

Anti-Gravity Treadmill and Functional Training for an Army Soldier Following a Femoroplasty and Labral Repair: A Case Report

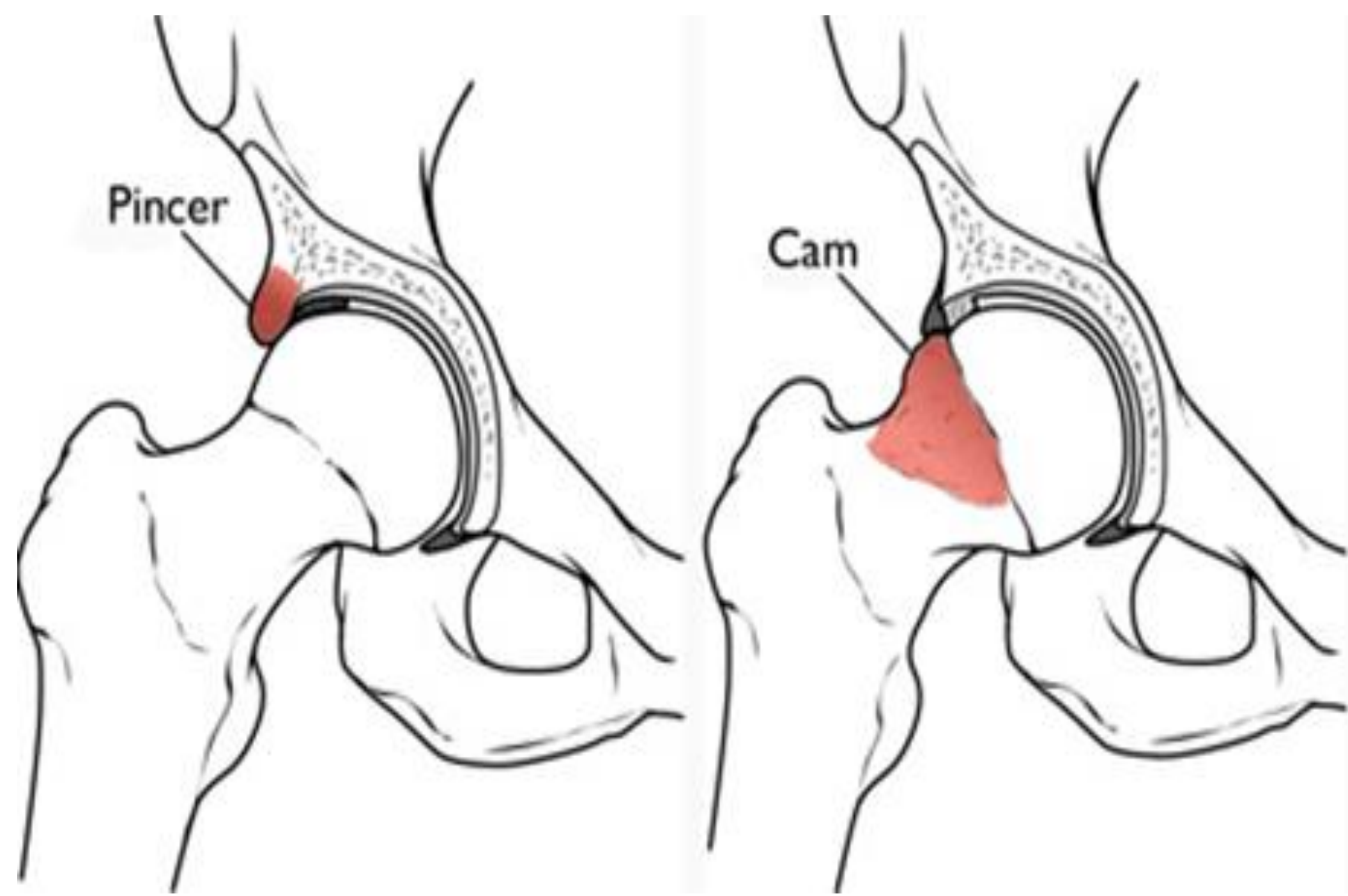
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Background/Purpose

Femoral Acetabular Impingement (FAI) is characterized by three specific types of impingement between the head of the femur and acetabulum. Cam impingement occurs when the head of the femur is abnormally shaped. The head of the femur isn't round, it is more of a pistol grip shape. It's even referred to as a pistol grip deformity. Due to this abnormal shape, the head of the femur cannot move properly in the anatomically designed ball-and-socket joint. The result is a shearing force on the labrum and the articular cartilage. Minimal amounts of articles were found that truly utilized physical therapy to go above and beyond "normal" activities of daily living like walking and negotiating stairs. Therefore the purpose of this case report is focused on learning the effects of higher functioning therapeutic exercise and the effects of the anti-gravity treadmill in the rehabilitation process of a patient diagnosed with FAI following surgery.



