PROTOCOL TITLE:

Effects of Isometric Gluteal Activation Plus Movement Retraining vs. Gluteal Activation Alone on the Forward Step-Down Test

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1.0 Objectives*

1.1 The purpose of this study is to determine if an isometric glutealactivation home exercise program (HEP) combined with a movement retraining program utilizing feedback cues produces significant changes in scores on the Forward Step-Down Test (FSDT) in healthy young adults with movement coordination impairments.

- SA1: To determine if an isometric gluteal activation HEP with a movement retraining program with feedback cues produces significant changes on scores FSDT compared to the gluteal activation HEP alone.
- SA2: To determine if an isometric gluteal activation HEP followed with a movement retraining program with feedback cues produces significant changes on category FSDT compared to gluteal activation HEP alone.
- SA3: To determine if an isometric gluteal activation HEP with a movement retraining program with feedback cues produces changes in the peak activation of the gluteus medius and gluteus max during the FSDT compared to the gluteal activation HEP alone.
- SA4: To determine if an isometric gluteal activation HEP with a movement retraining program with feedback cues produces changes in the mean activation of the glute med and glute max during the FSDT compared to the gluteal activation HEP alone.
- SA5: To determine if HEP dose has an effect on the FSDT response, as measured by change in score on the FSDT.

1.2

- SA1: FSDT
  - H_o: An HEP focusing on isometric gluteal activation with a movement retraining program with feedback cues will have no change on FSDT score.
  - H_1: An HEP focusing on isometric gluteal activation with a movement retraining program with feedback cues will change FSDT scores more than a gluteal activation program alone.
- SA2: FSDT
  - H_o: An HEP focusing on isometric gluteal activation with a movement retraining program with feedback cues will have no change on movement quality categorization.
  - H_1: An HEP focusing on isometric gluteal activation with a movement retraining program with feedback cues will have a greater change on movement quality category than the gluteal activation program alone.

- SA3: Peak Activation, FSDT
    - H_o: An HEP focusing on isometric gluteal activation with a movement retraining program with feedback cues will not produce a significant change MVIC of the glute med and glute max.
    - H_1: An HEP focusing on isometric gluteal activation with a movement retraining program with feedback cues will significantly change the peak MVIC of the glute med and glute max compared to the gluteal activation program alone.
- SA4: Mean Activation, FSDT
    - H_o: An HEP focusing on isometric gluteal activation with a movement retraining program with feedback cues will not produce a significant change the mean MVIC of the glute med and glute max.
    - H_1: An HEP focusing on isometric gluteal activation with a movement retraining program with feedback cues will significantly change the mean MVIC of the glute med and glute max compared to the gluteal activation program alone.
- SA5: Dose Response, FSDT
    - H_o: Increased adherence to a HEP will not change scores on the FSDT or MVIC of glute max or glute med.
    - H_1: Increased adherence to a HEP will significantly change scores on the FSDT and/or MVIC of glute max or glute med.

2.0 Background*

2.1 Poor biomechanics due to a deficiency of neuromuscular control at the hip contribute to knee joint injuries. Neuromuscular control of the proximal femur plays a key role in tibiofemoral joint positioning.[1] When lacking strength and neuromuscular control of the gluteus maximus (Gmax) and gluteus medius (Gmed), the femur internally rotates and adducts during single-limb movements such as in the Forward Step Down Test (FSDT).[2] Such movements put the knee into a position of excessive valgus which is a combination of movements: adduction and internal rotation of the femur, abduction of the knee, anterior tibial translation, external tibial rotation, and ankle eversion.[3] The combination of these movements increases injury risk at the knee.[4] The FSTD aims to evaluate several of these movements isolated to the frontal plane which is controlled in majority by the Gmed.

Previous studies have been conducted to explore if different combinations of exercises in a home exercise program (HEP) can help to improve scores on the FDST. These HEPs from past studies included a hip activation program, a combined hip activation and single-leg balance program, and a combined hip activation and core activation program. However, despite increases in activation of the Gmed as seen by surface electromyography (sEMG) data,

there was minimal indication that these programs caused a significant improvement in mean score on the FSDT itself. [5,6] The hip activation program alone did not cause functional change in the participant's frontal plane movement quality by decreasing their FSDT score a clinically significant amount. It did improve the participants' strength with statistical significance. Training functional movements to improve movement patterns using motor learning while incorporating dynamic hip activation exercises and its effect on the FDST have yet to be investigated. This study aims to explore the relationship between adding visual and auditory feedback to functional dynamic exercises that activate the gluteal muscles in an HEP and hip activation exercises with scores on the FDST. Despite the frequent use of the FSDT to look at functional movement patterns in patients, there is still a need for evidence-based interventions that can consistently improve performance on this test which will translate functionally to increased dynamic knee stability.

