

Smaller Hands and Less Experience Are Associated with Greater Ergonomic Strain During Endoscopic Procedures

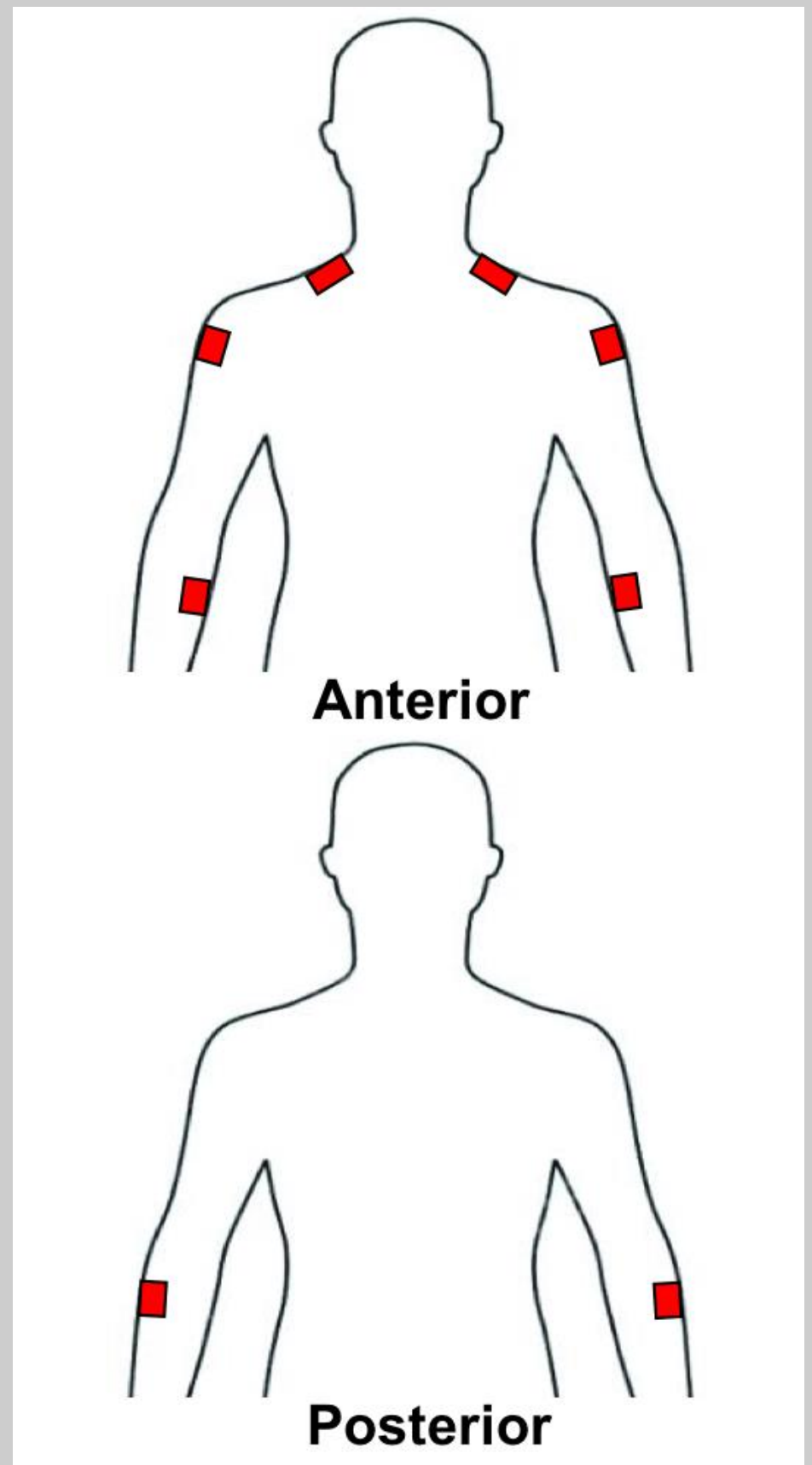
INTRODUCTION

- ❖ Routinely performing endoscopy can lead extremely high rates of work-related musculoskeletal (MSK) injury^{1,7,8}
- ❖ In a previous EAES study 21% of endoscopic surgeons had sought treatment for work-related pain/discomfort¹
- ❖ Common areas of pain include shoulders, wrists, thumb, neck, and lower back
- ❖ Our group has previously used surface electromyography (sEMG) to investigate the ergonomics of open, laparoscopic, and robotic surgery
- ❖ This study quantitatively investigates MSK strain during live endoscopic procedures