Case Description

The patient was a 19 year old male and a member of the United States Military. He experienced a cam-type impingement, which eventually lead to a labral tear and subsequent repair of the damaged acetabular labrum and femoroplasty.

MRI imaging was performed and presented with a left hip labral tear. Surgery was performed in the spring of 2014, in order to repair his torn labrum and shave down the head of the femur to prevent further impingement. His major complaint was his inability to return to boot camp until his injury had been resolved. In order to continue army boot camp the patient must be able to return to an extremely high prior level of function.



Examination

The decision was made to assess muscle performance in order to identify kinematic weaknesses involved post-surgically to the left hip surrounding musculature.



Manual Muscle tests were also utilized to address more specific muscle weaknesses. Major muscles that were affected included the quadriceps musculature, gluteus maximus, gluteus medius, hamstrings musculature, and iliopsoas. Range of motion was assessed by means of goniometric measurements. Overall the patient had significant decreases in range of motion about the left hip.

Integumentary/Pain	Admission	Discharge	Range of Motion/Muscle Performance	Admission	Discharge
Inspection	Deep scarring at lateral incision site	No palpable raised scarring	Hip Flexion	Strength: 3+/5 ROM: 95 degrees	Strength: 5/5 ROM: WNL
Post-operative healing	Incision site: clean and healing well	Incision site: clean and healing well	Hip Extension	S: 3/5 ROM: 10 degrees	S: 5/5 ROM: WNL
Scar Mobility	Hyponobile	Normal	Hip Abduction	S: 3+/5 ROM: 25 degrees	S: 5/5 ROM: WNL
Palpation	Tenderness at lateral hip incision site Grade 2 (pain and apprehension)	Decrease to Grade 0 with occasional days of slight pain(Grade 1)	Hip Adduction	S: Not Assessed ROM: 15 degrees	S: 5/5 ROM: WNL
Pain	7/10 sharp pain at the site of the incision and anterior hip. Best 5/10, Worst 8/10	0/10 pain at rest, Best: 0/10, Worst: 0-1/10 with some vigorous activity	Hip Internal Rotation	S: 4-/5 ROM: 25 degrees	S: 5/5 ROM: WNL
			Hip External Rotation	S: 4-/5 ROM: 30 degrees	S: 5/5 ROM: WNL

Manual Muscle Testing, ROM, balance, pain, gait, and skin integrity at admission and discharge can be seen in the tables below.

Gait and Balance	Admission	Discharge
WB status	WBAT	FWB
Gait	Antalgic, apprehensive with WB, shortened stride length, limited hip flexion and extension	Normal Gait pattern minimal guarding
Single Leg Stance	Unable to perform at this time, will assess balance in future visits	WNL, able to single leg balance on a foam pad for over a minute

Interventions

His initial prescription was set with a frequency of three visits per week for 12 weeks, which was later extended to 18 weeks due to his high functioning requirements.

- Therapeutic exercise started lightly with eccentric straight leg raises assisted by a therapist, hamstring stretches, and clamshell exercises.
- Manual techniques were added to stretch his hip flexors and perform a scar massage over the incision site.
- Patient education was utilized to inform the patient of his pathology, associated healing process, and HEP.
- Modalities (vasopneumatic cold device, electrical stimulation) were used to decrease pain and inflammation

As the patient progressed new exercises were added and also resistance was steadily increased. As ROM and strength improved, balance/proprioception exercises were added. Closed chain exercises were also added as the patient's tolerance improved. The Anti-Gravity treadmill was utilized, in order to normalize the patient's gait pattern and ease his transition into weight bearing activities, such as running. The progression of therapeutic exercises can be seen in the table below.