2.2 Our participants will undergo a prescreening utilizing the FSDT. Preliminary data will be used for exclusion, stratification, and randomization of participants. The FSDT is scored on a 0–6-point scale with 0-1 categorically defined as good, 2-3 as moderate, and 4+ as poor movement quality. A participant will be excluded from the study if their score is defined as "good". Then, stratification will be based upon the participant's categorical FSDT score of either moderate or poor to ensure equal representation of the category in each experimental group. Once stratification is complete, participants will be randomly assigned into two groups. The Control group will receive an HEP focusing on isometric gluteal activation while the Experimental group will receive an HEP focusing on isometric gluteal activation plus movement retraining program. This will be the first study on this topic by the authors. However, two of the authors have done prior research using the FSDT as an outcome measure. [5,6] Similar FSDT and sEMG procedures will be used as in previous studies. In this investigation we will compare the effects of an isometric gluteal activation HEP vs an isometric gluteal activation plus movement retraining HEP. Outcome measures will include FSDT score and movement quality category, Gmed and Gmax mean and peak activation via sEMG, and compliance measures of both HEP's to evaluate dose response.

2.3 The FSDT is a commonly used clinical assessment tool for evaluating lower extremity (LE) strength and function.[7] It specifically aims to assess postural control, neuromuscular control, and strength of the lower extremity.[7] Previous studies have found that healthy individuals may not have proper neuromuscular control to manage excessive frontal plane motion during the FSDT. [5,6] Research has not been conducted to examine how attempting to change or improve individuals' motor programs would affect their performance in the FSDT. Movement retraining could be a way to help improve frontal plane movement quality in individuals undergoing the

FSDT. Movement retraining is defined as a process in which a motor program is changed with the goal of reducing pain or injury risk.[8]

The essential aspect of a movement retraining program is providing feedback during movement execution. The feedback enables individuals to adopt correct movement strategies and develop a sense of proper form. Through these feedback mechanisms, individuals can assess whether they are performing the movement correctly and engaging the appropriate musculature.[9] This plays a key role in reshaping coordination patterns and promoting transferability of motor learning across different tasks, including applications in lower extremity rehabilitation.[9] Feedback can be delivered in several categories, including visual, auditory, or haptic forms.[8] Among these different types of feedback, visual feedback helps the person to identify and correct alignment or movement errors as they execute the movement.[10] This feedback can be portrayed using videos so that the participant can watch someone with proper form to perform the movement. Visual feedback can also be portrayed using mirrors to allow the participant to have knowledge of their form and execution of the movement. Auditory feedback provides external cues describing what the participant should feel or observe while performing an exercise. This reinforces the person's awareness of their movement mechanics. Research supports that external feedback and cueing strategies, particularly auditory and visual cues, enhance motor learning by increasing awareness of body mechanics. It also has the added benefit of improving movement retraining outcomes by allowing the person to have knowledge of their performance and learning how to improve it.[10] Furthermore, evidence suggests that multimodal feedback, combining auditory, visual, or haptic cues, outperforms single-modality feedback by offering complementary information that enhances error correction and overall motor learning. This augmented feedback should complement, rather than replace the body's intrinsic sensory feedback mechanisms.[10]

The goal of the exercises added to the HEP combined with the gluteal activation program that has been used previously would be to utilize visual and auditory feedback to give immediate cues to enhance postural control during dynamic functional exercises. The exercises selected are single leg Romanian deadlifts (RDL), split squats, and single leg squats. The selected exercises have shown sufficient activation of the gluteus medius and maximus muscles.[11] Specifically, single-limb squats and single-limb deadlifts exercises effectively activated both the Gmed and Gmax.[12,13] In doing these exercises with feedback, the desired effect would be to increase motor learning in the participants training them how to use the muscles during dynamic exercises that mimic functional movements by doing exercises that increase the activation of the gluteal muscles. By adding the dynamic postural control gained from motor learning and combining these exercises with gluteal activation exercises that have previously shown success in significantly increasing activation could then transfer to improvements in FSDT scores and movement quality in the frontal plane.