METHODS

- ❖ Twenty-seven physicians who perform flexible endoscopy were recruited
- ❖ The image to the right reflects the electrode placement
- ❖ Static maximal voluntary contraction (MVC) values were used to normalize the data from each subject^{4,5,6}
- ❖ Mean %MVC values were used as a proxy for muscular strain
- ❖ Subgroup analyses were performed based on glove size, experience level, specialty, & handedness

sEMG Electrode Placement



RESULTS

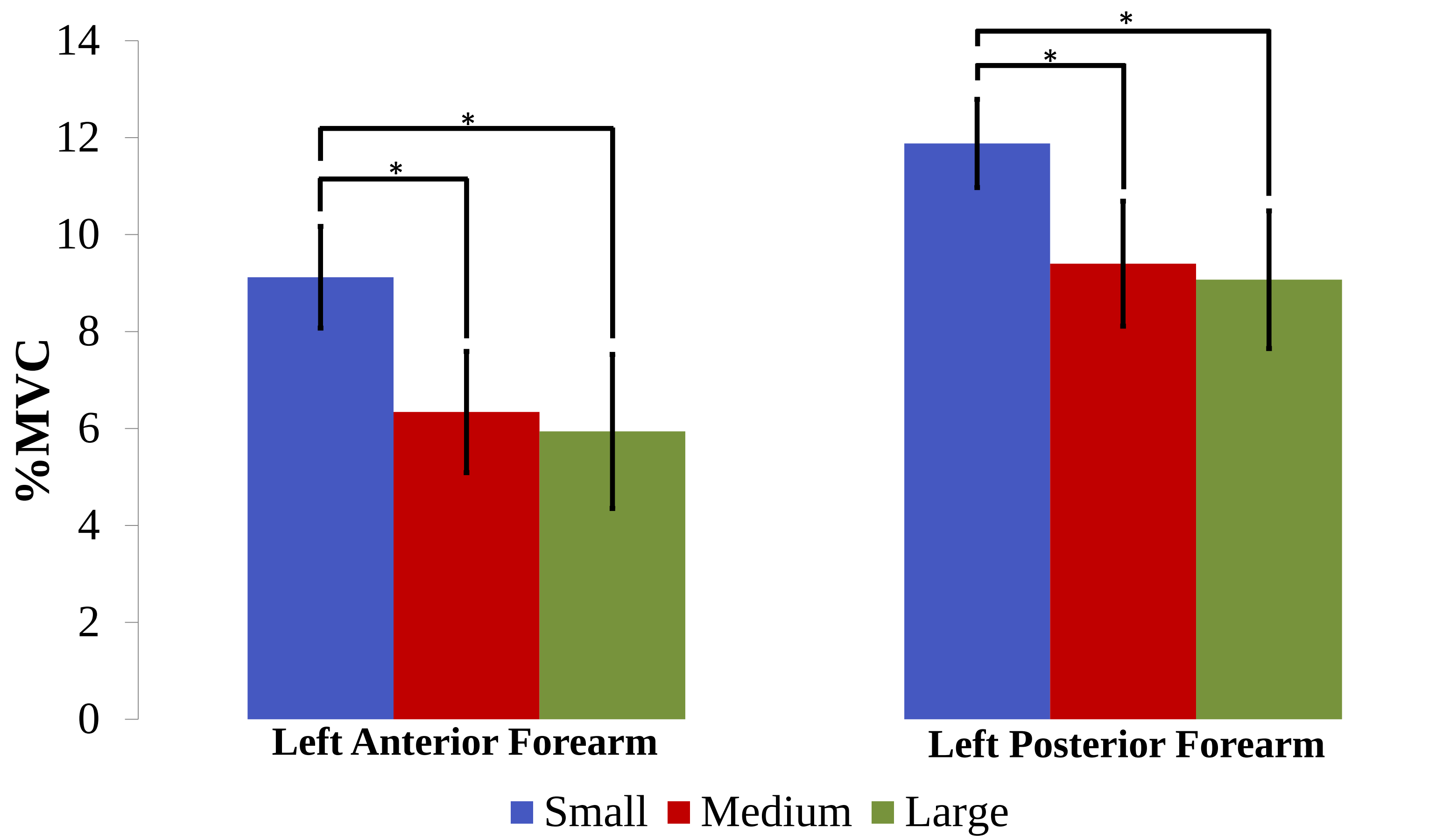


Fig. 1: A comparison of average %MVC values based on glove size in the left anterior and posterior forearm compartments. The error bars represent standard deviation. *p < 0.001

