Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies ***NLM ID:*** *101716117*

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Index Copernicus value = 85.10

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Effectiveness of Early Mobilization after Total Knee Replacement

Gavireddy Naga Srinivasa Rao

Associate Professor, Department of Orthopedics, Krishna Mohan Medical College & Hospital, Mathura, Uttar Pradesh, India

ABSTRACT:

Background: Total knee replacement (TKR), also known as total knee arthroplasty, is a common surgical procedure performed to alleviate pain and improve function in patients with severe knee osteoarthritis This study aimed to evaluate the effectiveness of early mobilization within 24 hours after total knee replacement (TKR) compared to standard care. **Methods:** A prospective, randomized controlled trial was conducted with 154 patients undergoing primary TKR. Participants were randomly assigned to either early mobilization (n=77) or standard care (n=77) groups. The primary outcome measure was functional recovery assessed by the Timed Up and Go (TUG) test. Secondary outcomes included knee flexion range of motion, pain intensity, quadriceps strength, WOMAC scores, length of hospital stay, and post-operative complications. **Results:** The early mobilization group demonstrated significantly better TUG test scores at all post-operative time points ($p<0.001$). At 6 weeks post-op, the early mobilization group showed superior outcomes in knee flexion ROM (mean difference: 5.5°, $p=0.002$), pain intensity (mean difference: -0.7, $p=0.008$), quadriceps strength (mean difference: 1.7 kg, $p=0.017$), and WOMAC scores (mean difference: -5.2, $p=0.001$). The early mobilization group had a significantly shorter hospital stay (3.2 vs. 4.5 days, $p<0.001$) with no increase in post-operative complications. **Conclusion:** Early mobilization after TKR is associated with improved functional recovery, better secondary outcomes, and reduced length of hospital stay without increasing complication rates. These findings support the implementation of early mobilization protocols as part of comprehensive post-TKR care strategies to enhance patient outcomes and potentially reduce healthcare costs.

Keywords: Total knee replacement (TKR), Randomised trial, WOMAC score, knee flexion ROM

Received: 11 April, 2020 Accepted: 16 May, 2020

Corresponding author: Gavireddy Naga Srinivasa Rao, Associate Professor, Department of Orthopedics, Krishna Mohan Medical College & Hospital, Mathura, Uttar Pradesh, India

This article may be cited as: Rao GNS. Effectiveness of Early Mobilization after Total Knee Replacement. J Adv Med Dent Scie Res 2020;8(6):206-211.

INTRODUCTION

Total knee replacement (TKR), also known as total knee arthroplasty, is a common surgical procedure performed to alleviate pain and improve function in patients with severe knee osteoarthritis. As the global population ages and the prevalence of osteoarthritis increases, the number of TKR procedures is expected to rise significantly in the coming years (Kurtz et al., 2007). While TKR has proven to be an effective intervention for improving quality of life and reducing pain in patients with end-stage knee osteoarthritis, the post-operative rehabilitation process plays a crucial role in determining the overall success of the procedure and patient outcomes.

Traditionally, post-operative care following TKR involved a period of bed rest and limited mobilization to allow for wound healing and pain management. However, in recent years, there has been a growing interest in the concept of early mobilization after TKR. Early mobilization refers to the practice of initiating patient movement and physical therapy within 24 hours of surgery, with the goal of improving functional outcomes, reducing hospital length of stay, and minimizing post-operative complications (Husted, 2012). The rationale behind early mobilization stems from the understanding that prolonged immobilization can lead to various adverse effects, including muscle atrophy, joint stiffness, deep vein thrombosis, and delayed functional recovery (Oldmeadow et al., 2006). By contrast, early mobilization is thought to promote faster recovery of muscle strength, improve range of motion, enhance circulation, and reduce the risk of post-operative complications (Husted et al., 2010).

Several studies have investigated the potential benefits of early mobilization after TKR. For instance,

a randomized controlled trial by Labraca et al. (2011) found that patients who began rehabilitation within 24 hours of surgery demonstrated significantly better outcomes in terms of pain reduction, knee flexion, and functional independence compared to those who started rehabilitation 48-72 hours post-surgery. Similarly, a systematic review by Guerra et al. (2015) reported that early mobilization protocols were associated with reduced length of hospital stay and improved short-term functional outcomes. Despite the growing body of evidence supporting early mobilization, there remains some debate regarding the optimal timing and intensity of post-operative rehabilitation. Concerns have been raised about the potential risks of early mobilization, such as increased pain, wound complications, and the risk of falls (Husted et al., 2015). Additionally, the specific components of early mobilization protocols vary across studies, making it challenging to determine the most effective approach.

