CASE REPORT

The Exclusion of "Bed Exercises" for Patients Following a Total Knee Arthroplasty (TKA) and its Effect on Functional Outcomes

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ABSTRACT

Background: The plan of care for patients following total knee arthroplasty (TKA) often entails functional retraining and "bed exercises." Existing research demonstrates that the inclusion of "bed exercises" to a treatment plan focused on functional retraining does not produce significant improvements in outcomes for patients post hip arthroplasty.[5,11] This case report aims to determine whether functional retraining, without the addition of "bed exercises," is an appropriate intervention strategy for a patient status-post TKA. ***Case Description:*** The subject of this case report was a 5'2", 76 year old woman, weighing 202 pounds, who underwent an elective TKA secondary to osteoarthritis. At initial evaluation, the patient required moderate to maximal assistance with functional skills, as scored by the Iowa Level of Assistance Scale (ILAS)[9]. Active range of motion (AROM) of her knee was 10°-85°. Physical therapy interventions focused on functional retraining to increase the patient's knee ROM and strength and decrease activity limitations to facilitate a safe return to her home. ***Outcomes:*** The patient's improvements were evident in decreased ILAS scores from 32 to 13 in 4 days and a discharge home, bypassing a stay in sub-acute rehab. Knee ROM improved to 0°-105°. Observational gait analysis improvements included a step-through gait pattern, appropriate heel strike bilaterally, increased stance time on the involved extremity, and an improved weight shift throughout the gait cycle. ***Conclusion:*** This case report supports 1) eliminating "bed exercises;" and 2) emphasizing functional retraining to maximize patient outcomes and the delivery of cost-effective care.

Background

Total knee arthroplasty (TKA) is one of the most common surgical interventions performed in the United States.[3] Despite the volume of patients receiving physical therapy after surgery, there is not a consistent physical therapy "protocol" for effective treatment of these patients.[4] The widely available programs differ in functional tasks performed, frequency of sessions, exercises and the overall therapeutic progression for these patients.[3] A typical plan of care for these patients often include continuous passive motion (CPM) machine use, a gait-training program, therapeutic exercises performed with the patient in bed (i.e. "bed exercises") and functional retraining such as bed mobility, transfer training and gait training.[4] The use of this combination of strategies has consistently resulted in improvements in mobility and overall function for patients after TKA.[11] Until recently, few studies have examined the efficacy of each individual strategy on the patient's overall outcome.[5,10,11]

Recent research has indicated that CPM use does not result in any added benefit to a patient's functional outcomes for up to one year post operation.[2,8] Furthermore, current research has demonstrated that "bed exercises," which typically consist of the exercises listed in Table 1, do not

demonstrate any significant benefit in functional outcomes for patients already receiving gait-training and functional retraining after a total hip arthroplasty.[5,10,11] Though the two surgical interventions are very different (i.e. TKA versus THA), similar bed exercises are utilized during the treatment sessions. If bed exercises were found to add no additional value to the post-operative intervention strategy, then elimination of these exercises would allow for more time to be spent on the patient's functional mobility.[5] Furthermore, if "bed exercises" are found to add no benefit to patient outcomes, then insurance companies may no longer reimburse physical therapists for this intervention strategy. Therefore, the purpose of this case report is to determine if functional retraining (i.e. bed mobility, transfer training and gait training), without the addition of "bed exercises," is an appropriate intervention strategy for patients post TKA.

Case Description

The patient chosen for this case report is a 76-year-old female admitted to the hospital for an elective right TKA, due to failed conservative treatment. The patient is 5' 2" tall and weighs 202-pounds with the following medical comorbidities: osteoarthritis, atrial fibrillation, bladder dysfunction, diabetes (type II), hypercholesterolemia, hypertension, sleep apnea & hypothyroidism. The aforementioned diagnoses have been managed appropriately for several years via prescribed medications. Based on the surgeon's report, radiographs demonstrate severe arthrosis of the right knee. Prior to surgery, the patient's right knee range of motion was 120° of flexion with full extension (i.e. 0°), as notated by the surgeon per surgical documentation.

