EFFECT OF HIGH INTENSITY INTERVAL TRAINING & TASK SPECIFIC TRAINING FOR STATUS POST KNEE REPLACEMENT

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INTRODUCTION:

A key factor in preserving mobility and independence in later years is maintaining the fitness capacity (e.g. strength, endurance, agility, and balance) needed to perform normal everyday activities—to do simple housework, climb steps, lift and carry objects, get in and out of chairs or transportation vehicles, and walk far enough in and around stores, buildings, and parking lots to do one's own shopping and errands. Unfortunately, limited information is available regarding the fitness level needed for maintaining physical independence, particularly information that is easily interpreted by most health professionals, program leaders, or by older adults themselves.[2] Preventing or delaying the onset of physical frailty is an increasingly important goal because more individuals are living well into their 8th and 9th decades.[3] Tests of functional ability for patients recovering from TKA cannot differentiate the contribution of each limb to performance outcome. A test of unilateral limb ability would provide a metric for assessing the surgical lower extremity, without the confounder of the status of the contralateral lower extremity. The SST is a reliable measure between testers and a valid and responsive test of activity limitations when assessing unilateral lower extremity impairments in patients after TKA.[1]

HISTORY:

Patient recently referred to skilled outpatient PT services (04/17/19) secondary to Quadriceps and LE Strengthening S/P R TKA (July 2, 2018); Pt performed 14 repetitions on the 30 Second Sit to Stand Test; Scores less than 8 (unassisted) stands were associated with lower levels of functional ability; Age matched norms for 60-64 Y/O is (12-17) repetitions; Pt performed 49 repetitions on the 2 Minute Step Test; Age matched norms for 60-64 Y/O is (75-107 Repetitions); Pt performed the Single Step Test and completed (20 repetitions) for the L LE (non-operative) within (45.56 seconds) and completed (20 repetitions) for the R LE (operative) within (46.44 seconds); Norms for 3 months surgical is (21.8 seconds) and non-surgical (20.7 seconds).

Medical History: R TKA (July 2, 2018).

Informed consent was obtained by the patient prior to inclusion into this case report.

EXAMINATION:

PLOF: Pt resides in a SSH with family; No stairs or steps to navigate; Pt has a ramp to enter home; Pt is Independent with all functional mobility and driving; Pt states having increased difficulty with community ambulation secondary to pain to R Knee and fatigue and will sit down to rest as needed; Pt states having difficulty with tasks around the house such as carrying groceries from her vehicle to the kitchen of the home secondary to pain to R Knee and balance deficits; Pt does not report any falls within the past 3 months.

Pain Assessment: Pt reports (5/10) pain to R Knee with activity.

OBJECTIVE TESTS & MEASURES		
Test Performed	*Evaluation Score*	*Interpretation*
30 Second Sit to Stand Test	14 Repetitions	Age Matched Norms: 12-17 Repetitions
2 Minute Step Test	49 Repetitions	Age Matched Norms: 75-107 Repetitions
Single Step Test	• L LE (Non-Operative): 20 Repetitions within (45.56 seconds)	Norms for 3 months S/P surgery: • Non-Operative: 20 Repetitions within (20.7 seconds)
	• R LE (Operative): 20 Repetitions within (46.44 seconds)	• Operative: 20 Repetitions within (21.8 seconds)

INTERVENTIONS:

- Manual therapy consisting of moist heat applied to R Knee followed by retrograde massage with use of biofreeze to facilitate elimination of pain.

- Seated B LE Omni Cycle performed for 15 mins on Ortho Setting to increase functional strength and tolerance to facilitate increased participation with functional tasks with resistance at 14 watts. Activity level at 99% and distance at 3.7 km at conclusion of 15 min trial.

- Gait training consisting of Pt performing a 6 min walk around 2 cones placed approximately 35’ apart; Pt instructed to ambulate around cones as fast as possible and to complete as much distance as possible; 35’ utilized for distance secondary to room available within gym; 3 min rest break given at conclusion of activity; Placed 3# on LE’s to increase resistance with activity as a progression of activity with success.

