EFFECTS OF VELOCITY BASED FEEDBACK ON NEUROMUSCULAR ACTIVITY DURING SUBMAXIMAL BACK SQUATS

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Introduction

- Back squatting is commonly programmed to improve athlete potentiation for power-based movements like sprints and vertical jumping [1].
- Current training intensity prescription is mostly based in percentage of 1RM rather than using rating of perceived exertion scales or velocity-based training techniques [1].
- Velocity intent prescription protocols have been seen to increase loads lifted significantly compared to percentage-based training [1-4].

Purpose

The purpose of this investigation was to quantify neuromuscular activity across 70% and 80% loads while cueing participants to squat with the intent to maximize velocity during the concentric phase.

Methods

- 15 recreationally trained male lifters participated
  - Age 24.8yrs ± 3.5yrs; Training Age 7yrs ± 3.8yrs; Height 1.7m ± 0.05m, Mass 95kg ± 17.6kg,
  - Average Weight Lifted: 230lbs (70% 1RM) and 265lbs (80% 1RM)
- Electrodes were placed on right leg Vastus Medialis (VM), Vastus Lateralis (VL), Rectus Femoris (RF), Biceps Femoris (BF), Gluteus Maximus (Gmax), and Gluteus Medius (Gmed).
- Full body three-dimensional motion capture (Vicon system, 200Hz) and force dynamometry (Bertec, 2000Hz) were collected for all squat trials.
- Squats from parallel to upright were processed in Visual 3D (Dynamics) and MATLAB (iEMG).
- Independent T-Tests compared iEMG and peak hip and knee moments between conditions (velocity) for 70% and 80% 1RM squats.