Prior to admission, the patient functioned independently and reported walking 2-3x/week, despite her persistent knee pain, as part of a conservative plan of care. In addition, the patient was instructed to perform hamstring stretches and straight leg raises. The patient reports non-compliance with the conservative plan of care due to knee pain. Though the patient reports exercising, her overall health can be considered poor, due to her body mass index (BMI) of 36.9kg/m^2 and extensive comorbidities. The patient is retired and lives alone in a ranch-style home, with two steps to enter & exit the residence. The patient's niece will be available to assist for two weeks after the patient's discharge from the acute care hospital. The patient's stated goal was to return to her prior level of function without limitations due to pain. In addition, the patient stated that she would like to avoid a sub-acute rehabilitation stay, as she has several cats at home awaiting her return.

The examination process was completed by a student physical therapist, under the guidance and supervision of a licensed doctor of physical therapy. The examination procedure began with the patient in semi-fowler's position with the following equipment: anti-embolic devices, cryo-cuff, indwelling catheter, nasal canula (2L of 0_2), PCA pump, knee immobilizer, and an On-Q pump. The bed was lowered and rails removed to accurately portray the conditions the patient will face in her own home.

The Iowa Level of Assistance Scale (ILAS) was utilized to quantify the level of assistance the patient required throughout her stay in the acute care facility. The ILAS[9] is an outcome measure (Table 2), specifically designed for both the acute care setting and for patients who are post-operative total hip/knee arthroplasty (THKA). The outcome tool looks at four functionally related activities, which play a crucial role in determining post acute care status and transfer destination. In addition,

the ILAS assigns a score for the level of assistance required for each of the functional tasks and the assistive device utilized (Table 4). During the examination procedure, the patient required moderate assistance with bed mobility and maximum assistance to perform a sit to stand transfer. Furthermore, the patient required maximum assistance and a rolling walker to ambulate to her bedside recliner (approximately 6'). Based on initial mobility and assistance requirements, it was deemed unsafe and unnecessary to attempt ascending and descending stairs during the examination.

Range of motion measurements were taken with a goniometer on the involved lower extremity, both actively and passively utilizing standard goniometric landmarks. Measurements were taken on the day of the initial exam and 1x/day during her stay in the acute care hospital. The patient demonstrated 85° of knee flexion, and lacked 10° of full extension on the surgical side during the initial examination. With passive over pressure at end-range, the patient was able to achieve 88° of knee flexion, and lacked 8° of full knee extension measures, with noted muscle guarding due to pain.

Due to the patient's post-surgical status, true manual muscle testing was not performed. Gross assessments of strength, with the patient at the edge of the bed, were performed as appropriate. As seen in Table 3, the patient demonstrated generalized muscle weakness on the surgical side, as expected. It should be noted that she demonstrated proximal weakness on the non-surgical side, which is likely due to her sedentary lifestyle and advanced age. Though no appreciable strength gains were expected to be made through hypertrophy of the weak musculature, strength measures were assessed as a baseline measure, as muscular activation and recruitment can improve through functional retraining.

The patient was able to ambulate approximately six feet with a rolling walker, requiring maximum assistance. She demonstrated an antalgic gait pattern, characterized as a step-to gait with the absence of an appropriate heel strike bilaterally. In addition, the patient ambulated with a forward-leaning trunk posture and displayed minimal weight shifting over the right lower extremity, due to her high level of pain. Furthermore, the patient demonstrated inconsistent gait sequencing; however, due to patient's post-surgical status and limited mobility, a correct gait pattern was unable to be established via verbal cueing.

After the examination procedure, the clinical impression was that the patient would benefit from a stay at a sub-acute rehabilitation facility. Due to the assistance required for functional mobility and her niece's inexperience, the patient's safety in returning home was the primary concern. Despite her initial presentation, the patient was highly motivated to return home and to walk out of the hospital. She was, however, able and willing to spend some time in a sub-acute rehabilitation hospital, if deemed necessary.

The patient was informed she would benefit from continued skilled physical therapy after discharge from acute care to attain her goal of a full recovery. Home health physical therapy and sub-acute rehabilitation were both discussed with the patient, following the examination procedure, and the decision would be made based on her progress during her acute care stay. Due to the patient's rather sedentary lifestyle prior to her surgery, she was likely to regain her prior functional ability. However, our ultimate goal was for the patient to exceed her prior level of function and be able to participate in a regular exercise program without pain.

