

An Evaluation of the Loading Forces Across the Hip and Knee Contributing to Early Knee Joint Degeneration

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INTRODUCTION

Osteoarthritis (OA) of the knee is a common diagnosis affecting a large and growing proportion of the population. The medial compartment of the knee is a site recognized for initial deterioration of articular cartilage prompting the diagnosis of OA. To date, most studies have focused on pharmacologic and surgical interventions for OA, which are both costly and burdensome to the healthcare system. A two-year randomized clinical trial found no difference in the joint space size (a measure of knee degeneration) between placebo and treatment groups who received pharmacological supplements (Sawizke et al, 2008). Arthroscopic surgery for knee osteoarthritis demonstrated no additional benefit when compared to a supervised physical therapy exercise program (Kirkley et al, 2008). Few studies have looked at the benefits of a supervised exercise program to decrease the forces at the hip and knee which may contribute to early knee degeneration, which may be safer, cheaper, and ultimately more effective. One study investigated the effects of a strengthening program targeting the hip adductors and hip abductors on the knee adductor moment (Bennel et al, 2009). There were no differences in the pre- and post-treatment loads along the medial knee (adductor moment) in patients with early knee OA, though improvements were noted in both function and pain.

The purpose of this research is to determine the abnormal forces at the hip and knee joints in healthy controls and participants with early knee degeneration and/or patellofemoral pain. By gaining a better understanding on the potentially adverse forces in the lower extremity, specifically at the hip and knee joints, we hope to provide clinicians with a scientific rationale for developing and prescribing treatment programs for individuals with OA. This case study represents preliminary data from the larger cohort study that is currently underway.