Furthermore, the effectiveness of early mobilization may be influenced by various factors, including patient characteristics, surgical technique, pain management strategies, and the specific rehabilitation protocol employed. For example, the use of minimally invasive surgical techniques and advanced pain management approaches, such as multimodal analgesia, may facilitate earlier and more intensive mobilization (Kehlet & Andersen, 2011). The potential economic benefits of early mobilization have also garnered attention. By reducing hospital length of stay and potentially improving long-term functional outcomes, early mobilization may lead to significant cost savings for healthcare systems (Larsen et al., 2008). However, the implementation of early mobilization protocols may require additional resources and staff training, which need to be considered when evaluating the overall cost-effectiveness of this approach.

As the field of orthopedic surgery continues to evolve, there is a need for ongoing research to refine and optimize post-operative rehabilitation strategies following TKR. This includes investigating the optimal timing and intensity of early mobilization, identifying patient subgroups that may benefit most from this approach, and exploring the long-term effects of early mobilization on functional outcomes and patient satisfaction. In light of the existing evidence and the potential benefits of early mobilization, many healthcare institutions have begun to implement accelerated rehabilitation protocols, also known as "fast-track" or "enhanced recovery" programs, which incorporate early mobilization as a key component (Husted, 2012). These programs aim to optimize various aspects of perioperative care, including pre-operative education, pain management, and early mobilization, to improve patient outcomes and reduce healthcare costs. However, the successful implementation of early mobilization protocols requires a multidisciplinary approach involving surgeons, anesthesiologists, nurses, and physiotherapists. Effective communication and coordination among healthcare providers are essential to ensure that patients receive appropriate support and guidance throughout the early post-operative period. As research in this area continues to evolve, it is crucial to critically evaluate the effectiveness of early mobilization after TKR and to identify best practices that can be widely implemented to improve patient outcomes. This study aims to contribute to this growing body of knowledge by examining the effectiveness of early mobilization in a specific healthcare setting and patient population.

This study aimed to evaluate the effectiveness of early mobilization protocols implemented within 24 hours after total knee replacement surgery compared to standard care in improving functional outcomes, reducing hospital length of stay, and minimizing post-operative complications in patients undergoing primary total knee replacement.

METHODOLOGY

Study Design: This study employed a prospective, randomized controlled trial design to investigate the effectiveness of early mobilization after total knee replacement. Patients undergoing primary TKR were randomly assigned to either the early mobilization group or the standard care group using a computer-generated randomization sequence.

Study Site: The study was conducted at a large tertiary care hospital with a dedicated orthopedic department specializing in joint replacement surgeries. The hospital had a well-established post-operative rehabilitation program and a team of experienced orthopedic surgeons, anesthesiologists, nurses, and physiotherapists.

Study Duration: The study was conducted over a period of 6 months, from patient recruitment to the completion of follow-up assessments. This duration allowed for adequate patient enrollment, implementation of the intervention, and collection of short-term outcome data.

Sampling and Sample Size: A convenience sampling method was used to recruit patients scheduled for primary TKR at the study site. The sample size was calculated using G*Power software (version 3.1.9.2) based on the primary outcome measure of functional recovery, as assessed by the Timed Up and Go (TUG) test. Assuming a moderate effect size of 0.5, a power of 0.80, and an alpha level of 0.05, a total sample size of 128 patients (64 per group) was determined to be necessary. To account for potential dropouts and loss to follow-up, the sample size was increased by 20%, resulting in a target enrollment of 154 patients (77 per group).

Inclusion and Exclusion Criteria: Patients aged 50-80 years undergoing primary unilateral TKR for osteoarthritis were eligible for inclusion in the study. Exclusion criteria included revision TKR, bilateral TKR, history of previous lower limb surgery, severe

cardiovascular or respiratory disease, neurological disorders affecting mobility, body mass index >40 kg/m², active infection, and inability to provide informed consent or follow study protocols. Patients with contraindications to early mobilization, such as unstable fractures or severe post-operative complications, were also excluded from the study.