Based on the initial examination, realistic goals for this patient, while in acute care, would be to achieve the following functional potentials: 1) score 14 or less on the ILAS, indicating significant advancement in functional mobility; 2) have sufficient bilateral strength and knee range of motion to enable the patient to perform transfers, gait on level surfaces and stairs with modified independence; and 3) have adequate knee range of motion to allow for a proper heel strike on the involved lower extremity, so she could ambulate with a normal stride length and cadence.

The plan of care for this patient included: 1) educating the patient on the nature of her condition; 2) safety training; 3) therapeutic exercises promoting range-of-motion; 4) strengthening through function; and 5) functional retraining. While in the hospital, she would be seen twice per day for physical rehabilitation, before and after lunch. In addition, she would be seen for occupational rehabilitation for one hour per day to work on activities of daily living (ADLs). The treatment team included one Doctor of Physical Therapy (DPT), one Student Physical Therapist (SPT) and one Occupational Therapist (OT).

Two commonly utilized intervention strategies, continuous passive motion (CPM) machine and "bed exercises," were not added to her treatment plan. Recent research has demonstrated that the use of a CPM shows "no significant advantage in terms of improving function or range of movement" for up to one year.[8] Additionally, Jesudason et. al.[5] and Smith et. al.[10,11] both demonstrated that the use of "bed exercises" do not significantly improve range of movement or functional outcomes for total hip arthroplasty patients. Furthermore, the exclusion of "bed exercises" did not affect or alter the patient's length of stay or influence complication rates for up to one-year post operation.[10] Based on the literature review, we opted to utilize the available treatment time for more functionally relevant tasks, as these tasks tend to be more crucial in determining the patient's discharge destination as well as her length of stay. The achievement of these functional tasks is paramount for a safe transition back to one's home. In addition, Badholm et. al.[1] points out the effectiveness and the rationale for earlier, more intensive treatment strategies.

The patient participated in skilled physical therapy services twice per day. Each session lasted forty-five minutes to one hour with a DPT and SPT. Her episode of care lasted four days. Treatment sessions were adapted and advanced during each session, based on patient's performance as seen in Table 5.

Outcomes

Discharge planning for this patient began immediately following the examination procedure. The patient stated that she did not want to attend sub-acute rehabilitation after her acute care discharge; however, she would participate if deemed necessary. This remained a motivating factor throughout her acute care stay. Home health physical therapy and sub-acute rehabilitation placement were both discussed with the patient at length. Parameters for each option were made clear to the patient, and goals were developed with the patient to avoid placement in a sub-acute care facility.

The patient was reassessed at post-operation day three. She was able to increase her range of motion to 105° knee flexion, with full knee extension. The patient was also able to demonstrate improved muscular recruitment (Table 6), due to diminished effects of the nerve block and/or significant reduction in pain, allowing for an improved muscular contraction. In addition, as seen in Table 4, the patient was able to perform bed mobility independently. Furthermore, she was able to perform a sit to stand transfer, ambulate for

Table 1: Typical "bed exercise" program

Bed Exercises
Ankle pumps
Short-arc Quads
Quad sets
Straight-leg Raise
Heel Slides

Table 2: Iowa Level of Assistance scale scoring parameters for the level of assistance (top) and the assistive device (bottom)[3]

Scoring Level of Assistance

GRADE	IMPLICATION	DEFINITION
6	Not Tested	Pt not tested due to reasons of safety
5	Failure	Activity attempted but not completed
4	Maximal Assistance	PT(s) provide a total of 3(+) points of contact
3	Moderate Assistance	PT(s) provide a total of 2 points of contact
2	Minimal Assistance	PT provides one point of contact
1	Stand-by Assistance	PT would not feel comfortable leaving the pt
0	Independent	PT could leave room and pt complete task safely

Scoring Assistive Device

GRADE	IMPLICATION
5	Standard/Rolling Walker
4	Two Axillary Crutches
3	Two Loftstrand Crutches
2	Two Canes
1	One Cane/Axillary Crutch
0	No Assistive Device