Practical Application

Velocity-based cueing, during submaximal squatting, increases hip muscle activity and hip extension moments. Improved hip extensor engagement can translate to triple extension in sport.
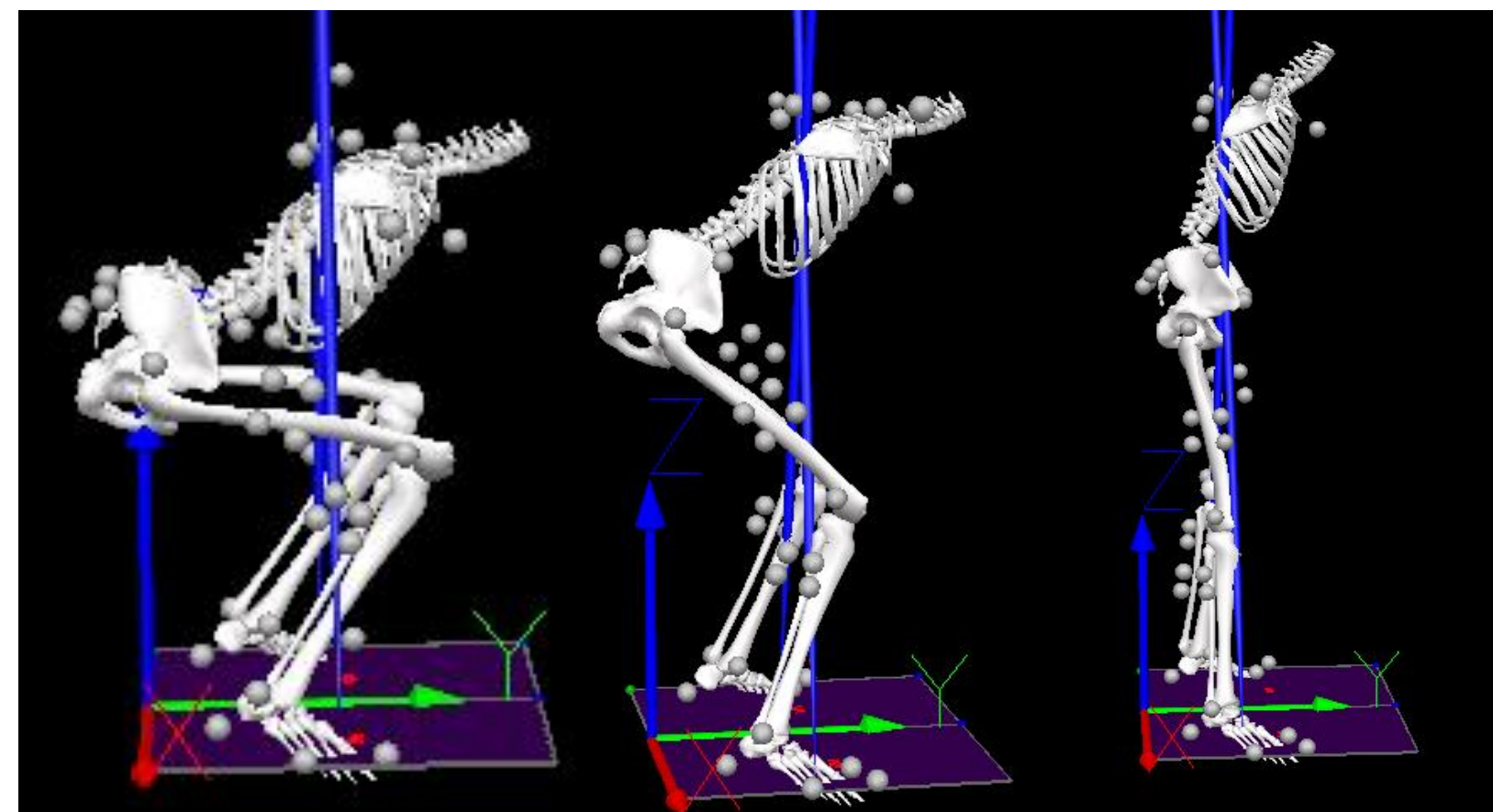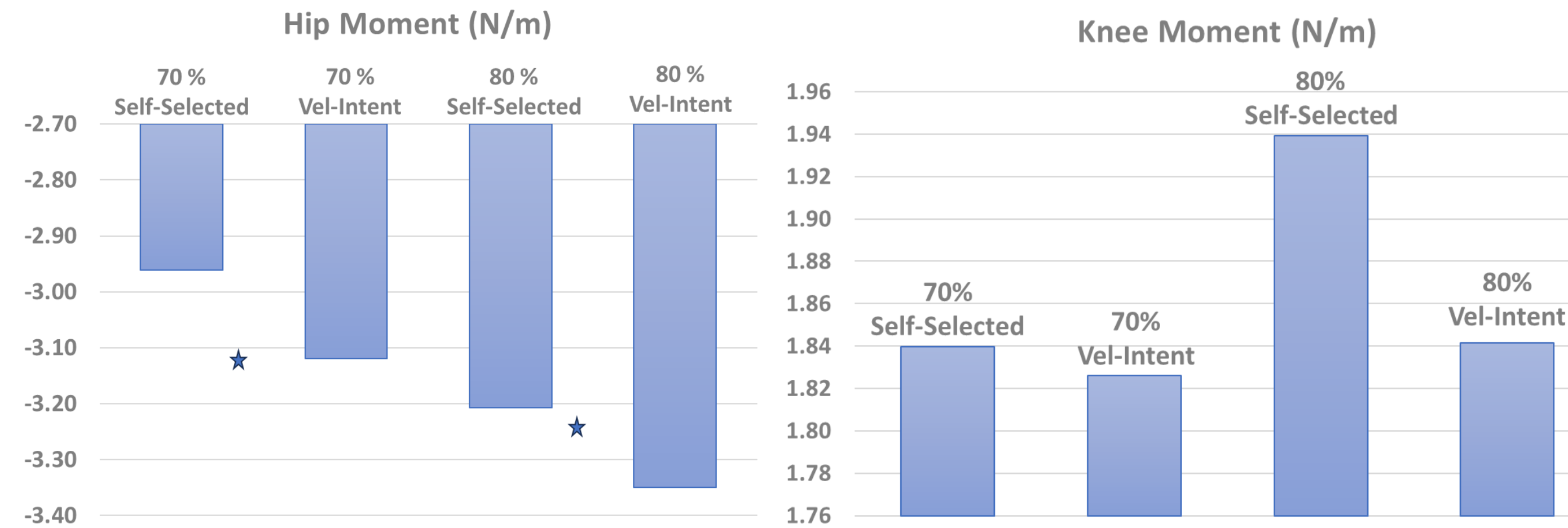

Figure 1 (Top Left): Peak Hip Moments (N/m) across all four investigated conditions

Figure 2 (Top Right): Peak Knee Moments (N/m) across all four investigated conditions

Visual 3D Figure (Bottom Left):
- Ascent Phase of Back Squat (bottom, middle, top)