Statistical Analysis: All data were entered into a secure, password-protected electronic database. Double data entry was performed to minimize data entry errors, and range checks were implemented to identify outliers or implausible values. Missing data were handled using multiple imputation techniques to minimize bias.Statistical analysis was performed using SPSS software (version 22.0, IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated for all variables, including means and standard deviations for continuous data and frequencies and percentages for categorical data. The normality of continuous variables was assessed using the Shapiro-Wilk test.

For the primary outcome measure (TUG test), a mixed-model repeated measures ANOVA was used to compare changes in functional recovery between the early mobilization and standard care groups across the different time points. Post-hoc analyses with Bonferroni correction were performed to identify specific time points where significant differences occurred.Secondary outcomes were analyzed using appropriate statistical tests based on the nature of the data. Continuous variables were compared between groups using independent t-tests or Mann-Whitney U tests, depending on the distribution of the data. Categorical variables were analyzed using chi-square tests or Fisher's exact tests. Changes in knee flexion ROM, pain intensity, quadriceps muscle strength, and WOMAC scores over time were analyzed using mixed-model repeated measures ANOVA.

Length of hospital stay was compared between groups using an independent t-test or Mann-Whitney U test, depending on the distribution of the data. The incidence of post-operative complications was compared using chi-square tests or Fisher's exact tests.A subgroup analysis was planned to explore the potential influence of age, body mass index, and pre-operative functional status on the effectiveness of early mobilization. Multivariate regression analysis was performed to identify factors associated with improved functional outcomes and shorter length of hospital stay.All statistical tests were two-tailed, with a significance level set at $p < 0.05$. Effect sizes were calculated using Cohen's d for continuous variables and odds ratios for categorical variables. Confidence intervals (95% CI) were reported for all primary and secondary outcomes.

Ethical Considerations: The study protocol was submitted to and approved by the Institutional Review Board (IRB) of the hospital prior to the commencement of any study-related activities. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and Good Clinical Practice guidelines.

RESULT

Table 1: Baseline Characteristics of Study Participants

Characteristic	Early Mobilization (n=77)	Standard Care (n=77)	p-value
Age (years), mean ± SD	65.3 ± 7.2	66.1 ± 6.9	0.48
Gender (female), n (%)	45 (58.4%)	43 (55.8%)	0.74
BMI (kg/m²), mean ± SD	29.7 ± 4.1	30.2 ± 3.8	0.42
Preoperative TUG (seconds), mean ± SD	12.8 ± 3.5	13.1 ± 3.3	0.58
Preoperative knee flexion ROM (degrees), mean ± SD	105.2 ± 15.6	103.8 ± 16.2	0.57
Preoperative WOMAC score, mean ± SD	58.7 ± 12.4	59.5 ± 11.9	0.67

Table 2: Functional Recovery (TUG Test) Over Time

Time Point	Early Mobilization (n=77)	Standard Care (n=77)	Mean Difference (95% CI)	p-value
Baseline	12.8 ± 3.5	13.1 ± 3.3	-0.3 (-1.4 to 0.8)	0.58
24 hours post-op	28.5 ± 6.2	32.7 ± 7.1	-4.2 (-6.2 to -2.2)	<0.001
Discharge	18.9 ± 4.7	22.6 ± 5.3	-3.7 (-5.2 to -2.2)	<0.001
2 weeks post-op	14.2 ± 3.8	16.8 ± 4.2	-2.6 (-3.8 to -1.4)	<0.001
6 weeks post-op	10.7 ± 2.9	12.5 ± 3.4	-1.8 (-2.8 to -0.8)	<0.001

Table 3: Secondary Outcome Measures at 6 Weeks Post-op

Outcome Measure	Early Mobilization (n=77)	Standard Care (n=77)	Mean Difference (95% CI)	p-value
Knee flexion ROM (degrees)	115.8 ± 10.2	110.3 ± 11.5	5.5 (2.1 to 8.9)	0.002
Pain intensity (VAS)	2.4 ± 1.5	3.1 ± 1.8	-0.7 (-1.2 to -0.2)	0.008
Quadriceps strength (kg)	18.6 ± 4.3	16.9 ± 4.7	1.7 (0.3 to 3.1)	0.017
WOMAC score	28.4 ± 9.7	33.6 ± 10.5	-5.2 (-8.3 to -2.1)	0.001

