rectus femoris on left leg
4. Participants performed 3 sets of 8 barbell squats with 50% bodyweight loaded on the bar
    a. Set 1: completed with feet at hip width
    b. Set 2: each foot positioned ~1.5 inches wider (3 inches wider than hip width)
    c. Set 3: each foot positioned ~3 inches wider (6 inches wider)
5. EMG data was collected during each squat sequence

Equipment

- Squat rack/weights
- EMG (computer system, sensors, etc.)
- Measuring tape
- Spotters

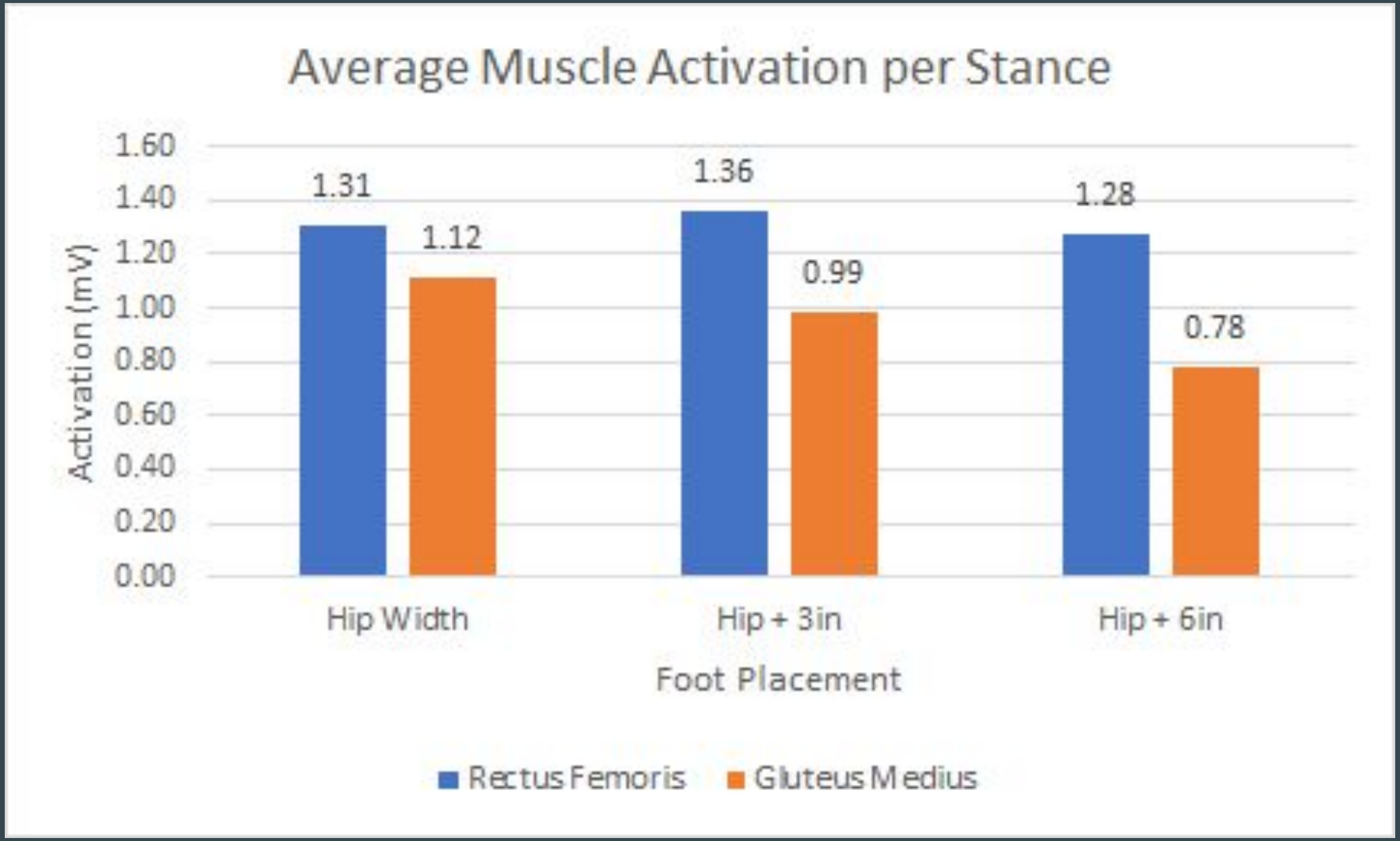
Assessment

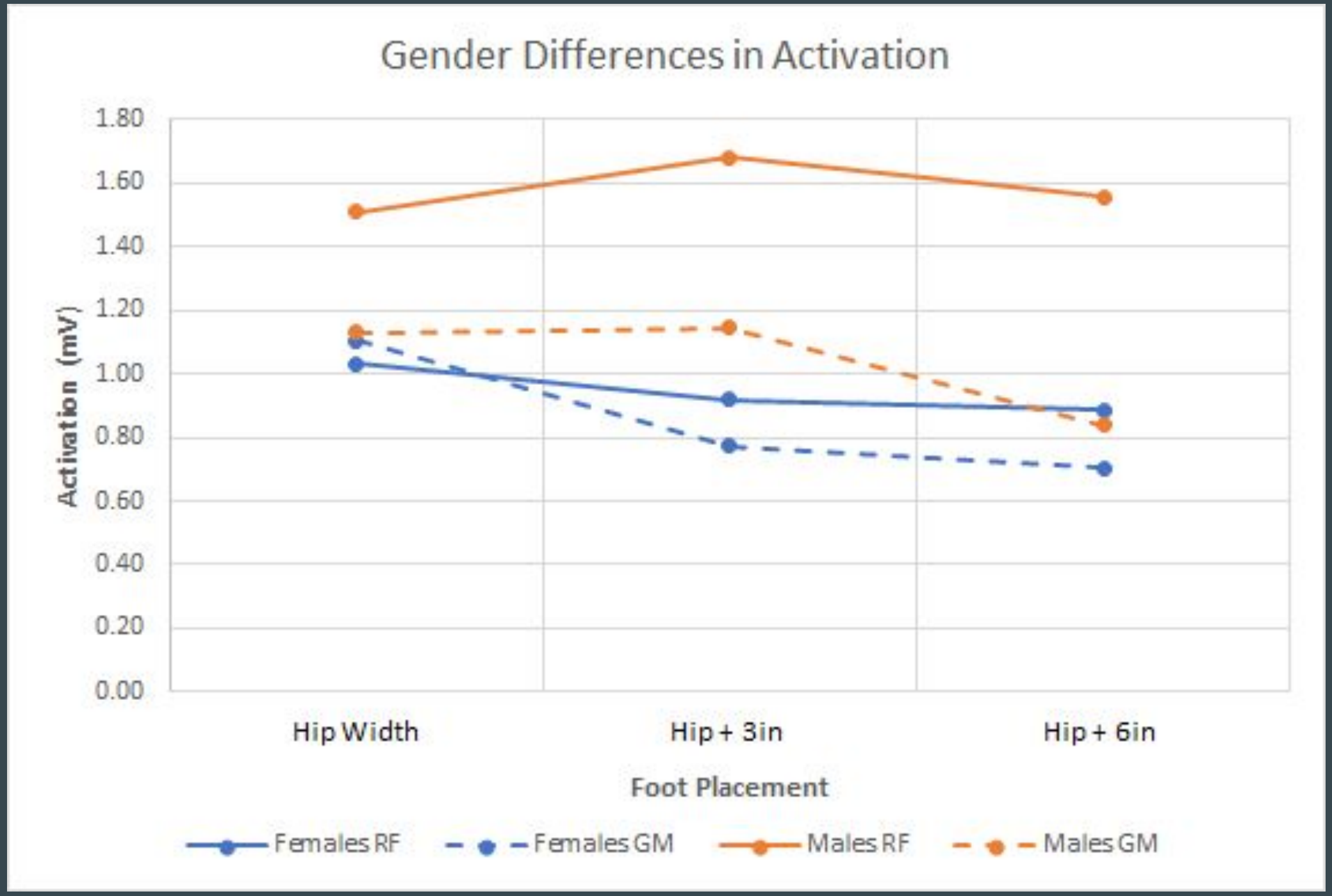
- Quantitative (mV)
- Average activation of gluteus medius and rectus femoris
- Activation patterns across different stances
- Male vs. female activation



Results

- No Outliers
- Found average activation (mV) for each muscle in each stance
- Compared average activation (mV) in males and females
- Isolated the subjects that showed consistent trends
    - Calculated the change in activation in these subjects
    - Identified any patterns in the directions of the trends


Average Muscle Activation per Stance
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Activation (mV)
1.31
1.12
1.36
0.99
1.28
0.78
Hip Width
Hip + 3in
Hip + 6in
Foot Placement
Rectus Femoris
Gluteus Medius


Gender Differences in Activation
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Activation (mV)
Hip Width
Hip + 3in
Hip + 6in
Foot Placement
Females RF
Females GM
Males RF
Males GM

Trends in the Data

	RF	GM	Both
Total	8	6	5
Positive	5	1	1
Negative	3	5	4

	Rectus Femoris		Gluteus Medius	
	3 inches	6 inches	3 inches	6 inches
Average Change (mV)	-0.01	-0.15	-0.47	-0.63

Discussion

- Previous studies demonstrated a wider foot stance increases hip muscle activation during a squat.
- Males vs Female muscle activation patterns
- Strength - reproducible
- Weakness - sample size
- Challenged by technology
- Barbell back squat may not be best for strengthening gluteus medius

Conclusions

- Miniscule changes in muscle activation
  - Wider stance = more Rectus Femoris activation
- Males Generate more force with Rectus Femoris than Gluteus Medius in our project
- Not enough data to verify results

Future Direction

- Continue testing variation of squats to determine ideal techniques for muscle activation.
    - Foot Placement, Load, Duration, Type of Squat
- Core activation and contribution? Other Muscles?
- Experienced vs Inexperienced Lifter?

Acknowledgements/Questions/Comments

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