Results

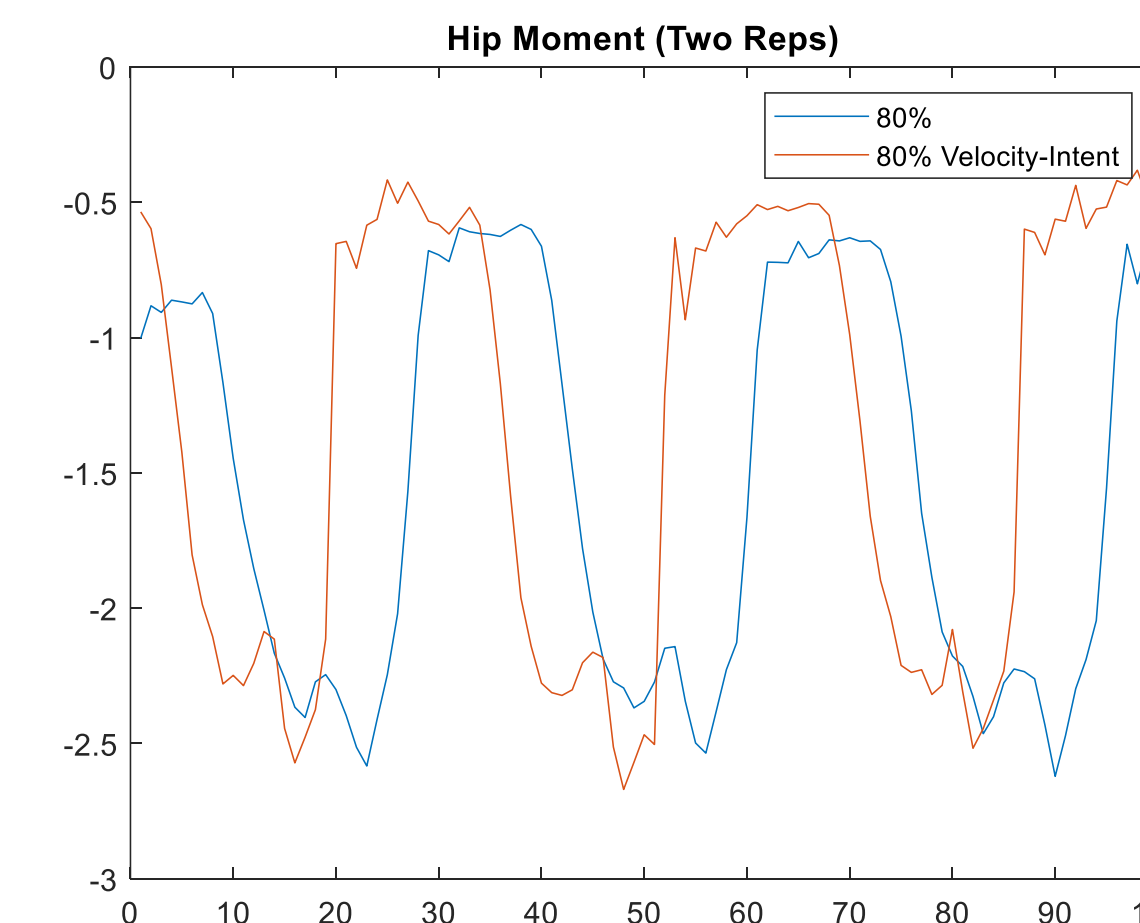|	iEMG						Velocity
	VM	RF	VL	GMax	GMin	BF	m/s
80%V	61.53	55.68	48.06	50.36	42.90	69.54	0.60
80%	54.81	51.56	42.06	43.45	34.30	52.02	0.49
70%V	61.63	55.68	48.06	48.48	39.71	46.67	0.69
70%	54.68	51.55	42.15	37.81	31.51	42.70	0.54

Table 1: Averaged peak iEMG and velocity across all conditions

Figure 3: Hip Moments during consecutive back squat repetitions for 80 & 80v conditions

Conclusions

- Training with velocity intent significantly (p<0.05) improves engagement of hip musculature.
- With the addition of velocity intent, coaches can expect to significantly improve hip muscle engagement for their athletes .
- Coaches should implement velocity-based squatting as a method to improve the hip portion of triple extension for power athletes.

Future Considerations

- Future research should aim to investigate long-term effects of a velocity-based strength training program on peak sports performance

References

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