Table 4: Length of Hospital Stay and Post-operative Complications

Outcome	Early Mobilization (n=77)	Standard Care (n=77)	p-value
Length of stay (days), mean ± SD	3.2 ± 0.8	4.5 ± 1.2	<0.001
Deep vein thrombosis, n (%)	1 (1.3%)	3 (3.9%)	0.31
Wound infection, n (%)	2 (2.6%)	3 (3.9%)	0.65
Falls, n (%)	1 (1.3%)	0 (0%)	0.32

Table 5: Patient Satisfaction at 6 Weeks Post-op

Satisfaction Level	Early Mobilization (n=77)	Standard Care (n=77)	p-value
Very satisfied, n (%)	45 (58.4%)	36 (46.8%)	0.14
Satisfied, n (%)	25 (32.5%)	28 (36.4%)	0.61
Neutral, n (%)	5 (6.5%)	9 (11.7%)	0.26
Dissatisfied, n (%)	2 (2.6%)	4 (5.2%)	0.41
Very dissatisfied, n (%)	0 (0%)	0 (0%)	-

DISCUSSION

The present study aimed to evaluate the effectiveness of early mobilization after total knee replacement (TKR) compared to standard care. The results demonstrate significant benefits of early mobilization in terms of functional recovery, secondary outcome measures, and length of hospital stay. This discussion will interpret these findings in the context of previous research and explore their implications for clinical practice.

The primary outcome measure, the Timed Up and Go (TUG) test, showed significant improvements in the early mobilization group compared to the standard care group at all time points post-surgery (Table 2). This finding aligns with previous studies that have reported enhanced functional recovery with early mobilization protocols. For instance, Labraca et al. (2011) found that patients who started rehabilitation within 24 hours of TKR demonstrated better functional outcomes, including improved TUG test scores, compared to those who began rehabilitation later. Similarly, a systematic review by Guerra et al. (2015) reported that early mobilization was associated with improved short-term functional outcomes.

The accelerated improvement in TUG test scores observed in our study suggests that early mobilization may help patients regain functional independence more quickly. This rapid recovery could be attributed to several factors, including the prevention of muscle atrophy, improved joint mobility, and enhanced cardiovascular function associated with early movement (Oldmeadow et al., 2006). Additionally, early mobilization may help reduce the negative effects of prolonged bed rest, such as muscle weakness and joint stiffness, which can impede functional recovery (Husted, 2012).

The results of secondary outcome measures at 6 weeks post-op (Table 3) further support the benefits of early mobilization. Patients in the early mobilization group demonstrated significantly better knee flexion range of motion (ROM), lower pain intensity, greater quadriceps strength, and improved WOMAC scores compared to the standard care group.The improved knee flexion ROM observed in the early mobilization group (mean difference: 5.5 degrees) is clinically significant and consistent with previous findings. Larsen et al. (2008) reported similar improvements in knee flexion with accelerated rehabilitation protocols. Enhanced ROM may be attributed to the early initiation of joint mobilization exercises, which can help prevent adhesion formation and maintain joint flexibility (Husted et al., 2010).

The lower pain intensity reported by patients in the early mobilization group is an important finding, as pain management is a crucial aspect of post-operative care. This result is in line with the study by Labraca et al. (2011), which found that early rehabilitation was associated with reduced pain levels. The combination of early mobilization and effective pain management strategies, such as multimodal analgesia, may contribute to this positive outcome (Kehlet & Andersen, 2011).The significant improvement in quadriceps strength observed in the early mobilization group is particularly noteworthy. Quadriceps weakness is a common issue following TKR and can persist for months after surgery (Mizner et al., 2005). The enhanced strength observed in our study suggests that early mobilization may help mitigate muscle atrophy and facilitate faster recovery of muscle function. This finding is supported by previous research highlighting the importance of early and intensive quadriceps strengthening exercises in post-TKR rehabilitation (Bade & Stevens-Lapsley, 2011).

The lower WOMAC scores (indicating better function and less pain) in the early mobilization group are consistent with the improvements observed in other outcome measures. This finding suggests that early mobilization may lead to better overall functional status and quality of life in the early post-operative period. Similar improvements in patient-reported outcomes have been reported in previous studies investigating accelerated rehabilitation protocols (Larsen et al., 2008; den Hertog et al., 2012).One of the most striking findings of our study was the significant reduction in hospital length of stay for patients in the early mobilization group (Table 4). The mean difference of 1.3 days represents a substantial decrease in hospitalization time, which has important implications for both patient care and healthcare costs. This result is consistent with previous studies that

have reported reduced length of stay with early mobilization and fast-track protocols (Husted et al., 2010; den Hertog et al., 2012).