- Circuit training consisting of high intensity interval training; Circuit consisted of 2 min Step Test with 2# ankle weights, 30 second Sit to Stand Test while holding orange weighted ball and Single Step Test (30 seconds for each LE) with 2# ankle weight and with patient performing test on 18” step with H/R for external support. 2 rounds performed with a 45

second break following the 2 min step test and a 30 second break following all other activities; At conclusion of 1st round a 4min rest break given.

- B LE bridging with patient supine and LE's atop red physioball; Physioball supported by therapist for stabilization; Single leg bridging with patient supine on mat; Pt performed (2x10) to increase hip extensor strength to facilitate increased functional strength to assist with functional independence.

- Standing B LE Ther Ex consisting of closed chain exercises for (3x10) with 4#; Activities consisted of B LE Hip Flexion, Hip Abduction, Knee Flexion and Heel Raises with HHA for external support as needed.

- Task specific training geared towards Limits of Stability and Ankle Strategy activities to increase Anticipatory Postural Control and Reactive Postural Response to increase functional strength, tolerance and standing dynamic/standing balance to reduce risk for falls while in the community. Activities performed consisted of ball toss with use of rebounder (2# ball) with patient standing on balance pad for (3x15).

- Single leg step training with R LE placed on a 12' step with Pt utilizing no H/R for external support and Pt placing L LE on/off step for strength training purposes for (3x10); Added 3# to B LE for increased resistance.

- Balance training consisting of SLS with HHA for external support as needed; Pt performed 3x trials of 20 seconds for R & L LE.

- Balance training consisting of standing on foam pad with no external support with eyes closed for 3 trials of 15 seconds; balance training consisting of semi-tandem standing on foam block with no external support with eyes opened for 3 trials of 15 seconds; balance training performed to facilitate increased proprioception and to increase functional strength and dynamic balance.

- Gait training consisting of tandem walking on a line marked on the floor for 15'; Side stepping R<--->L for 15', Grape vine walking R<--->L for 15', Reverse walking for 15'; All gait training performed to facilitate increased proprioception and facilitate increased balance; 3x trials performed for each activity.

- Sit<--->Stand transfer training performed at EOM with no external support for (3x15) with emphasis on concentric and eccentric control to facilitate increased functional strength to facilitate increased functional independence with mobility tasks; Pt performed functional transfers while holding a 5# weighted ball for increased weight to facilitate increased strength gains as a progression.

OUTCOME:

OBJECTIVE TESTS & MEASURES			
Test Performed	*Evaluation Score*	*Interpretation*	*Discharge Score*
30 Second Sit to Stand Test	14 Repetitions	Age Matched Norms: 12-17 Repetitions[4]	20 Repetitions
2 Minute Step Test	49 Repetitions	Age Matched Norms: 75-107 Repetitions[4]	106 Repetitions
Single Step Test	L LE (Non-Operative): 20 Repetitions within (45.56 seconds)	Norms for 3 months S/P surgery:[1] Non-Operative: 20 Repetitions within (20.7 seconds)	L LE (Non-Operative): 20 Repetitions within (26.18 seconds)
	R LE (Operative): 20 Repetitions within (46.44 seconds)	Operative: 20 Repetitions within (21.8 seconds)	R LE (Operative): 20 Repetitions within (27.22 seconds)

DISCUSSION:

- Pt was evaluated on (05/03/19) with the above aforementioned scores from 3 Objective Test & Measures as described; The 3 tests were chosen to address B LE Strength/Endurance (30-Second Sit to Stand Test), Cardiovascular Endurance (2 Minute Step Test), and strength of the quadriceps in a concentric and eccentric repetitive contraction in a unilateral functional task S/P TKA (Single Step Test); After completing the evaluation the patient was treated 3x per week for 3 weeks for a total of 9 visits with D/C on (05/30/19); Treatment encounters focused on treatment days of Monday & Friday to emphasize HIIT (High Intensity Interval Training) and Wednesday to emphasize balance and strength training.
- All treatments were initiated with manual work consisting of moist heat to R Knee followed by myofascial release to R Knee with utilization of biofreeze for pain management.
- Monday & Friday treatments then utilized a circuit consisting of task specific training within the HIIT:

HIIT Circuit Training	Progression (2nd Week & 3rd Week)
2 Minute Step Test	2 Minute Step Test
60 Second Rest Break	45 Second Rest Break
30 Second Sit to Stand	Added orange weighted ball for Pt to carry while performing activity for increased resistance.