Table 3: Gross strength assessment results at initial examination

	(R)	(L)
Hip Flexion	3	4
Hip Extension	3	3
Hip Abduction	3	4
Hip Adduction	3	4
Hip Internal Rotation	3	4
Hip External Rotation	3	4
Knee Flexion	---	5
Knee Extension	---	5
Ankle Dorsiflexion	5	5
Ankle Plantar Flexion	5	5

Table 4: ILAS assessment scores per session throughout the patient's LOS

	TASK	Level of Assistance	Assistive Device	
Examination	Supine <> EOB	3		3
	Sit <>Stand	4	5	9
	Ambulation (15')	4	5	9
	3 Stairs (↑ & ↓)	6	5	11
				32

	TASK	Level of Assistance	Assistive Device	
Day 1 Post-op	Supine <> EOB	1		1
	Sit <>Stand	2	5	7
	Ambulation (15')	2	5	7
	3 Stairs (↑ & ↓)	6	5	11
				26

	TASK	Level of Assistance	Assistive Device	
Day 2 Post-op	Supine <> EOB	0		0
	Sit <>Stand	1	5	6
	Ambulation (15')	1	5	6
	3 Stairs (↑ & ↓)	3	5	8
				20

	TASK	Level of Assistance	Assistive Device	
Day 3 Post-op	Supine <> EOB	0		0
	Sit <>Stand	1	0	1
	Ambulation (15')	1	5	6
	3 Stairs (↑ & ↓)	1	5	6
				13

Table 5: Treatment sessions; day 1 to day 3 (discharge) with gait training details and observational gait analysis. (*) Indicates family training

	Session	Therapeutic Exercises	Functional Retraining	Gait Training	Distance & Device
Day 1 Post-op	1[a]	① PROM/AAROM knee flexion and extension stretch	❶ Bed Mobility ❷ Sit-to-Stand	○ AD use/sequencing ○ Facilitate weight shift	• 20' • Rolling Walker
	2[b]	① ② Standing weight shifts ③ Long-arc quad	❶ & ❷	○ AD use/sequencing ○ Promote knee flexion ○ Facilitate heel strike	• 35' • Rolling Walker
Day 2 Post-op	3[c]	①, ② & ③ ④ Standing hip aBd & ext	❶ & ❷ ❸ Stairs	○ Progression of distance ○ Circumduction	• 56' x 1 & 22' x 1 • Rolling Walker
	4[d]	①, ②, ③ & ④ ⑤ Marching	❶, ❷ & ❸*	○ Progression of distance ○ Decreasing assistance ○ Family training	• 150' • Rolling Walker
Day 3 Post-op	5[e]	①, ②, ③, ④ & ⑤ ⑥ Standing calf-raises	❶, ❷ & ❸*	○ Progression of distance ○ Decreasing assistance ○ Family training	• 175' • Rolling Walker

[a] Improved posture this session, however, continues to demonstrate an antalgic gait with the following characteristics; circumduction of (R) LE, decreased heel strike and stance time of (R) LE, forward posture and bent (R) knee throughout gait cycle.
[b] Continues to demonstrate an antalgic gait but able to correct/improve her heel strike and elimination of circumduction with verbal/tactile cues.
[c] Continues to demonstrate flexed (R) knee throughout gait though improved. In addition, she ambulates with inconsistent heel strike and stance time of (R) LE. She continues to demonstrate circumduction of (R) LE, however, able to correct with verbal/tactile cues.
[d] Increased distance this session with improvements in (R) heel strike and stance time. She was able to eliminate the circumduction of (R) LE from her gait this session demonstrating significant improvements in weight shifting over involved LE.
[e] Improved the quality of her gait as demonstrated by her progression to a step-through gait pattern, a proper heel strike bilaterally, increased stance time on the involved extremity and an improved weight shift throughout the gait cycle.