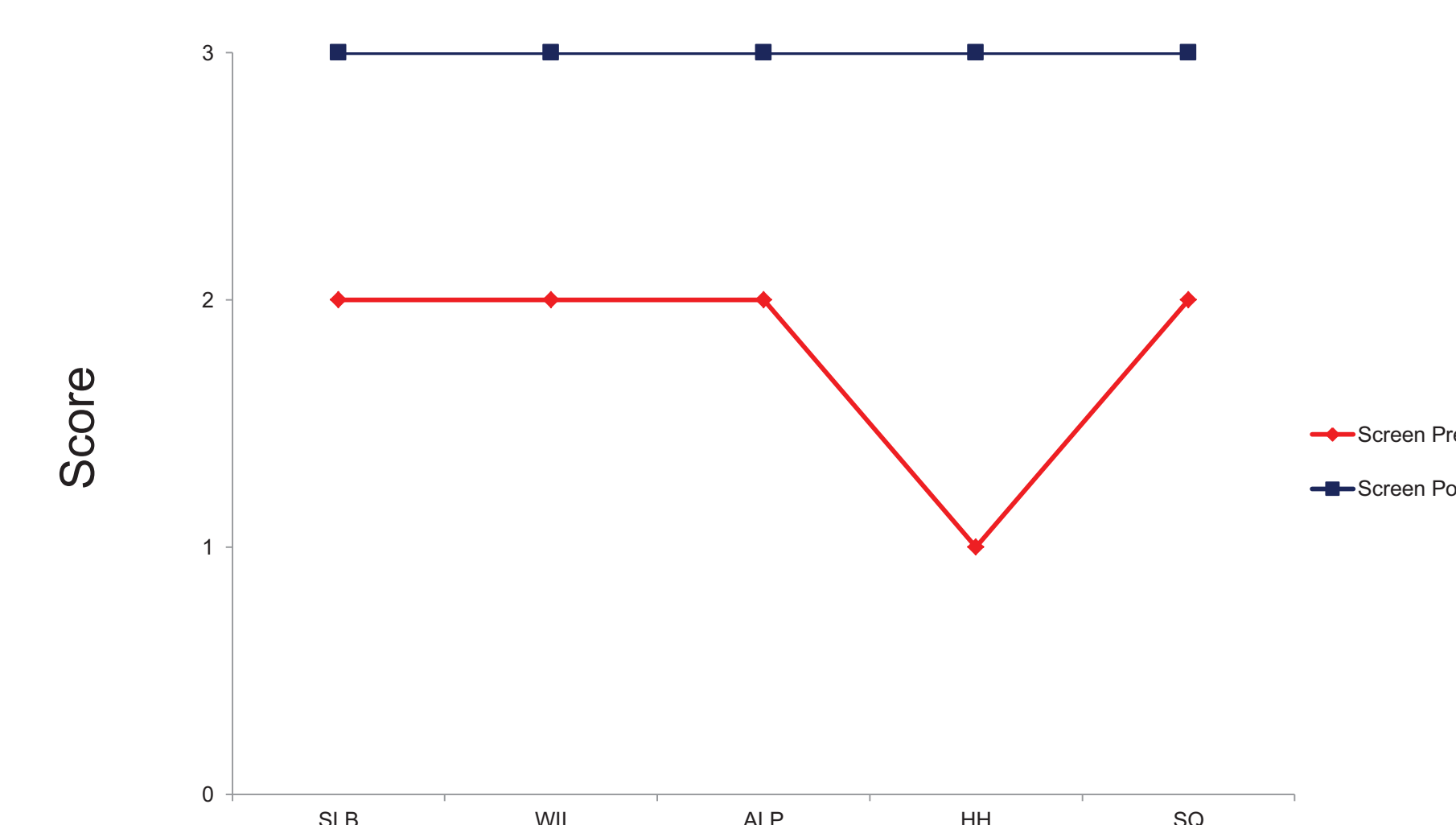
METHODS

The participant chosen for this case study was from a larger cohort of participants with knee OA and/or patellofemoral pain. He is a 50 year old male with a history of documented right knee medial knee OA with a KL score of 1 and status post right knee arthroscopy three years ago. He was evaluated twice in the Motion Analysis Laboratory (baseline and post-treatment following 12 physical therapy sessions over an 8 week period). In his first session, he signed an informed consent and the study was explained. Descriptive data (height, weight, sex) was obtained. In both sessions, he completed the Knee Injury and Osteoarthritis Outcome Score (KOOS) and Short Form-36 Health Inventory (SF-36) to quantify symptoms, function, and pain.

He was evaluated using instrumented three-dimensional instrumented motion analysis. He was asked to perform three functional tests in the first session (Modified STAR Excursion Test, gait analysis and step test Practice trials were performed with rest periods as needed. Three test trials were performed on each leg. Following the baseline evaluation, the participant completed a focused exercise program. The exercise program included muscle strengthening and stretching exercises for the hip and knee muscles, postural training, and balance exercises. One of the evaluation tools utilized by the physical therapist was a functional screen developed for this study.

RESULTS

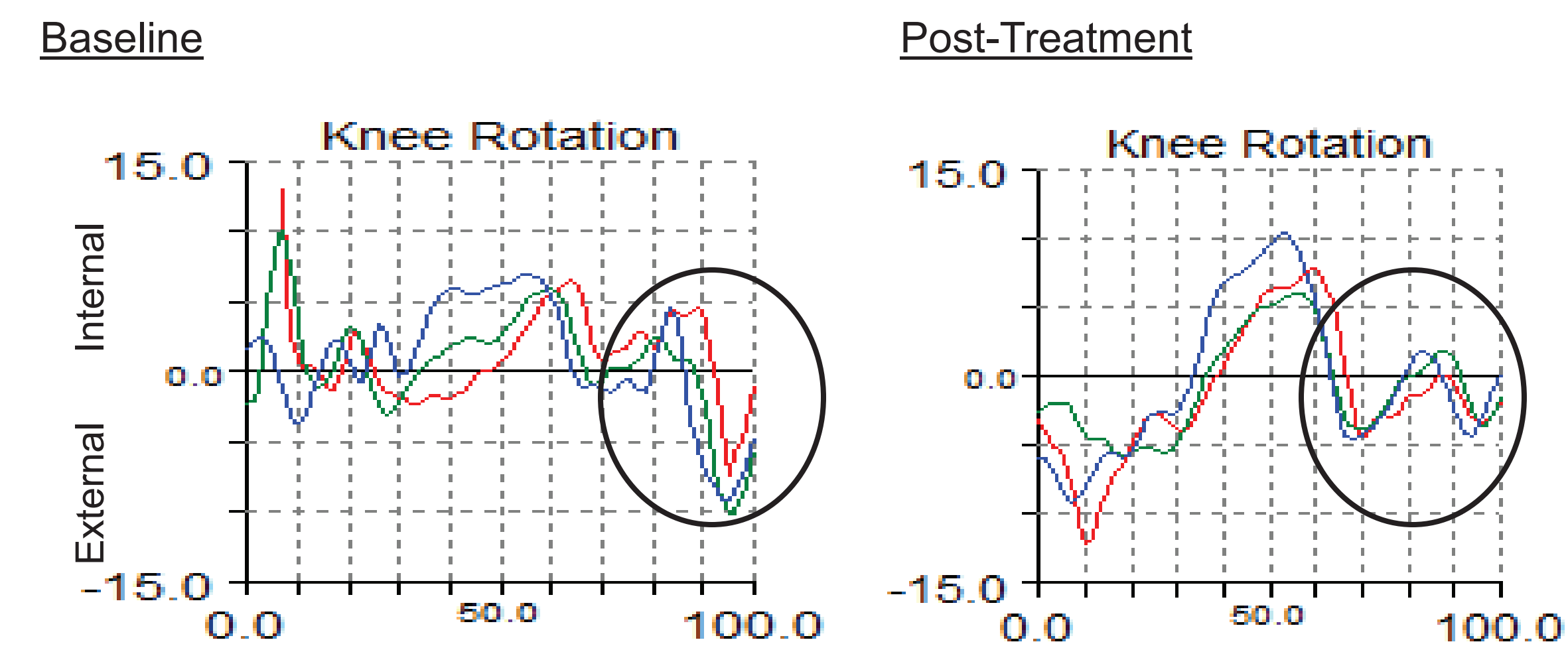
Physical Therapy Functional Screen Scores (Right Knee)



