Assessment of Muscular Anatomical and Physiological Development During Injury Rehabilitation

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Abstract

INTRODUCTION: After an injury occurs, there are many physiological regressions that occur. These regressions lead to altered muscle thickness, muscle length, strength and power potentials, motor recruitment, and neuromuscular control. These variables are further exacerbated if the given injury requires surgical intervention. Rehabilitation aids in reducing these regressions and is important both pre-surgery and post-surgery when intervention beyond rehabilitation is needed. Ultrasound imaging can be utilized to monitor the progression of a muscle's specific muscles anatomy. The muscles of interest are dependent upon the injury, The purpose of this study is to monitor short-term muscular adaptations to establish their importance in injury rehabilitation. A secondary purpose is to determine the importance of monitoring the development of these physiological properties in the return-to-play process. The specific physiological factor of interest in this case study is pennation angle, but multiple will be assessed and analyzed.

Participant and Injury Information

Participant Information: Subject is a NCAA Division 1 Athlete with no previous history of significant or catastrophic injury

Injury and Timeline: The participant suffered a dislocated patella in his Right leg on 10/26/2022 and had surgery on 12/12/2022. During the surgery, a loose body was removed from the joint, For the first month of rehabilitation, he completed sessions with a PT. After the first month, the rehab was taken over by a Certified Athletic Trainer.
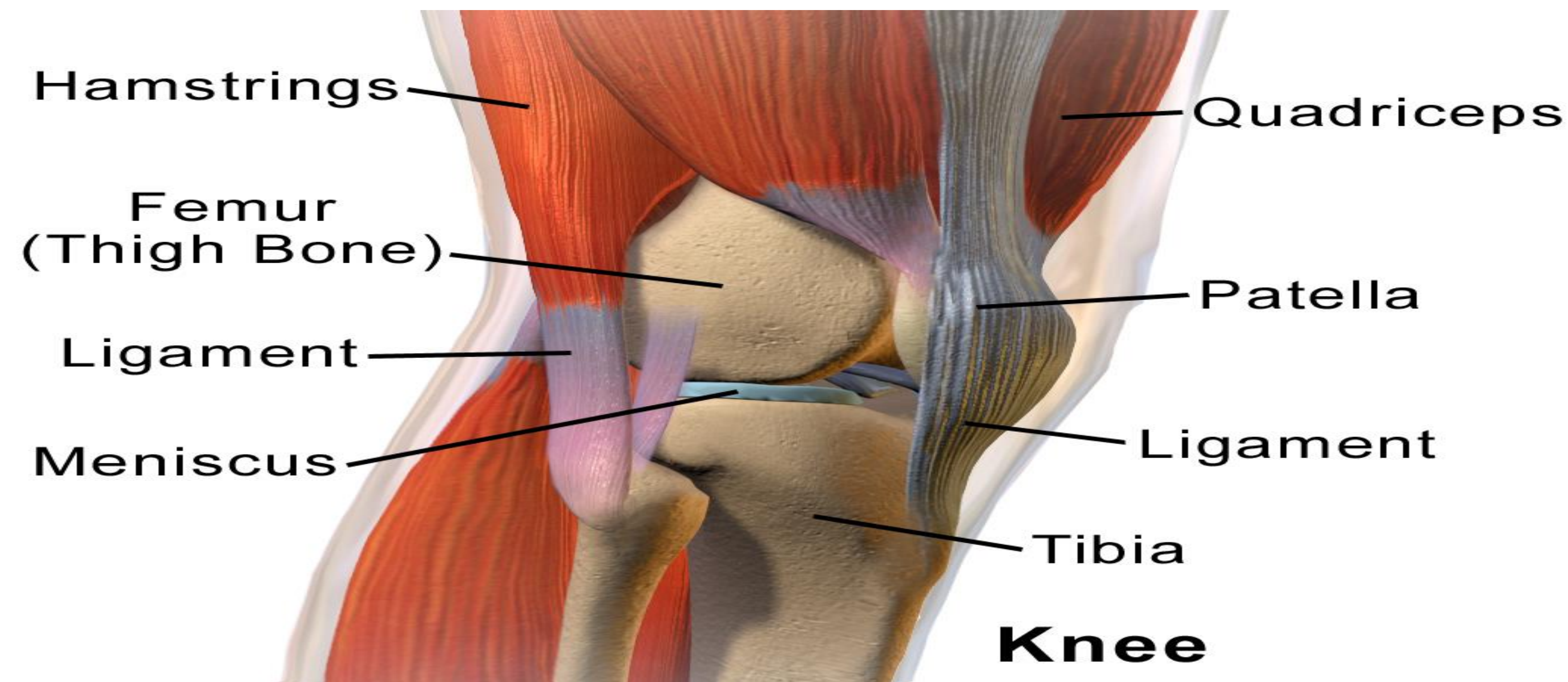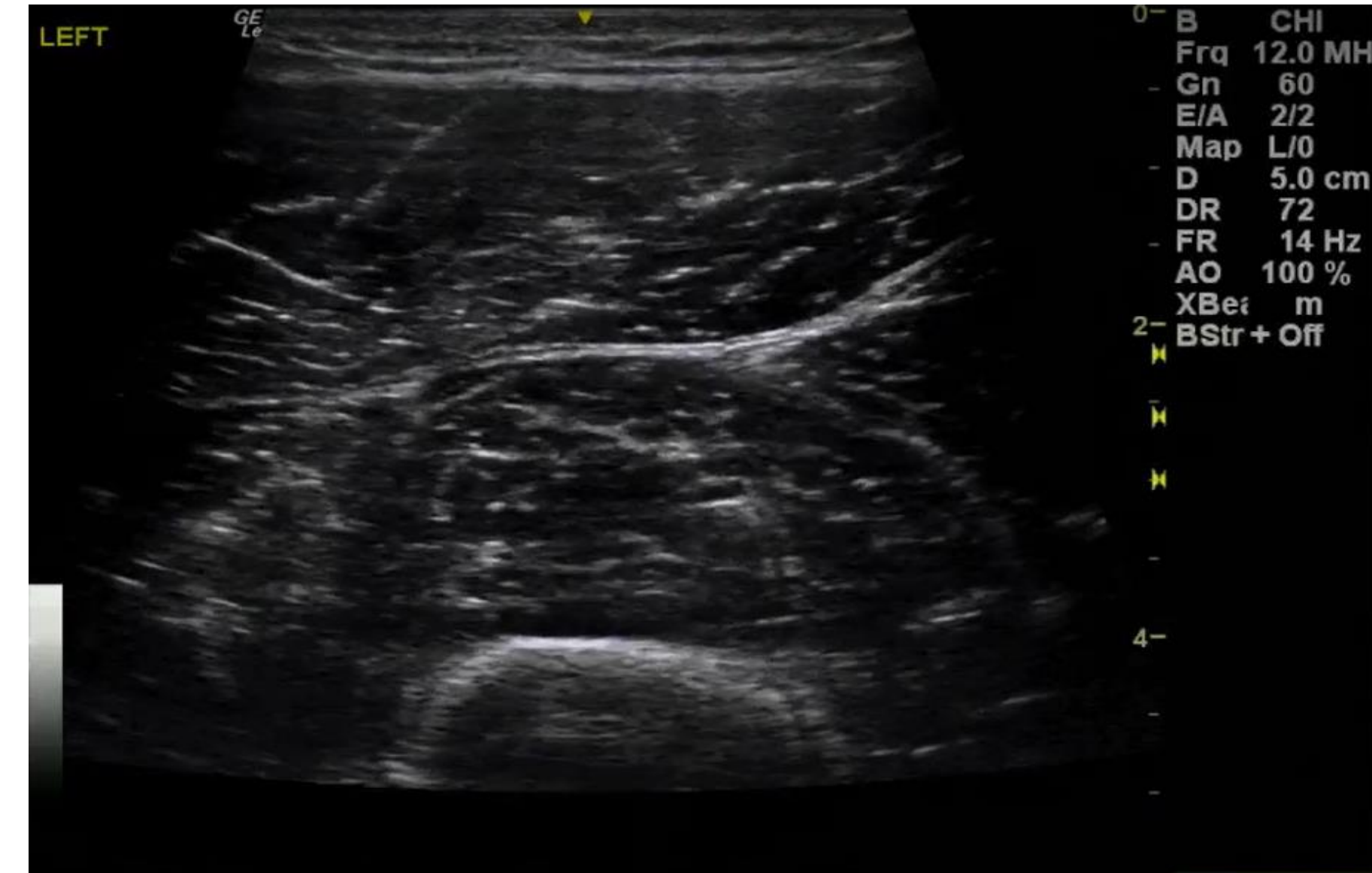

Methods and Assessments

1. Ultrasound imaging is used to monitor muscle thickness, fascicle length, and Pennation Angle. Both the injured and injured sides will be assessed

2. The Tampa Scale of Kinesiophobia (TSK) is a patient-reported outcome measure that measures psychological readiness for return to sport