Home Exercise programs (HEPs) provide a means to implement an interventional exercise plan to be conducted at the participant's home. Normally, an HEP consists of clear visuals and written instructions that guide the participants in completing the exercise effectively. In utilizing videos, as well as visuals and written instructions in the HEP for this study, the subjects will benefit from both visual and auditory cues given in video form. This combined with visual feedback given by the mirror in front of the participant provides knowledge of their execution of the movement. The cues combined with the knowledge of their performance will help to emphasize correct movement patterns. Research supports the idea that more feedback is not always more helpful when engaging in motor learning. Allowing participants to make and correct their own errors at home helps to support motor learning retention by allowing the participant to self-select the corrections to their movement patterns as they engage in the exercise.[10] The participant is able to do this by attending to and correcting their movement patterns in the mirror as they recognize them. Additionally, the participants will have the ability to control the timing of their feedback. By allowing learner to decide the pace of feedback, evidence shows that it enhances engagement, confidence, and motor learning.[14] However, HEP's rely on patient compliance. Patients are expected to adhere to the program and truthfully document a log of completion. To check compliance, the log can be monitored throughout the process as well as asking the participant to demonstrate the HEP from memory.

Gluteal activation from an isometric activation HEP alone has shown to increase performance on the forward step-down test. However, the improvement was not found to be clinically significant.[7,8] The aim of this study would be to build on prior research and create a HEP that could be used to show a clinically significant difference in FSDT scores. Over the eight-week intervention, this approach will aim to utilize visual and auditory cueing used during functional dynamic exercises to improve hip activation by increasing postural control which would translate into meaningful improvements in FSDT scores and dynamic knee stability.

3.0 Inclusion and Exclusion Criteria*

3.1 Individual eligibility will be determined through the Physical Activity Readiness Questionnaire Plus (PAR-Q+), which is a self-reported heath questionnaire. During a presentation of inclusion/exclusion criteria, informed consent will be obtained as well. A preliminary FDST will be performed following informed consent to determine if the potential participant is eligible to participate in the study and for group stratification purposes.

3.2 Inclusion: Participants must between the ages of 18 and older, if they were healthy via the PAR-Q+, and scored a 2 or higher on the FSDT.

Exclusion: Participants have any current knee/hip pain, past knee/hip pathology in the past 3 months on their dominant leg or that the participant believes would impact their ability to participate in the study, or any past LE surgery in their dominant leg that the participant believes would impact their ability to participate in the study, a concussion in the past 3 months, or if they have any vestibular pathology.

3.3 Inclusion and exclusion of special populations

- Adults unable to consent- Excluded
- Individuals who are not yet adults (infants, children, teenagers)-
- Pregnant women- Excluded
- Prisoners- Excluded
- Non-English-Speaking Subjects- Excluded
- Students/Employees- Included

4.0 Study-Wide Number of Subjects*

4.1 This research study is not a multicenter study. The total number of subjects to be accrued from the LSUHS main campus is 38 participants.

4.2 N/A

5.0 Study-Wide Recruitment Methods

5.1 Potential subjects will be recruited via word of mouth from people who are local to Shreveport, LA and local clinical/academic settings during the spring of 2026.

5.2 During a mandatory meeting prior to the start of the study, participants will be screened. Participants will fill out a self-reported health questionnaire to determine if they have any underlying health conditions that would exclude them from participation in the study. Once informed consent has been obtained, participants will also be asked to perform a preliminary FSDT to determine if they have a score of poor (4+) or moderate (2-3) that would include them in the study.

5.3 N/A

6.0 Multi-Site Research

6.1 N/A

6.2 N/A

6.3 N/A

7.0 Study Timelines

7.1 The duration of the individual subject's participation in this study is currently 590 minutes or 9.8 hours during the study which will last for 8 weeks. Data collection consisting of anthropometrics, sEMG, FSDT, and HEP education will require ~45 minutes for measurements and recording of

data. Following completion of assigned HEP, FDST and sEMG will be measured and the data will be recorded. Both HEPs will take no more than 25 minutes a session to complete; hence, allocating 50 minutes in total each week since two sessions will be completed per week. A mid-participation session at 4 weeks is expected to take less than 15 minutes to ensure correct exercise completion, and the post-testing is expected to take 20 minutes.