HIIT Circuit Training	Progression (2nd Week & 3rd Week)
45 Second Rest Break	30 Second Rest Break
Single Step Test (R) LE	Added 2# to LE for increased resistance.
45 Second Rest Break	30 Second Rest Break
Single Step Test (L) LE	Added 2# to LE for increased resistance.
4 Minute Rest Break	4 Minute Rest Break
Cycle Repeated (Total of 2 Rounds Completed)	Cycle Repeated (Total of 2 Rounds Completed)
B LE Omni Cycle for 15 Minutes at 14 Watts Resistance	B LE Omni Cycle for 15 Minutes at 14 Watts Resistance

- Wednesday treatments focused on cardiovascular conditioning, standing static/dynamic balance training and LE strengthening; Activities described above within interventions.
- Clinically I did not believe that the patient would achieve her age matched norms for the 2 Minute Step Test (75-107 repetitions) based on the fact that the patient performed (49 repetitions) at time of evaluation; What really expedited the score was while performing the D/C test, I allowed for the patient to see a running timer so she knew how much time was left on the test; I also wrote down what her goal was (75-107 repetitions) on a dry erase board for her to view while performing the test; Lastly I counted out the repetitions as she was performing the test and gave max V/C's for encouragement; It really assisted the patient in achieving the score she completed (106 repetitions); While performing the 2 Minute Step Test within the HIIT Circuit we did not count repetitions and I did not give her maximum encouragement; V/C's were given for time simply stating she had time remaining at 60 seconds left and 30 seconds left; The visual feedback of the timer and goal to achieve encouraged the patient to perform the test at her maximum effort; For next test I will be sure to implement the same testing conditions for evaluation and discharge testing.
- Overall the patient was pleased with the results from her treatments; Although the patient did not meet the age matched norms for the Single Step Test she was able to achieve and exceed her age matched norms for the 30 Second Sit to Stand Test and for the 2 Minute Step Test.
- Pt did go on to state that she felt a sense of increased confidence with her functional abilities within the community; Pt stated that she was now able to ambulate within the grocery store and no longer needs to utilize the electric cart and that she is now able to carry her groceries on her own from her vehicle to the inside of her home.

CONCLUSION:

- Pt made consistent progress with all STG's and LTG's within the POC; Pt was able to increase B LE Strength from (4/5) grossly at time of evaluation to (5/5) grossly at time of D/C; Pt improved score on the 30 Second Sit to Stand Test from (14 repetitions) at time of evaluation to (20 repetitions) at time of D/C; At time of evaluation Pt was in her age matched norms for number of repetitions (12-17 repetitions for Female aged 60-64 Y/O); At D/C Pt had exceeded her age matched norms; Pt improved score on the Two Minute Step Test from (49 repetitions) at time of evaluation to (106 repetitions) at time of D/C; Scores of less then (65 repetitions) were associated with lower levels of functional ability; Pt was able to reduce time on performance of the Single Step Test from (45.56 seconds) for her L LE at time of evaluation to (26.18 seconds) for her L LE at time of D/C; Pt was able to reduce time on performance of the Single Step Test from (46.44 seconds) for her R LE at time of evaluation to (27.22 seconds) for her R LE at time of D/C.
- Additionally, Pt self reported that she has increased her endurance and safety within the community; Pt states that she is now able to walk within the grocery store without having to utilize an electric chair to do her shopping; Pt states that she is now able to carry her groceries by herself from her car to the inside of her home.

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