SLB: Single-Leg Balance; WII: Modified Warrior II pose; ALP: Alternating-Leg Push-Off; HH: Hip Hinge; SQ: Squat

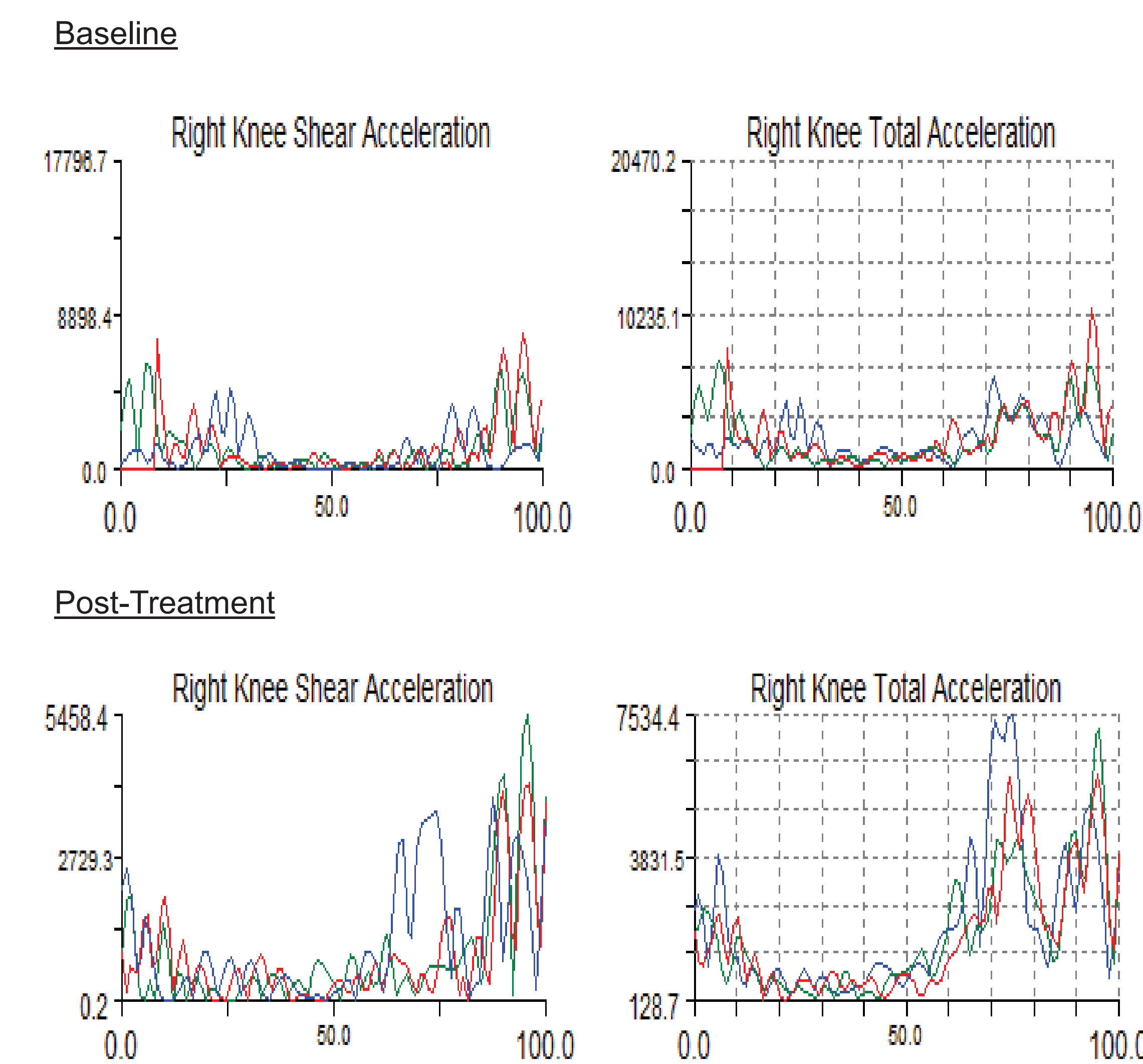
Scores: 0 = Pain during task, 1 = unable to perform task, 2 = with compensation, 3 = without compensation

