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ERGONOMICS IN VETERINARY CARE

Ergonomic Analysis of Veterinary Surgical Tasks

School of Industrial Engineering

Hamed Asadi, MSc, **Denny Yu**, PhD,
Micha C. Simons, DVM, **Gert J. Breur**, DVM, MS, PhD, **Samantha M. Browne**

2017 Pilot Research Project (PRP) Symposium

What is Ergonomics?

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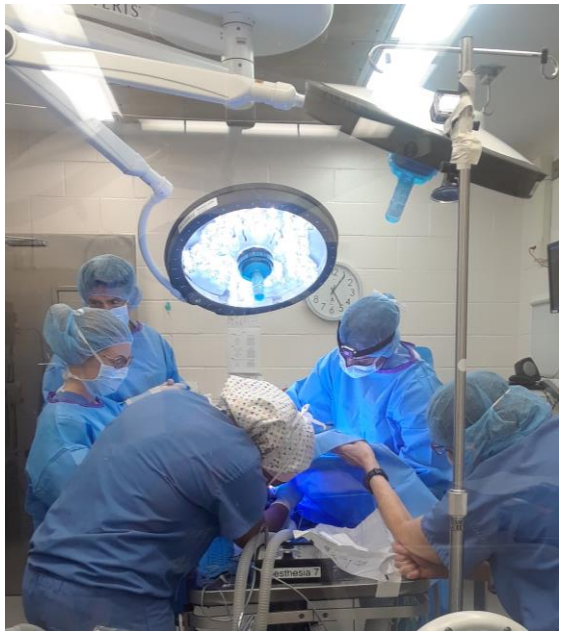
ERGONOMICS IS THE STUDY OF EFFICIENCY IN A WORK ENVIRONMENT



Motivation:

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72% of surgeons in human medicine have experienced either back pain, neck pain, or both [1]

98% of practicing veterinarians have reported injury in 2004-2009 [2]

Injuries in veterinary medicine is ***2.9 times higher*** than human counterparts [3]

Veterinary medicine and animal care has the ***15th highest incidence rate*** for nonfatal occupational injuries and illnesses in the United States (NORA) [4]

current studies are limited to survey methods *[5-6]*
quantitative workplace exposures are needed *[7]*

Objective:

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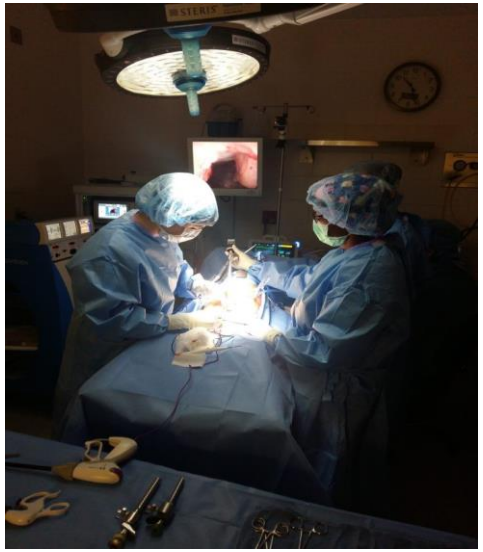
To model the relationship between work demands and exposure levels that may correlate with veterinary surgeon injuries and pain



Methods:

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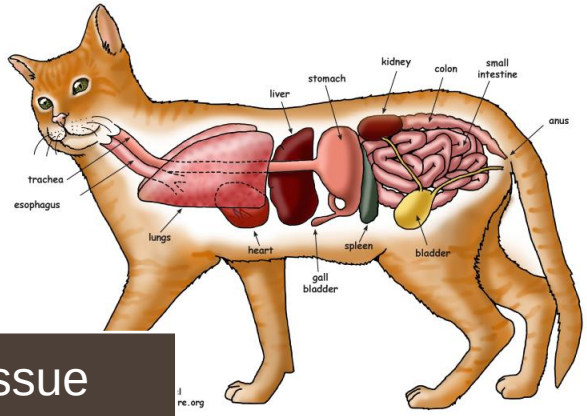
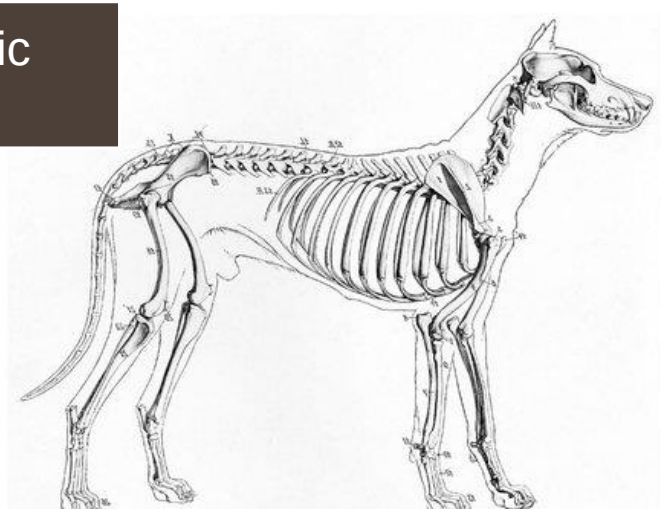