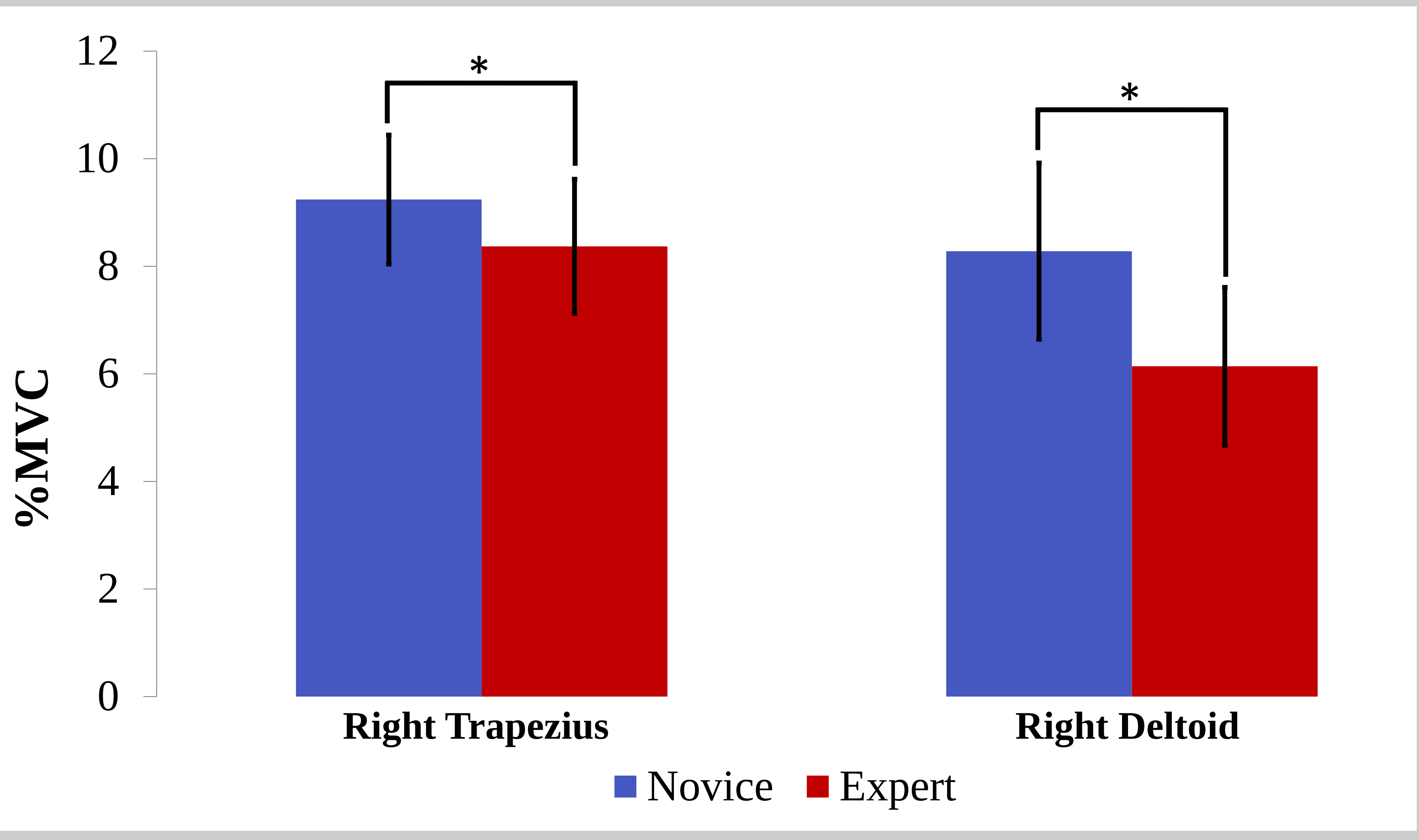


Fig. 2: A comparison of average %MVC values based on physician experience level in the right deltoid and trapezius muscle groups. The error bars represent standard deviation. *p < 0.05

Experience Level

Right	Novice (n=61)	Expert (n=104)
Anterior Forearm	5.1	5.1
Posterior Forearm	10.8	10.6
Deltoid	8.3	6.1
Trapezius	9.2	8.4

Left

Anterior Forearm	6.2	6.1
Posterior Forearm	9.4	9.1
Deltoid	5.1	4.9
Trapezius	5.4	5.2

Glove Size

Right	Small (n=40)	Medium (n=71)	Large (n=54)
Anterior Forearm	5.1	5.2	5.0
Posterior Forearm	10.3	10.8	10.7
Deltoid	6.6	7.0	7.1
Trapezius	8.6	8.6	8.8

Left

Anterior Forearm	9.1	6.3	5.9
Posterior Forearm	11.9	9.4	9.1
Deltoid	5.1	4.9	5.0
Trapezius	5.2	5.3	5.3

Table 1: A breakdown of average %MVC values resulting from our subgroup analyses based on experience level and glove size.

DISCUSSION

- ❖ Physicians with smaller hands had greater muscular strain placed on their left anterior and posterior forearm compartments *
- ❖ One size does not fit all when it comes to endoscope design, we hope this is a consideration in designs future endoscopic equipment
- ❖ Physicians with less experience had greater right-sided strain in their upper arm and shoulder, likely a result of the trainees using great amounts of force to advance the endoscope forward
- ❖ It's important to monitor the posture of novices, providing them with more ergonomic strategies early on in their training
- ❖ No significant ergonomic differences based on specialty type or handedness
- ❖ Awareness of these ergonomic differences will hopefully ameliorate the quantity and severity of endoscopic MSK complications.

*All subjects held the body of the endoscope and manipulated the dials with their left hand.

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