Right Knee Transverse Plane Kinematics During Ascent and Descent (From a 6-Inch Step)



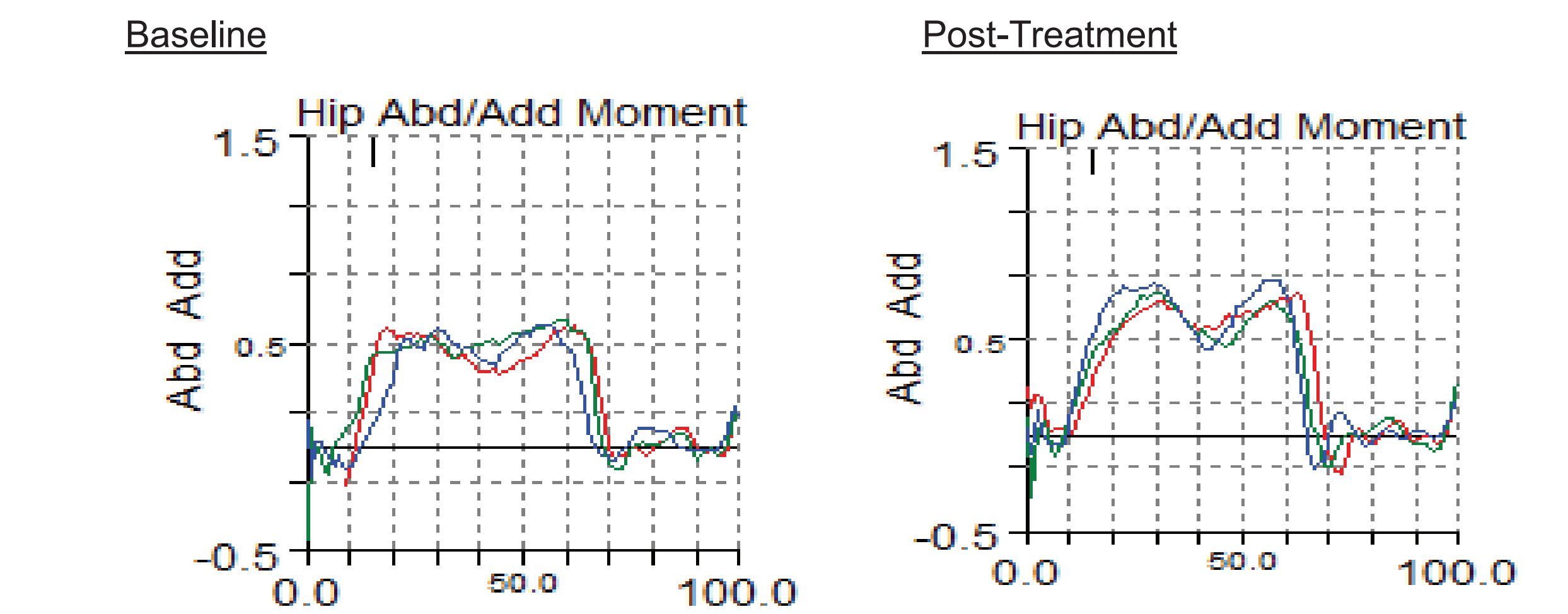
In the baseline testing, there is a rapid change from internal rotation (about 5°) to external rotation (9°) during descent. During the post-treatment, there is less rapid change from internal rotation to external rotation during descent, which may indicate better control.