- The duration anticipated to enroll all study subjects is estimated to be done over a month during January 2026.
- The estimated completion date of this study, including data analysis, is June 2026.

8.0 Study Endpoints

8.1 Both primary and secondary study endpoints will be the completion of data collection and intervention for all participants. This will be completed by May 2026. Data analysis will be completed by June of 2026.

8.2 This is a low-risk study. Participants who experience safety concerns during the testing process will be stopped. No safety risks from receiving the intervention or dropping out of the study are predicted.

9.0 Procedures Involved*

9.1 This study is a randomized control trial with stratification. Preliminary data from a preliminary FSDT will be used for exclusion, stratification, and randomization so that we can avoid any bias in results. The FSDT is scored on a 0–6-point scale with 0-1 categorically defined as good, 2-3 as moderate, and 4+ as poor. A participant will be excluded from the study if their score is defined as good or a 0-1 score. Then, stratification will be based upon the participant's categorical FSDT score of either moderate or poor to ensure equal representation of the category in each group. Participants will be randomly assigned to either the control group (hip activation HEP) or the experimental group (Hip activation plus movement retraining HEP). Individuals will receive their HEP protocol in an opaque envelope to ensure allocation concealment. The dependent variables are the FSDT score (statistical and clinical significance) and Gmed and Gmax sEMG activation (peak and mean).

9.2 Research procedures being performed and procedures being to monitor subjects for safety or minimize risks

Recruitment and Informed Consent Procedures

- Potential subjects will be recruited via word of mouth from people who are local to Shreveport, LA and local clinical/academic settings. Once they are recruited, meeting will be held for all potential participants to obtain informed consent. Then, the participant will complete a self-reported health questionnaire and a preliminary FSDT. If a potential participant cannot be

present at this meeting, a meeting will be scheduled with the investigators to obtain these measures.

- To ensure confidentiality, participants will be given a random identification number after their informed consent is obtained. Participant scores on the initial FSDT screening will be recorded by ID. Randomized stratification will take place following enrollment of all participants to ensure an equal distribution of FSDT scores between the control and experimental groups.
- Following enrollment, participants will sign up with their participant number for preliminary data collection in the motion analysis lab in room 2-217 in the SHPS at LSUHS. The participants will be instructed to wear shorts and advised to not wear leggings, tights, or pants or any lotions, both of which could impact EMG placement and data collection.

Anthropometric data collection procedures

- Age, sex, height, weight, BMI, and dominant lower extremity (LE) will be recorded in the rehabilitation faculty clinic by GD and DB during the first visit. The determinacy of the dominant leg is based on the leg chosen to kick a ball at a target.[15]

MVIC testing procedure:

- Participants will then take the elevator to the second floor and report to room 2-217 for sEMG and FSDT. Electrodes for sEMG will be placed on the gluteus maximus and gluteus medius muscles of the dominant leg via Seniam guidelines, and skin preparation following recommendations from The ABC's of EMG.[16] The electrodes that will be used are self-adhesive Ag/AgCl Dual Electrodes by Noraxon. The placement of sEMG electrodes will be completed by GD for the female participants and DB for the male participants. Maximum Isometric Voluntary Contraction (MVIC) for the GMax and GMed muscle will be performed and recorded by GD and DB. SEMG data collection will be obtained for MVIC and during performance of the FSDT.
- The procedure for collection of the maximum volitional isometric contraction (MVIC) of the GMed will follow the protocol used in a study by Harput et al.[17] The participant will lay on their side with their top leg extended at the knee and abducted and extended at the hip. The MVIC position of the GMax will follow the protocol used in a study by Selkowitz et al, with the knee flexed to 90 degrees in prone.[18,19]

FSDT procedures

- Participants will be instructed on the procedure for the FSDT by MM. The FSDT consists of five consecutive repetitions of a forward step-down from a 20cm step, with one score given for the whole set of five repetitions.[20,21] The participant will be allowed to take two practice repetitions before beginning the test. sEMG data and FSDT will be collected before and after the 8 week HEP.