3. The plan of care was based on the post-surgery protocol provided by the orthopedic surgeon. Half of the exercises remained the same during each session, the others varied based upon set goals for that day.
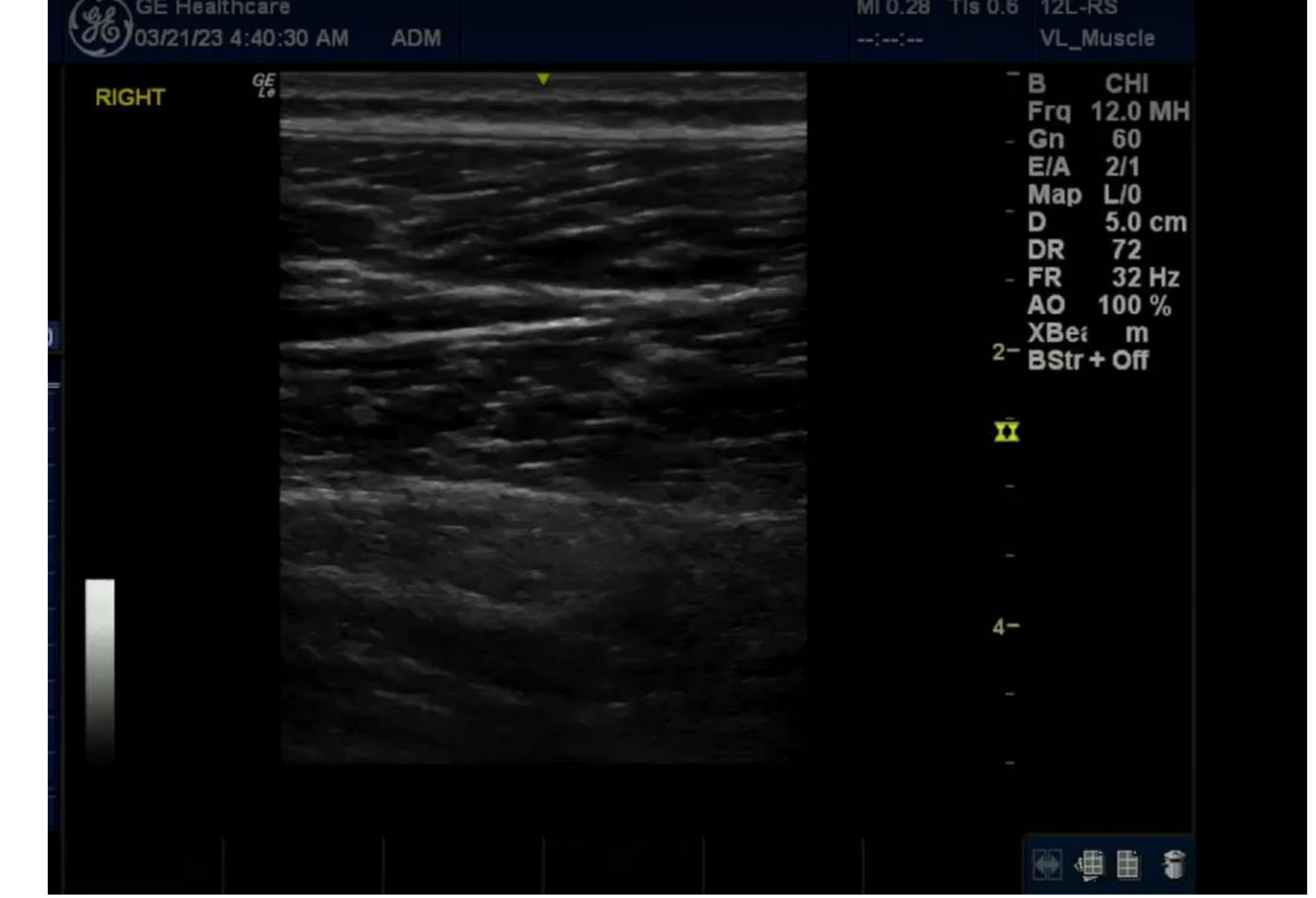
Ultrasound Images and Data

Left Vastus Lateralis (Uninjured side)

Right Vastus Lateralis (Injured Side)

Left Mid-thigh thickness (Uninjured Side)

Right Mid Thigh Thickness (Injured Side)

Measurement	Leg	Week 1	Week 2	Week 3	Week 4
VL Thickness (cm)	Left	33.30 cm	33.31 cm	33.34 cm	33.38 cm
	Right	29.21 cm	29.26 cm	29.28 cm	29.33 cm
Mid-Thigh Thickness (cm)	Left	3.81 cm	3.83 cm	3.84 cm	3.85 cm
	Right	2.71 cm	2.73 cm	2.75 cm	2.76 cm
Tampa Scale of Kinesiophobia	Total out of 68	45	41	37	42

Conclusion and Future Research

- This study was able to identify short-term adaptations in muscle thickness of the Vastus Lateralis, and mid-thigh thickness; however, pennation angle was unable to be assessed.

- Limitations to this study include obstacles and lack of progression during the rehabilitation process, the lack of true baseline measurements, and the return to formal PT during the study.

- Future research should focus on identifying rates of development in muscle architecture, implications for muscle architecture in the rehab process, and the utilization of assessments such as force plates to draw relationships between muscle function and pennation angle.