- 24 Small Animal Surgeries
  - 12 Soft Tissue Surgeries
  - 12 Orthopedic Surgeries



Methods:

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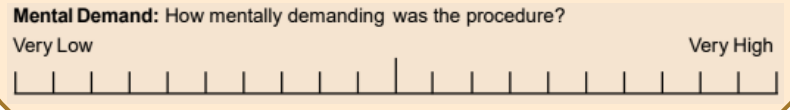
Subjective Surveys:

Surgery Task Load Index Survey

- Mental Demand
- Physical Demand
- Temporal Demand
- Task Complexity
- Degree of Difficulty
- Situational Awareness
- Distractions



Discomfort Surveys

(Pre and Post Surgery)

AREA/SUBJECT	*NO*	*SLIGHT*	*SUBSTANTIAL*
Numbness of the fingers and/or thumb	L | R	L | R	L | R
Hand/wrist stiffness	L | R	L | R	L | R
Hand/wrist pain	L | R	L | R	L | R
Shoulder/arm stiffness	L | R	L | R	L | R
Shoulder/arm pain	L | R	L | R	L | R
	NO	*SLIGHT*	*SUBSTANTIAL*
Neck stiffness			
Neck pain			
Back stiffness			
Back pain			
	NO	*SLIGHT*	*SUBSTANTIAL*
Headache			
Thinking requires effort			
Trouble concentrating			
Irritability			
Wandering thoughts			

Methods:

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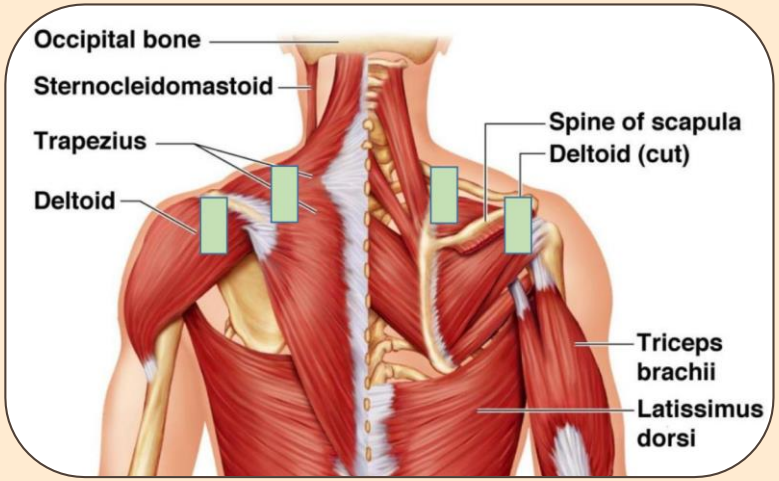
Objective Measurements:

Motion Tracking

4 Motion Tracking Sensors

Inertial Measurement Units (IMU)

Muscles Activity Level



4 EMG Sensors

Electromyography Sensors

Methods:

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Summary of Participant Details:

	Soft Tissue Surgeons (n=3)			Orthopedic Surgeons (n=2)		
	Mean ± SD	**Min**	**Max**	**Mean ± SD**	**Min**	**Max**
Age	32.3 ± 2.3	31	35	31.5 ± 0.5	31	32
Years of Experience	4 ± 1.7	3	6	3.5 ± 2.5	1	6
Height (m)	1.7 ± 0.04	1.6	1.7	1.7 ± 0.03	1.70	1.75
Weight (kg)	60.1 ± 1.1	58.9	61.2	88.9 ± 26.8	62.1	116
Glove Size	6.3 ± 0.3	6	6.5	6.8 ± 0.8	6	7.5

Results:

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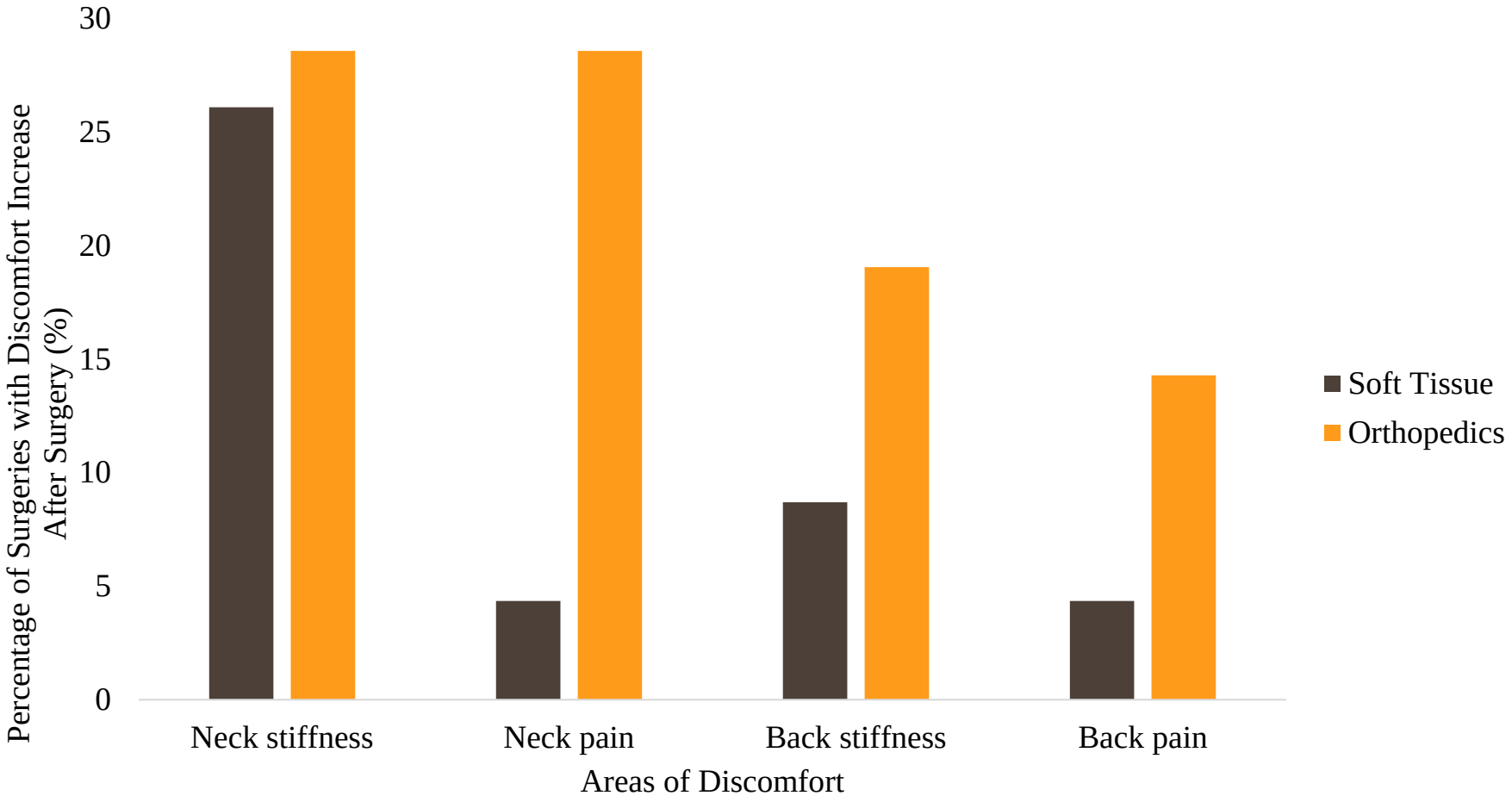
- Reported Discomfort Level Increase:



Results:

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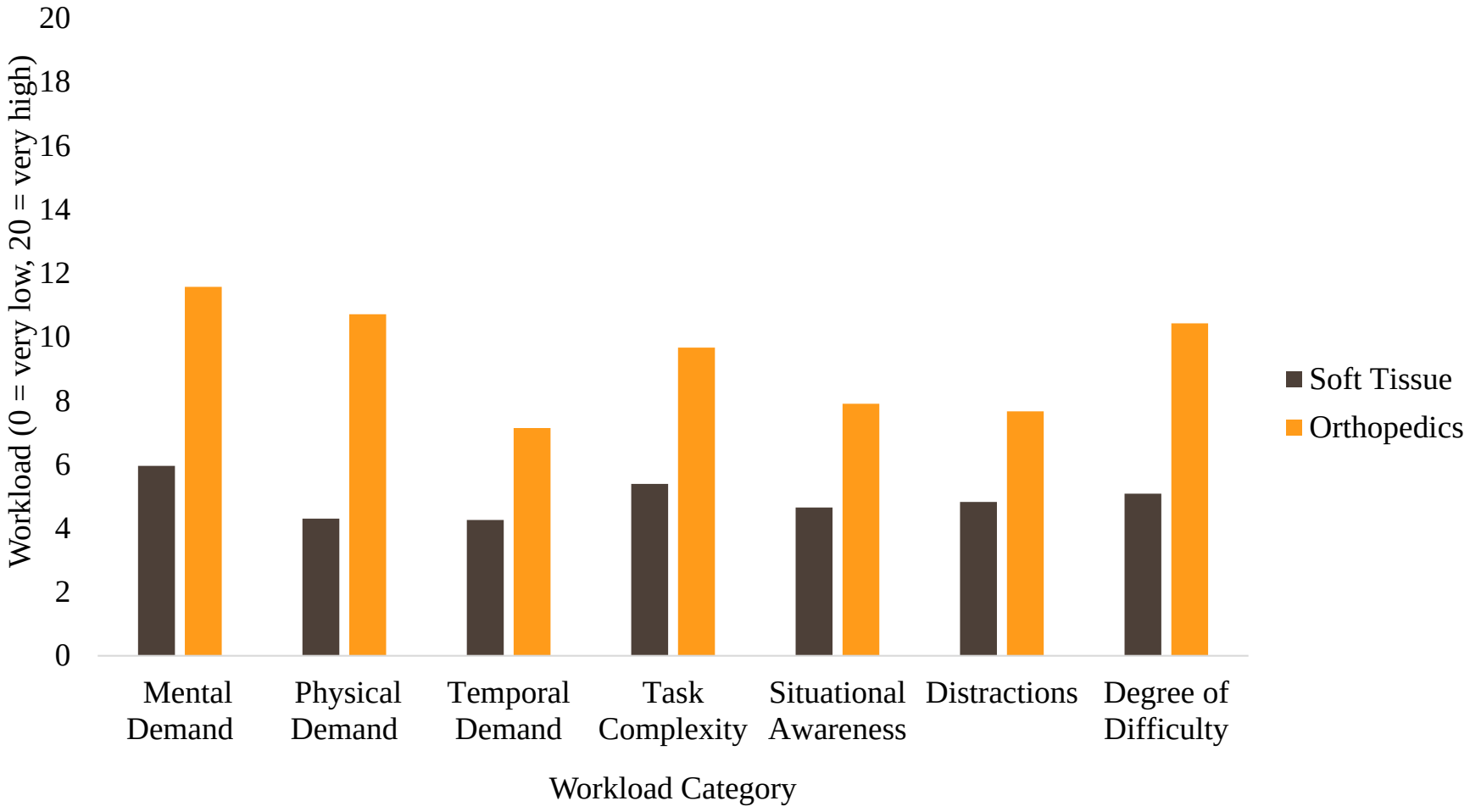
- Perceived workload



Results:

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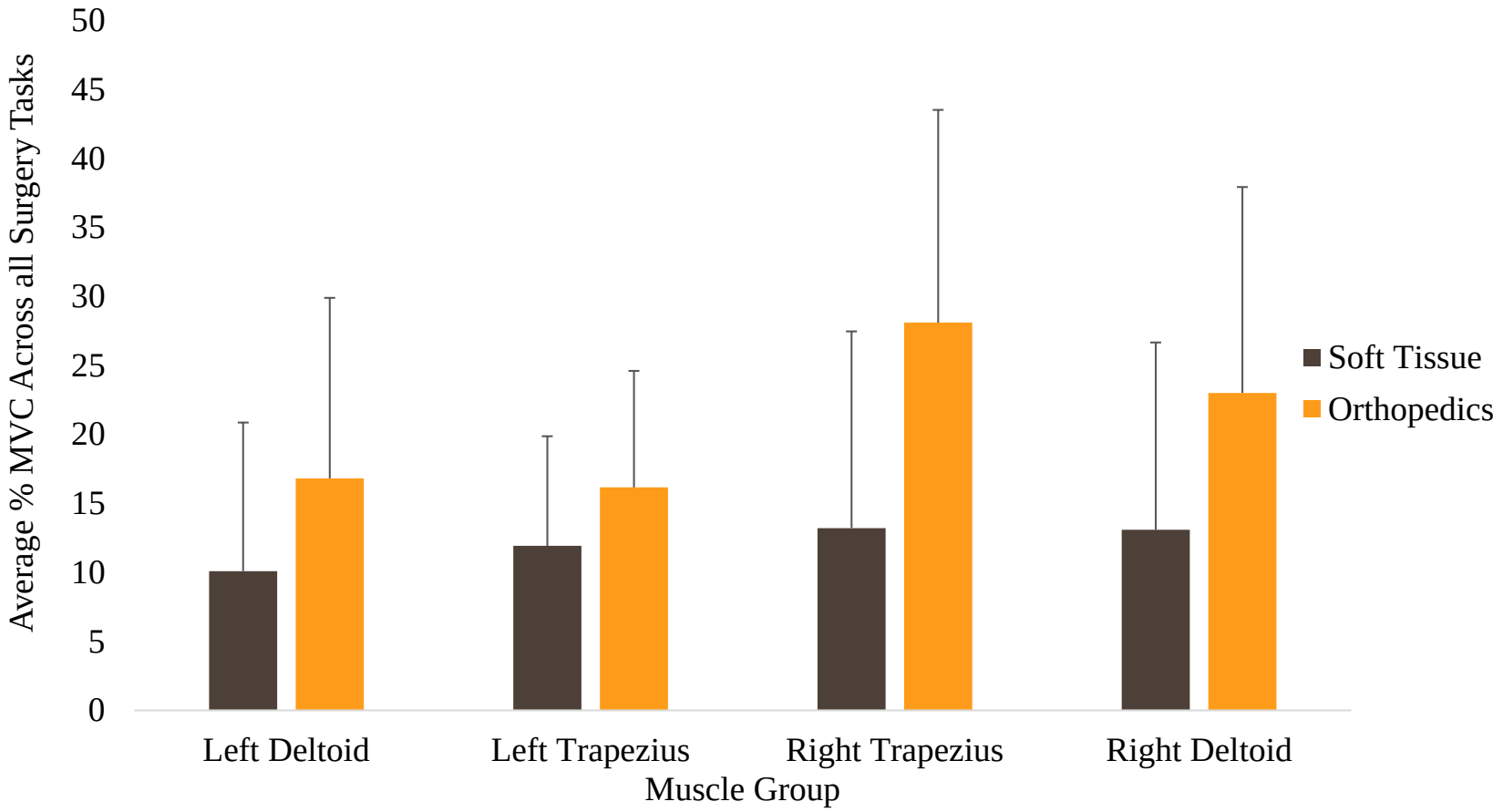
- Muscle Activity Level (EMG):