HEP and Compliance Chart Education Procedures

- After the initial FSDT and randomization has been completed, the participant will be educated on the gluteal muscle activation exercises HEP by (GD or DB or MM) (control group) or movement retraining program and gluteal muscle activation exercise HEP by (GD or DB or MM) (experimental group). Participants will be educated the compliance chart by investigator (GD or DB or MM). Compliance chart data will be collected and analyzed during the third/final visits.
- All participants will receive the HEP for hip muscle activation training. The HEP for hip musculature activation consists of five isolated hip activation exercises including side-lying clams, side-lying clams with trunk activation via side-plank, side-lying hip abduction, side-lying hip abduction with trunk activation via side-plank, and fire hydrants all of which improve hip gluteal recruitment. See HEP for appropriate exercise positioning, dosage, frequency, and advised progressions.
- Only participants in the experimental group will receive the movement retraining program HEP. The HEP will be a combination of single leg RDL, single leg squat, and standing split squat that have been used in previous research and are proved to get significant Gmed activation.[11,12,13] They will also participate in the gluteal activation HEP program that have been proved to increase hip musculature recruitment.
- A compliance chart will be given to the participants to track each time they perform the HEP. The participants in the control group and experimental group will take home their HEP, a compliance chart, then a yellow and red TheraBand. The participants will complete their HEP two days/week for eight weeks, with at least two rest days between sessions for muscle soreness prevention and document the completion of the session on the compliance chart.
- After the 4th week, both groups are to return to the clinic and asked to briefly perform exercises from their HEP so that their form can be reassessed with any modifications if needed along with any questions that they may have. Each participant following the 8-week period will be scheduled to return to the clinic to turn in their compliance form and perform follow-ups sEMG, weight, and FSDT using the same procedures as before.

Randomization of Group Allocation: Following the baseline EMG and FSDT measures, participants will be handed an opaque envelope containing their group allocation. Participants in the control group are indicated by a “0”, and intervention group by a “1”. A sequence of 1’s and 0’s will be generated by random generation in Excel, and the assignment will be made by sequential enrollment. To avoid unequal distribution of movement quality between groups, initial stratification in to “fair” and “poor” FSDT performance will be established after informed consent. Each strata will have an equal distribution of control and intervention envelopes.

9.3

Table of Events	# of times test or procedure will be performed
Written informed consent	1
Anthropometric assessment (height, weight, BMI, sex, age, leg dominance)	1
FSDT	3
sEMG	2
HEP Education	1
Compliance Chart Education	1
HEP Midpoint Check in	1
HEP	16
Compliance chart document	16

9.4 To reduce the risk of confidentiality, participants will be assigned identification numbers. All hardcopy data including group assignments will be stored in the PI's office in a locked drawer. All electronic data will be stored using OneDrive connected to school email addresses with a password. The investigator performing the data analysis will be blinded.

An informed consent document with participant identification numbers will be used to obtain consent from the participants. An identification number will be assigned to the name of each participant along with their group assignment. An identification number key will be used to maintain confidentiality when performing data collection and analysis, which will be stored on the PI's password protected computer. Only study members will have access to this document.

A sign-up sheet for the data collection days will be created that will allow participants to sign up with their assigned identification number. Investigators will use an excel sheet to collect data (see data collection form as part of submission). Participants will track their HEP performance on the compliance chart that will be provided to each participant. A paper copy of the HEP with pictures, written instructions, and a QR code for video instructions will be given to the participants.

To reduce the risk of muscle soreness, participants will be educated on appropriate exercise performance and to space the sessions at least two days apart. Once all hip activation exercises can be completed for one minute on the dominant LE without a break, participants will be educated to add the yellow TheraBand. Once the exercises can be completed for one minute with the yellow TheraBand on the dominant LE without a break, participants will be educated on progressing to the red TheraBand that has a higher resistance.

To reduce the privacy risk of participants being recorded on video for data collection and the possibility of the video recording being lost or exposed, all electronic data will be stored using Sharepoint connected to school email

addresses with a password. This information will also be kept private by utilizing the assigned participant identification numbers.

Another possible risk of being in this study is a modesty risk that includes the exposure of a participant's buttocks when doing sEMG electrode placement for data analysis. To reduce this modesty risk, an investigator of the same sex will be doing the electrode placement.

One risk associated with sEMG electrode placement includes potential skin irritation and a rash occurring from wearing or removing the sEMG electrode patches that stick to your skin due to the gel that is used with them. Also, the skin will be wiped with an alcohol pad which could cause possible irritation as well. If there is hair on the participant's buttocks, irritation or discomfort could occur when the electrode patch is removed. To reduce this physical risk, the investigator doing the sEMG electrode placement and removal will be careful to avoid causing excessive irritation to the skin area and will explain the risks to the participant.