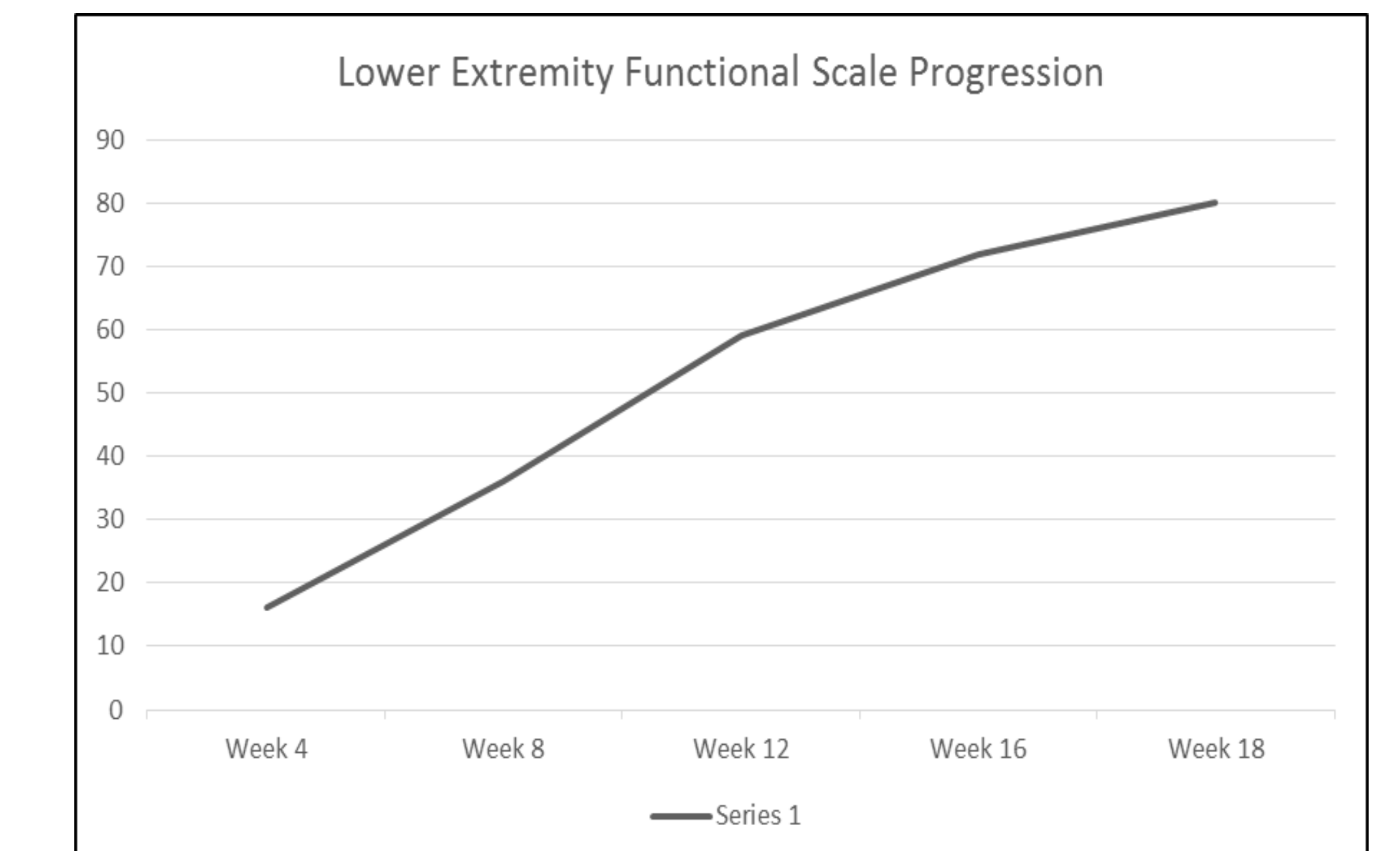
Phase 1:	Short Arc Quads w/bolster, Long Arc Quads (WP), Straight Leg Raise Eccentrics (PT assisted), Hamstring stretch with strap, Gastrocnemius Stretch with strap
Phase 2:	Clamshells (TBP), Straight Leg Raise(WP), Mini squats, Single leg stand (foam progression), Side-lying Hip Abduction(WP), Prone Hip Extensions(WP), Standing Hamstring Curls(WP)
Phase 3:	TRX squats, side-walks (TBP), Resisted leg press machine(WP), Resisted knee extension(WP), Resisted hamstring curls(WP), Anti-Gravity Treadmill (walk to light jog), Step ups, Single Leg Stand on foam
Phase 4:	Progression of Anti-Gravity Treadmill (running), TRX lateral jumps, TRX sliders, TRX jump squats, ladder drills, Single leg squats



Outcomes

The discharge examination showed the patient met or exceeded all therapy goals set forth.

- The patient was able to decrease reports of pain from a 7/10 to a 0/10
- Decrease in tenderness to palpation from a grade 2 to a grade 0 at the time of discharge.
- Increased weight bearing status to full weight bearing with a normal gait pattern.
- CTSIB: Initially unable to perform, Discharge WNL
- LEFS: initial score 16/80, Discharge 80/80
- He also improved all strength and range of motion to WNL.
- At Discharge he was running, performing ladder drills, jumping, squatting, and cutting at full speed with no increases in pain.
- Cleared to return to army boot camp



Discussion

Overall the patient made significant progress in the time frame that was given. Authors such as JA Hessel and Jennie McNee state, in summary, that a combination of manual therapy, stretching, active range of motion, lower extremity strengthening exercise, and gait training are most effective for treating these types of patients post-surgically. Few authors, such as JK Loudon, published articles suggesting conservative treatment for a long distance runner prior to undergoing surgery. He believes this conservative method should involve extensive patient education on body mechanics, strengthening, and manual therapy. He also believed FAI most commonly occurred at end-ranges of hip flexion and adduction, therefore with proper knowledge of running mechanics pain/surgery could be avoided. No articles could be found, stating the effectiveness and use of an anti-gravity treadmill in patients with this diagnosis. With the instructed exercises and interventions provided the patient was able to safely and effectively return to army boot camp. However, additional research in the form of larger RCT trials are needed to establish any causal relationship.