Results:

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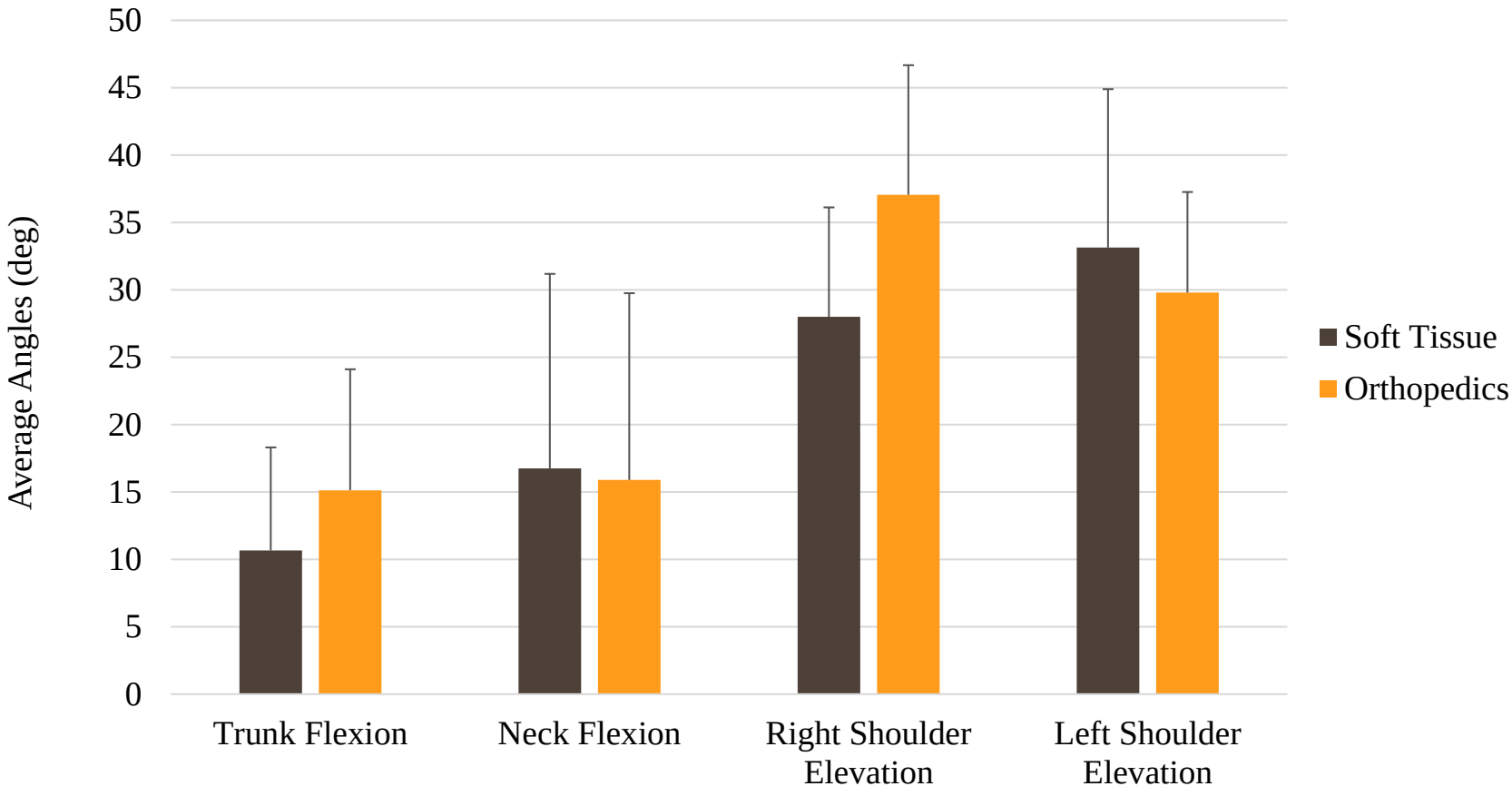
- Average Flexion/Elevation Angles:



Results:

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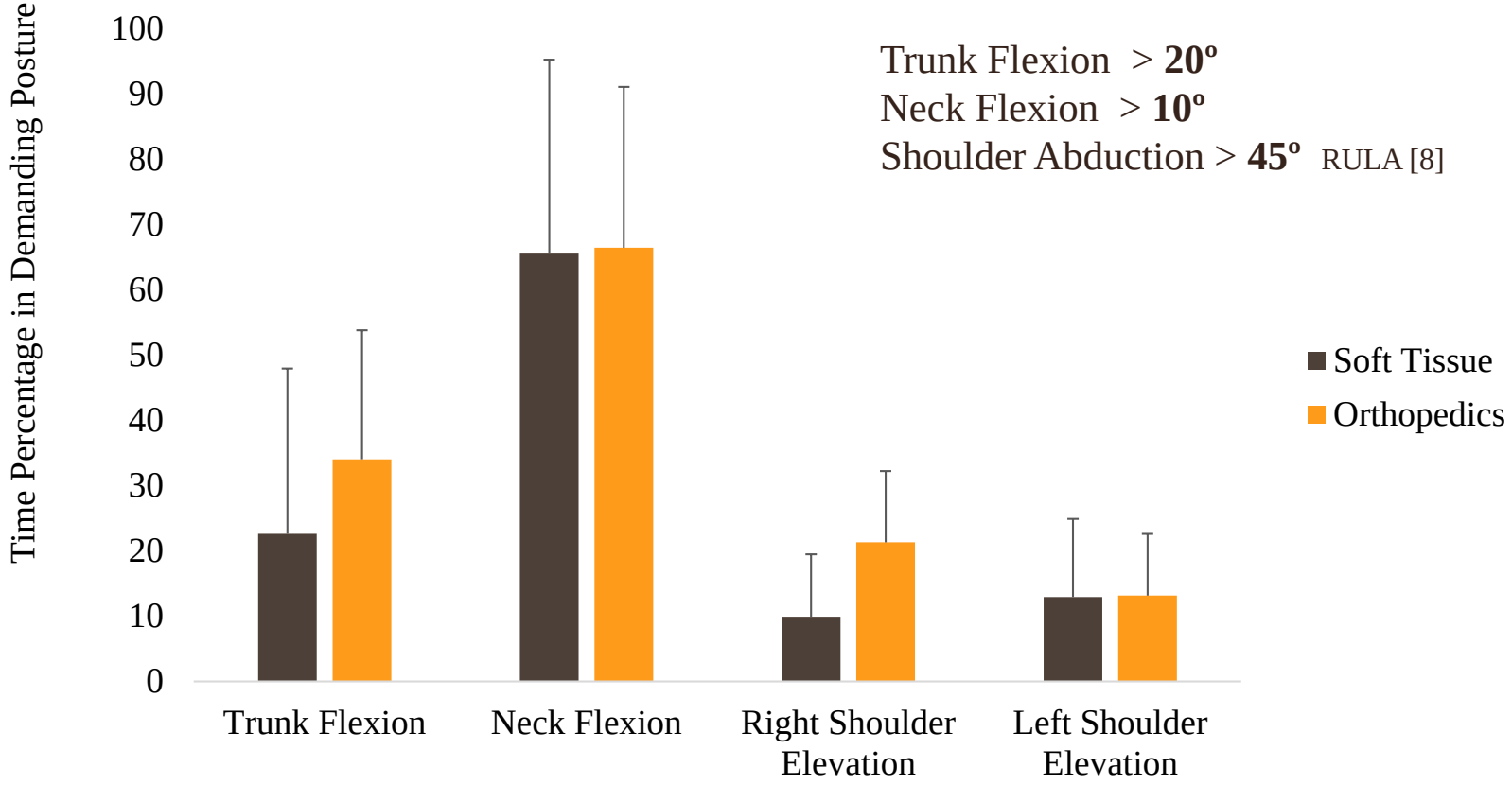
- Time Percentage in Demanding Postures:



Results:

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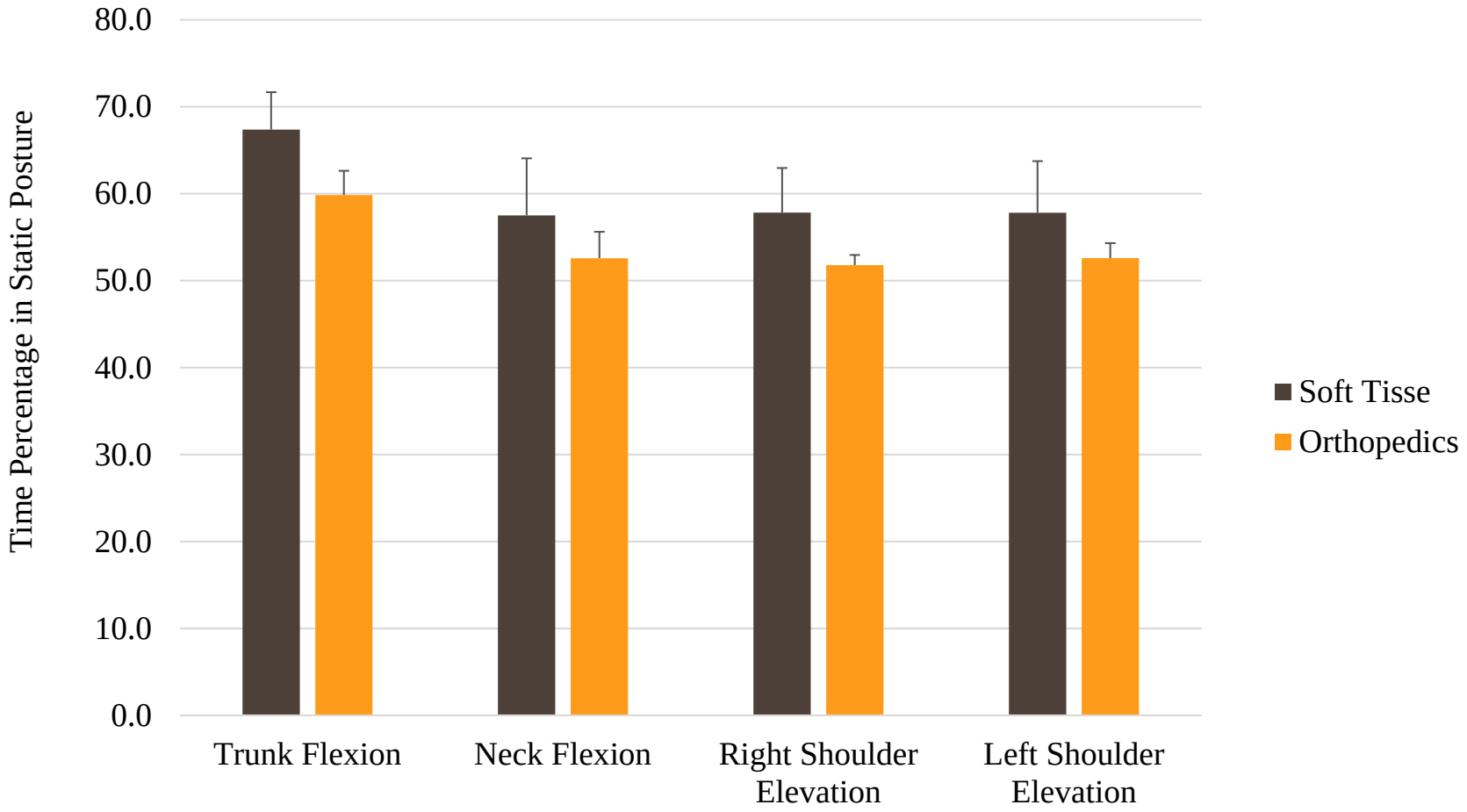
- Time in Static Postures:



Results:

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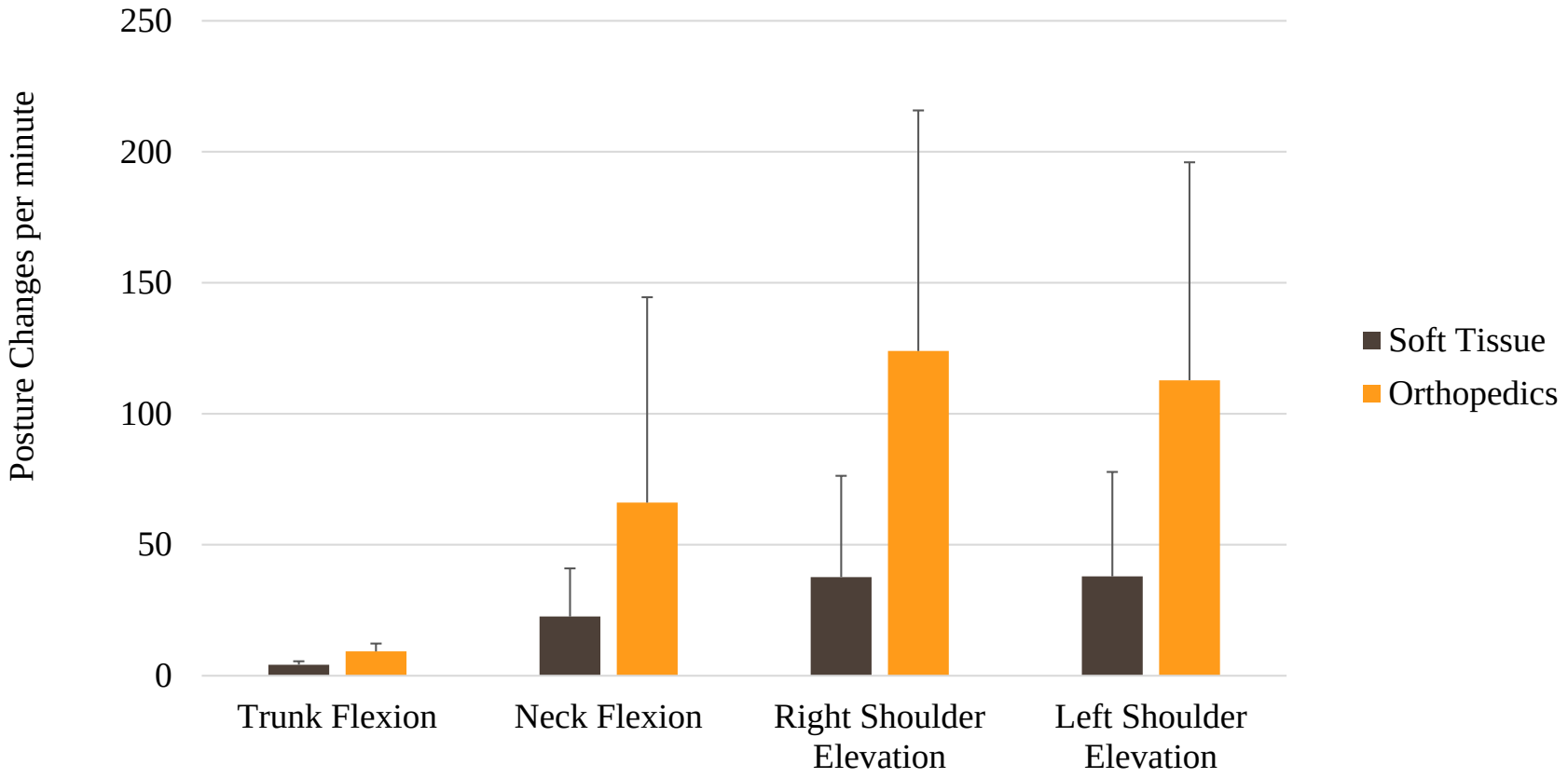
- Number of Posture Changes (movements >10° with angular velocity faster than 1°/sec):



Discussion:

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- **Workload and Discomfort Level Survey**
  - Increased pain after surgery in both orthopedic and soft tissue surgeons
  - Back and Neck are the top regions
    - The similar pain is reported in human medicine [8]
  - Similarities between the operating room environment in small animal and human surgeries

Discussion:

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- **Muscle Activity Level**
  - Average muscle activity level for Orthopedics surgeons is high
    - Interventions to reduce high force exertions
    - Modification in hand tools and equipment
- **Motion Tracking**
  - Time in demanding postures is high for both surgeons [8]
    - Modify positioning by workplace design
  - Time in static postures (soft tissue surgeons)
    - Low Back Pain
    - Cardiovascular Problems
    - Fatigue/Discomfort
  - Number of posture changes (orthopedics)
    - Workplace and tools design

Future Directions:

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- Expand the study to large animal studies
- Orthopedics environment modification and tool design
- Perform research in large sample size to highlight key areas

Acknowledgements:

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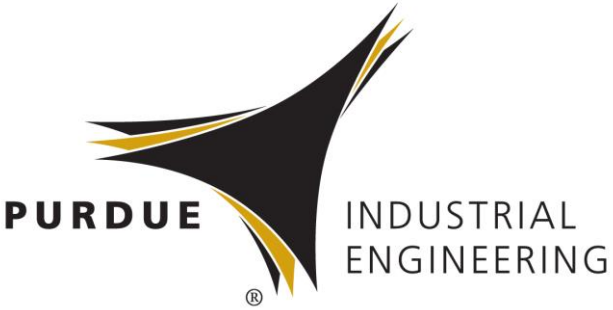

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Contact Information:
Hamed Asadi
hasadi@purdue.edu

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