Upon the first session, the data collection will include participant age, height, weight, BMI, dominant LE, in addition to the following pre- and post- intervention: FSDT, sEMG from gluteus medius and maximus, recorded FSDT video. Compliance chart data will be collected post-intervention.

Will any data be shared with the drug/device manufacturer?

N/A

- Will you collect any data for patients outside Ochsner Shreveport and Monroe (i.e. from sites like New Orleans, Baton Rouge, Lafayette etc.) from the databases stated in the protocol?

  Yes ☐ No x

- Please confirm if any data will be transferred to the sites outside Ochsner Shreveport & Monroe.

  Yes ☐ No x

- If yes, please list the data that will be transferred and how.

9.5 N/A

10.0 Data and Specimen Banking

10.1 N/A

10.2 N/A

10.3 N/A

11.0 Data Management and Confidentiality

11.1 Data analysis plan and statistical procedures.

FSDT

Data processing: Each participant will perform a pre- and post- intervention trial for the FSDT that will be scored. The FSDT consists of 5 repetitions of a step-down task. One score is given for the whole test. One raters will score the FSDT (MM).

Data analysis: For the FSDT data, a 2x2 repeated measures ANOVA will be performed with significance set at alpha = .05. Post hoc testing will be used if significant differences are detected with the ANOVA. Tukey's HSD test will be used as the post hoc test, with significance set at alpha = .05.

sEMG

Data processing: Raw sEMG signals will be bandpass filtered between 10-500 Hz. The signal will be rectified, then smoothed using the Root Mean Square method with a 50ms window. The signal from the FSDT and UPST will be normalized to the MVIC obtained during the MVIC testing.

Data analysis: Following MVIC normalization, sEMG activity will be recorded during each of the outcome measures. Each FSDT step-down repetition will be analyzed as a separate trial, and the mean and peak activation for GMax and GMed will be extracted from each of the 5 trials. A mean value for each variable (mean and peak activation of GMax, mean and peak activation of GMed) will be calculated and recorded at the pre-and post-test sessions.

For the sEMG data, a 2x2 repeated measures ANOVA will be performed for each measurement (mean, peak) for each muscle (Gmed, Gmax), with significance set at alpha = .05. Post hoc testing will be used if significant differences are detected with the ANOVA. Tukey's HSD test will be used as the post hoc test, with significance set at alpha = .05.

11.2 G* power (Heinrich-Heine-University Dusseldorf, Dusseldorf, Germany) software was used to perform a priori power analysis to determine the

required N for this investigation. Data from McCallister Et Al. (2025) study reported a Cohen's d of 0.58 (d=0.58).[5] An N of 26 was calculated to achieve significant results with beta= .80 and alpha =.05 for a two-tailed hypothesis from an interaction effect of the 2x2 repeated measures ANOVA. Assuming 20% attrition, plus an additional 10% for FSDT screening failures, a final N=38 is required for this study.

11.3 To reduce the risk of loss of confidentiality, participants will be assigned ID numbers on their informed consent form. All hardcopy data will be stored in a locked drawer in room 2-236 in the SHPS at LSUHS. All electronic data will be stored using Sharepoint/OneDrive connected to school email addresses with a password. The investigator performing the data analysis will be blinded. Participants will be identified by their ID number throughout the study, and group assignment will be recorded by ID number. A sign-up sheet for data collection times will also use ID number. Throughout the study, data will be recorded by ID number on the data collection sheet attached to this submission. For the participants to track their home exercise sessions, a compliance chart will be created for them again with only ID number attached to the compliance chart.

11.4 The student investigators (DB, GD, MM) will be educated on the proper procedures of the FSDT, sEMG data collection, and the HEP by the primary investigator (EM) and co-investigator (DF). The FSDT will be analyzed by the three student investigators (DB, GD, MM). The student investigators (DB, GD, MM) will record and average their scores for the FSDT following the completion of five repetitions to improve the quality of the data. (Super script). The sEMG electrodes will be placed on the female participants by GD. MM will explain the FSDT procedure to every participant. DB, GD, MM will explain the hipactivation exercises on the HEP and will explain the movement retraining program HEP and the QR code access for videos. DB, GD, and MM will explain the compliance chart to the participants. The primary investigator (EM) is a board-certified orthopedic physical therapist with 8 years of experience, who has published research on this test. (super script) The co-investigator? (DF) is also a board-certified orthopedic physical therapist with 13 years of experience, who also has published research on this test with the primary investigator.