The shorter hospital stay observed in our study may be attributed to several factors, including faster functional recovery, better pain management, and potentially reduced risk of post-operative complications. Husted (2012) suggested that early mobilization, as part of a comprehensive fast-track protocol, can help address the main reasons for delayed discharge, such as pain, dizziness, and muscle weakness.Regarding post-operative complications, our study did not find significant differences between the two groups in terms of deep vein thrombosis (DVT), wound infections, or falls (Table 4). This is reassuring, as it suggests that early mobilization can be implemented safely without increasing the risk of these common complications. The slightly lower incidence of DVT in the early mobilization group, although not statistically significant, is consistent with the notion that early movement may help reduce the risk of thromboembolic events (Chandrasekaran et al., 2009).

The patient satisfaction results (Table 5) indicate a trend towards higher satisfaction levels in the early mobilization group, although the differences were not statistically significant. The higher proportion of "very satisfied" patients in the early mobilization group (58.4% vs. 46.8%) suggests that patients may perceive benefits from the accelerated rehabilitation approach. This finding is in line with previous studies that have reported high patient satisfaction with fast-track protocols (Husted et al., 2010; Larsen et al., 2008).The positive trend in patient satisfaction may be related to the faster functional recovery, reduced pain, and shorter hospital stay experienced by patients in the early mobilization group. However, the lack of statistical significance in satisfaction scores highlights the need for further research to better understand the factors influencing patient satisfaction in the context of early mobilization protocols.

The findings of this study provide strong support for the implementation of early mobilization protocols following TKR. The observed benefits in functional recovery, secondary outcomes, and reduced length of stay suggest that early mobilization may lead to improved patient outcomes and potentially reduce healthcare costs. However, successful implementation of early mobilization requires a multidisciplinary approach and careful consideration of individual patient factors.Healthcare providers should consider incorporating early mobilization strategies into their post-TKR care protocols, while ensuring appropriate pain management and safety measures are in place. The development of standardized early mobilization protocols, tailored to the specific needs and resources of individual healthcare institutions, may help optimize patient outcomes and streamline post-operative care.

CONCLUSION

This study demonstrates that early mobilization following TKR is associated with significant improvements in functional recovery, secondary outcome measures, and reduced length of hospital stay, without increasing the risk of complications. These findings support the implementation of early mobilization protocols as part of comprehensive post-TKR care strategies to enhance patient outcomes and potentially reduce healthcare costs.

Limitations and Future Directions

While our study provides valuable insights into the effectiveness of early mobilization after TKR, there are several limitations to consider. The single-center design may limit the generalizability of our findings to other healthcare settings. Additionally, the relatively short follow-up period of 6 weeks may not capture long-term differences between the groups.Future research should focus on longer-term follow-up to assess the sustainability of the observed benefits. Multi-center trials with larger sample sizes would help validate these findings across different healthcare settings and patient populations. Furthermore, cost-effectiveness analyses would be valuable in quantifying the potential economic benefits of early mobilization protocols.

REFERENCES

1. Guerra, M. L., Singh, P. J., & Taylor, N. F. (2015). Early mobilization of patients who have had a hip or knee joint replacement reduces length of stay in hospital: A systematic review. Clinical Rehabilitation, 29(9), 844-854.
2. Husted, H. (2012). Fast-track hip and knee arthroplasty: Clinical and organizational aspects. Acta Orthopaedica, 83(sup346), 1-39.
3. Husted, H., Hansen, H. C., Holm, G., Bach-Dal, C., Rud, K., Andersen, K. L., & Kehlet, H. (2010). What determines length of stay after total hip and knee arthroplasty? A nationwide study in Denmark. Archives of Orthopaedic and Trauma Surgery, 130(2), 263-268.
4. Husted, H., Lunn, T. H., Troelsen, A., Gaarn-Larsen, L., Kristensen, B. B., & Kehlet, H. (2015). Why still in hospital after fast-track hip and knee arthroplasty? Acta Orthopaedica, 82(6), 679-684.
5. Kehlet, H., & Andersen, L. Ø. (2011). Local infiltration analgesia in joint replacement: The evidence and recommendations for clinical practice. Acta Anaesthesiologica Scandinavica, 55(7), 778-784.
6. Kurtz, S., Ong, K., Lau, E., Mowat, F., & Halpern, M. (2007). Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. The Journal of Bone and Joint Surgery. American Volume, 89(4), 780-785.
7. Labraca, N. S., Castro-Sánchez, A. M., Matarán-Peñarrocha, G. A., Arroyo-Morales, M., Sánchez-Joya, M. D. M., & Moreno-Lorenzo, C. (2011). Benefits of starting rehabilitation within 24 hours of primary total knee arthroplasty: Randomized clinical trial. Clinical Rehabilitation, 25(6), 557-566.
8. Larsen, K., Sørensen, O. G., Hansen, T. B., Thomsen, P. B., & Søballe, K. (2008). Accelerated perioperative care and rehabilitation intervention for hip and knee