Table 6: Gross strength assessment at discharge

	(R)	(L)
Hip Flexion	4	4
Hip Extension	3+	3+
Hip Abduction	4	4
Hip Adduction	4	4
Hip Internal Rotation	4	4
Hip External Rotation	4	4
Knee Flexion	3+	5
Knee Extension	3+	5
Ankle Dorsiflexion	5	5
Ankle Plantar Flexion	5	5

at least fifteen feet, and ascend/descend three steps, requiring no more than stand-by assist. Despite her significant functional advancements, she required the use of a rolling walker for ambulation to improve her balance and facilitate an appropriate weight shift during gait cycle. Furthermore, she utilized the rolling walker while ascending/descending stairs. Because the stairs leading into the patient's house were railed only on the right side, the rolling walker was used, as a second hand hold, to improve the quality and safety of her gait. During the final session, the patient improved the quality of her gait, progressing to a step-through pattern with minimization of lower extremity circumduction, enabling a proper heel-strike on the involved side.

Since the patient met all of the aforementioned goals, and her niece was available to assist her at home, the patient was discharged home with home health physical therapy. Prior to her discharge, two sessions were devoted to teaching the patient's niece to safely assist her, as necessary. Based on the patient's functional status at discharge, the niece only needed to provide supervision for safety during prolonged ambulation and stair navigation. In addition, a home exercise program was prescribed to the patient, promoting weight-bearing activities to advance functional gains. These exercises included standing alternating hip abduction, hip extension and hip/knee flexion (i.e. marching), standing calf raise, and long-arc quads. These exercises were prescribed to empower the patient with her rehabilitation prior to her home health physical therapy consult.

Discussion

For this case report, the patient was medically stable and presented with enough active movement and strength of bilateral lower extremities to justify performing functional tasks and weight bearing activities. Because the patient's ultimate goal was to return home, physical therapy interventions focused on addressing the patient's activity limitations, which subsequently facilitated improvements with her specific impairments (range of motion, strengthening through function, and functional retraining). These activities 1) improve the healing process; 2) decrease the likelihood of developing bedsores; 3) are functionally relevant for the patient; and 4) remain crucial to post acute care discharge planning. The results of this study echo outcomes produced by Jesudason et. al.[5] and Smith et. al.[10,11] further reinforcing the elimination of bed exercises from post THKA in favor of more functionally relevant tasks.

Limitations to this case report include the lack of an assessment of the patient's feelings toward her individual plan of care. Smith et. al.[11] found that patients tend to feel empowered when given exercises to perform on their own. In hindsight, an outcome tool, such as the short-form 12 or 36, would have been beneficial to examine and include in this report.

Furthermore, it should be noted that the patient attended the pre-surgical educational sessions offered through the acute care hospital. These sessions educate the patients on what to expect after the surgical procedure and encourage patients to exercise, prior to their respective surgical dates, to develop lower extremity strength. This case report does not address the patient's compliance with the pre-surgical exercise program. Jones et al. [7] concluded that a patient's preoperative status has a direct correlation with post-operative function. Because the patient's prior level of function is reported without a verification process during the initial examination procedure, a true assessment regarding pre-operative functional ability, versus post-

operative functional ability, is impossible to complete.

Conclusion

Physical therapists have felt an increased push, from health insurance companies, to utilize valid outcome measures to justify compensation for individual treatment strategies. These outcome measures provide physical therapists with the ability to demonstrate a direct cause and effect relationship between various intervention strategies, in relation to a patient's outcomes.[6] This push has led to research focused on individual treatment strategies and their effectiveness. Based on current evidence, [5,10,11] bed exercises do not add any additional value to patient outcomes if the patient is already receiving functional retraining post-op THA; consequently, health insurance companies may end reimbursement for these activities in the future. This case report supports the elimination of bed exercises for TKA patients in favor of placing more emphasis on functional retraining tasks. Further research should be conducted to determine, unequivocally, whether bed exercises are beneficial for TKA patients.

Despite the research, there are instances where bed exercises are appropriate and necessary. For example, patients that were not functioning independently prior to surgery may require more assistance to achieve a weight bearing status, rendering bed exercises a beneficial use of the patient's time. Furthermore, patients that are medically unstable for weight bearing/ambulatory tasks would also benefit from the aforementioned strategies, to prevent blood clots, and to develop lower extremity range of motion and strength.

Because of the vast differences in patient presentation from one day to the next in the acute care setting, it is crucial that the therapy team reassess and modify the treatment program based on the individual's presentation, and not based on "protocol."

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