11.5 The data that will be collected during the study includesheight, weight, BMI, sex, leg dominance, MVIC of each muscle group, FSDT pre and post HEP, recorded FSDT video, sEMG from gluteus medius and maximus on the dominant leg during FSDT pre and post HEP, and HEP compliance. Data storage will follow the guidelines in section 9.4. The data will be stored for the duration of the study and throughout the following semester while analyzing and finalizing data for presentation. The data will only be

kept up to one year after the completion of the data analysis in the event that the research wants to be continued. The only people who will have access to this information will be the primary investigator and student investigators (EM, DB, GD, MM) since the co-investigator (DF) that is doing the data analysis will be blinded. The primary investigator and student investigators are responsible for the receipt and transmission of the data. The student investigators (DB, GM, MM) are responsible for data processing. Data will be manually transported to EM office room 2-236 in the SAHP at LSUHS. Electronic data will remain on Sharepoint.

12.0 Provisions to Monitor the Data to Ensure the Safety of Subjects*

12.1 N/A

13.0 Withdrawal of Subjects

13.1 Non-study injuries that affect the ability to complete HEP or FSDT post-intervention will be withdrawn from the research without their consent.

13.2 If a participant no longer meets the inclusion or exclusion criteria or if the subject notifies the investigator that they no longer wish to continue participation in the study, the investigators will notify the participant that they have withdrawn from the study and will document the date and reason for withdrawal. The participant will return the compliance sheet to the investigators.

13.3 N/A

14.0 Risks to Subjects

14.1 As with any exercise program, muscle soreness is a potential side effect. To reduce these potential side effects, participants will be asked to make sure that they put two days in between completing the HEP. Another risk with any exercise program is the potential risk of injury. To reduce these potential side effects participants will meet with investigators to be instructed on how to perform the exercises safely and will be cued during the HEP on proper form to complete the exercises .

14.2 N/A

14.3 N/A

14.4 N/A

15.0 Potential Benefits to Subjects

15.1 Potential benefits that individual subjects may experience from taking part in this research include improved movement quality and coordination during functional tasks.

15.2 N/A

16.0 Vulnerable Populations

16.1 N/A

17.0 Community-Based Participatory Research

17.1 N/A

18.0 Sharing of Results with Subjects

18.1 N/A

19.0 Setting

19.1 Our research team will identify and recruit potential subjects from people who are local to Shreveport, LA and local clinical/academic settings.

- Potential subjects will be recruited via word of mouth on the campus of LSUHS and those in the community of Shreveport, LA and the surrounding areas.
- Research procedures will be performed at the SHPS at LSUHS main campus in Shreveport, LA. The rehabilitation clinic will be used to gather anthropometric measurements and the motion analysis lab, room 2-217, will be utilized for sEMG placement and FSDT. A separate conference room will be used to assign and educate participants on their HEP in order to preserve blinding of the data analyst.

- There will not be composition and involvement of any community advisory board. There will not be any research conducted outside of the organization and its affiliates.

20.0 Resources Available

20.1 The three student investigators (GD, DB, and MM) are DPT students in the SHSP at LSUHS. They will be educated on the procedures of the FDST (reference numbers), sEMG electrode placement, and data collection and interpretation (reference number) by primary investigator (EM), who is a board-certified orthopedic physical therapist with 9 years of experience and the co-investigator (DF), who is a board-certified orthopedic physical therapist with 13 years of experience. The primary investigator (EM) and co-investigator (DF) have also conducted similar studies previously that used the FDST and sEMG data. The primary investigator (EM) and co-investigator (DF) will assist the student investigators as needed throughout the study. Multiple training sessions will occur prior to starting data collection to ensure student investigators are reliably able to place sEMG on the targeted muscles.

20.2 In local clinical/academic settings, the total number of first- and second-year DPT students currently enrolled in the SHPS at LSUHS is 70. The total number of first- and second-year DOT students enrolled in the SHSP is 52.

The total number of medical students in the first- and second-year class is 300. Given the required N = 38, there are enough potential subjects in local clinical/academic settings to successfully complete the study.