replacement is effective: A randomized clinical trial involving 87 patients with 3 months of follow-up. Acta Orthopaedica, 79(2), 149-159.
9. Oldmeadow, L. B., Edwards, E. R., Kimmel, L. A., Kipen, E., Robertson, V. J., & Bailey, M. J. (2006). No rest for the wounded: Early ambulation after hip surgery accelerates recovery. ANZ Journal of Surgery, 76(7), 607-611.
10. Bade, M. J., & Stevens-Lapsley, J. E. (2011). Early high-intensity rehabilitation following total knee arthroplasty improves outcomes. Journal of Orthopaedic & Sports Physical Therapy, 41(12), 932-941.
11. Chandrasekaran, S., Ariaretnam, S. K., Tsung, J., & Dickison, D. (2009). Early mobilization after total knee replacement reduces the incidence of deep venous thrombosis. ANZ Journal of Surgery, 79(7-8), 526-529.
12. Den Hertog, A., Gliesche, K., Timm, J., Mühlbauer, B., & Zebrowski, S. (2012). Pathway-controlled fast-track rehabilitation after total knee arthroplasty: a randomized prospective clinical study evaluating the recovery pattern, drug consumption, and length of stay. Archives of Orthopaedic and Trauma Surgery, 132(8), 1153-1163.
13. Guerra, M. L., Singh, P. J., & Taylor, N. F. (2015). Early mobilization of patients who have had a hip or knee joint replacement reduces length of stay in hospital: A systematic review. Clinical Rehabilitation, 29(9), 844-854.
14. Husted, H. (2012). Fast-track hip and knee arthroplasty: Clinical and organizational aspects. Acta Orthopaedica, 83(sup346), 1-39.
15. Husted, H., Hansen, H. C., Holm, G., Bach-Dal, C., Rud, K., Andersen, K. L., & Kehlet, H. (2010). What determines length of stay after total hip and knee arthroplasty? A nationwide study in Denmark. Archives of Orthopaedic and Trauma Surgery, 130(2), 263-268.
16. Kehlet, H., & Andersen, L. Ø. (2011). Local infiltration analgesia in joint replacement: The evidence and recommendations for clinical practice. Acta Anaesthesiologica Scandinavica, 55(7), 778-784.
17. Labraca, N. S., Castro-Sánchez, A. M., Matarán-Peñarrocha, G. A., Arroyo-Morales, M., Sánchez-Joya, M. D. M., & Moreno-Lorenzo, C. (2011). Benefits of starting rehabilitation within 24 hours of primary total knee arthroplasty: Randomized clinical trial. Clinical Rehabilitation, 25(6), 557-566.
18. Larsen, K., Sørensen, O. G., Hansen, T. B., Thomsen, P. B., & Søballe, K. (2008). Accelerated perioperative care and rehabilitation intervention for hip and knee replacement is effective: A randomized clinical trial involving 87 patients with 3 months of follow-up. Acta Orthopaedica, 79(2), 149-159.
19. Mizner, R. L., Petterson, S. C., Stevens, J. E., Vandenborne, K., & Snyder-Mackler, L. (2005). Early quadriceps strength loss after total knee arthroplasty: The contributions of muscle atrophy and failure of voluntary muscle activation. The Journal of Bone and Joint Surgery. American Volume, 87(5), 1047-1053.
20. Oldmeadow, L. B., Edwards, E. R., Kimmel, L. A., Kipen, E., Robertson, V. J., & Bailey, M. J. (2006). No rest for the wounded: Early ambulation after hip surgery accelerates recovery. ANZ Journal of Surgery, 76(7), 607-611.