Right Knee Acceleration During Ascent and Descent (From a 6-Inch Step)



Baseline peak shear acceleration is around **x**, while post-treatment shear acceleration is around **y**. The decrease in acceleration may be attributed to improved neuromuscular control during descent from a 6 inch step after participating in 12 physical therapy visits.

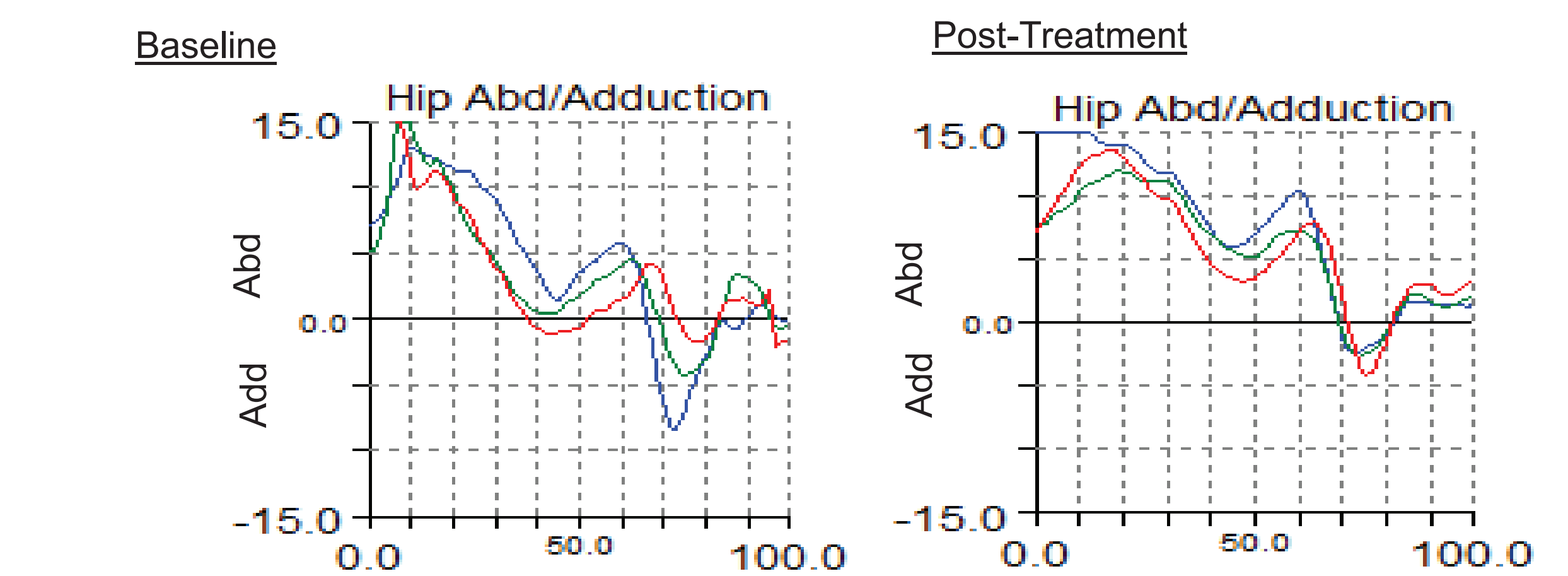
Right Hip Frontal Plane Moments During Ascent and Descent (From a 6-Inch Step)



Unit of measurement

Hip adductor moment improved during stair ascent and descent, attributed to better control of the hip abductor muscles.

Right Hip Frontal Plane Kinematics During Ascent and Descent (From a 6-Inch Step)



Improved control of femoral adduction is noted upon stair descent and variability in trials decreased, demonstrating improved control of the hip abductors muscles.

DISCUSSION

CONCLUSION

REFERENCES