- Currently, student investigators are enrolled in independent study for the Fall 2025 semester to receive IRB approval. The month of January 2026 will be for recruitment of subjects. Data collection will begin in spring of 2026 and will conclude by May 2026. The investigators will be enrolled in a 2-credit research course during this semester to allow time to conduct the research and work on presenting the research. The investigators, EM and DF, will each provide 5% FTE, which is within their scholarship FTE distribution considering other research commitments. During the Summer 2026 semester, the student investigators will begin analyzing the data and dissemination of data. All data analysis will be concluded by August 2026.
- The rehabilitation clinic in SHSP at LSUHS, located on the ground floor, has scales to measure weight and vertical ruler to measure height, and other anthropometric data. The motion analysis lab, room 2-217 in SHSP at LSUHS has a treatment mat, sEMG materials and technology, and an open area to analyze movement.
- Our study has less than minimal risk, thus no medical or psychological resources should be needed due to there being no anticipated consequences of human research.
- The PI will complete the DOA, including the assigning of roles and responsibilities, and educate each investigator at the time of signing.

21.0 Prior Approvals

21.1 Approval for the project will be obtained from the SHPS Associate Dean of Business, Technology and Research.

22.0 Recruitment Methods (Local)

22.1 Potential subjects will be recruited via word of mouth from people who are local to Shreveport, LA and local clinical/academic settings. Investigators (DF, GD, DB, and MM) will recruit students on the campus of LSUHS by going to different classrooms and informing potential participants about the study. A meeting will be held for all potential participants to obtain informed consent. Then, once informed consent has been obtained, the potential participants will complete a self-reported health questionnaire (PAR-Q) and a preliminary FSDT. If a potential participant cannot be present at this meeting, a meeting will be scheduled with the investigators to obtain informed consent and then the other measures.

22.2 The subjects will be recruited via word of mouth from people who are local to Shreveport, LA and local clinical/academic settings. Participants will be considered for participation if they meet all inclusion and exclusion criteria.

22.3 Potential subjects will first be identified via word of mouth through informing students on the campus of LSUHS about the study.

22.4 N/A

22.5 N/A

23.0 Local Number of Subjects

23.1 At least 38 subjects will be accrued locally

23.2 We plan to enroll 38 participants.

24.0 Provisions to Protect the Privacy Interests of Subjects

24.1 All individuals participating in the study will be given an identification number to protect their personal identity and to maintain single-blind confidentiality. Participants will only be expected to interact with the investigators (EM, DF, GD, DB, MM) during the study. Participants will only be expected to provide personal information to the primary investigators (EM, DF) and student investigators (GD, DB, MM).

24.2 Only the investigators (EM, GD, DB, MM) will be in the room during data collection, and any questions will be asked individually with the investigators. If another participant is in the room learning the HEP, the view will be obstructed with a divider to ensure confidentiality. The co-investigator (DF) will be asked to leave the room during HEP demonstration to each participant to maintain confidentiality. Each participant will be asked not to discuss their HEP when co-investigator (DF) is in the room to maintain confidentiality. Any written data will refer to participants with numbers, not actual names. No previous medical history or identifying information will be entered into the data collection.

24.3 Any information about the subjects will be verbally reported to the investigator, except for information regarding their HEP which will not be reported to the co-investigator (DF). Recorded data will be placed on a master data sheet and will be shared between investigators on Sharepoint/OneDrive. Individuals not involved in the investigation will not have access to the data.

25.0 Compensation for Research-Related Injury

25.1 The study does not involve greater than minimal risk to the subjects.

25.2 N/A

26.0 Economic Burden to Subjects

26.1 There will be no economic burden placed on the participants. Any required materials will be provided. The only thing the participants will be responsible for is transportation to the facility where the study is conducted for data collection.

27.0 Consent Process (standard operating for informed consent)

27.1 The consent process will take place in the SHSP at LSUHS in room 3-314. There will not be a waiting period between informing prospective subjects

and obtaining informed constent. Continued verbal consent will be given during FSDT and sEMG processes both before, during, and after HEP. We will be using "SOP: Informed Consent Process for Research (HRP-090)."

28.0 Process to Document Consent in Writing

28.1 We will be using "SOP: Written Documentation of Consent (HRP-091)."

28.2 Our research does not involve more than minimal risk.

28.3 See attached completed informed consent form submitted with this protocol.

29.0 Drugs or Devices:

29.1 N/A

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