

Effect of Physiotherapy after Total Knee Replacement to Prevent Knee Stiffness: A Literature Review

Mimozë Zogaj

PhD Cand in Physiotherapy Program, Faculty of Medicine, Alma Mater Europaea - ECM; Lecturer at Alma Mater Europaea Campus Collage" Rezonanca"; PT at University Clinical Center of Kosovo

Abstract: ***Introduction:** All over the world, total joint replacement is one of the most common and popular surgical technology. Knee replacement surgery is done frequently and very successfully. Knee stiffness is a common symptom in patients after total knee arthroplasty. Restricted motion range, also known as knee stiffness, is one of the significant complications after intra - articular or extra - articular injury. Postoperatively, it is primarily due to articular fibrosis (intra and extra) and scarring adhesions in the quadriceps - femoral apparatus after ligament reconstruction, patellar tendon repair, burn, and total knee arthroplasty. Knee stiffness is both preventable and treatable with physiotherapy treatment. Physiotherapy includes electrotherapy and exercises therapy playing an important role in reduction of knee stiffness. The aim of the present study to survey the existing literature related to exercise therapy and electrotherapy programs for the management of post - operative knee stiffness. **Materials and Methods:** A computerized search of the ELSEVIER, PubMed, and Medline database was conducted for 1 year. The search was performed using English language. Review methods; The MEDLINE, Cochrane Central Register of Controlled Trials, EMBASE Web of Science, and PEDro databases were searched in 2023 - January 2024. Prospective or retrospective cohort studies were included, RCT and met analysis were used for referenced. **Results:** Based on the literature survey undertaken, the best approach for efficient recovery is to plan and start treatment regimen preoperatively that should be continued until achieving knee symmetry postoperatively and physical therapy has a very important role in achieving satisfactory results in terms of knee functionality and the ability to prevent stiffness. **Conclusions:** Interventions including physiotherapy functional exercises after discharge result in short term benefit after total knee arthroplasty.*

Keywords: knee stiffness; effects of physiotherapy; physiotherapy exercise; total knee arthroplasty; physiotherapy

1. Introduction

All over the world, total joint replacement is one of the most common and popular surgical technology. (1) the most common indication for this procedure is osteoarthritis, with reduced function and quality of life. (2, 3)

Total knee replacement requires follow - up rehabilitation treatment. This can take place on an outpatient basis as part of health insurance coverage, but also as outpatient or inpatient rehabilitation. (4) Persistent pain and functional limitations after TKA are associated with a lower rate of patient satisfaction. (5) It is recognized that reported symptoms of stiffness, failing to squat and kneel, after surgery results in a poor outcome for the patient. (6) Approximated five percent of patients suffer stiffness as a significant complication after their TKA (7), and some require manipulation under anesthesia (8) or revision surgery because of persistent stiffness. (9) Stiffness after knee arthroplasty may have a genetic component and epidemiological studies have found chromosomal changes in those reporting such symptoms (10), with an increased understanding of the biological basis for such a host response.

(11) This is leading to a greater awareness that stiffness is potentially avoidable both from a mechanical and biological perspective (7). However, the influencing factors or effects of knee joint stiffness are unknown. (12) Stiffness after total knee arthroplasty (TKA) adversely affects outcome and impacts patient function. Various risk factors for stiffness after TKA have been identified, including reduced preoperative knee range of motion, (13) history of prior knee

surgery, etiology of arthritis, incorrect positioning or oversizing of components, and incorrect gap balancing (14) and scarring adhesions in the quadriceps - femoral apparatus after ligament reconstruction, patellar tendon repair, burn, and total knee arthroplasty. Knee stiffness is both preventable and treatable with physiotherapy treatment. Physiotherapy includes electrotherapy and exercises therapy playing an important role in reduction of knee stiffness. (15) Rehabilitation, with a particular emphasis on physiotherapy and exercise, is widely promoted after total knee replacement. (16) The stiffness of the joint has a high risk for patients after the knee implant, the aim of the present study is to survey the existing literature related to exercise therapy and electrotherapy programs for the management of post - operative knee stiffness.

2. Objective

Through the literature review I investigate the effect of physical therapy after total knee replacement to prevent joint stiffness.

3. Materials and Methods

The MEDLINE, Cochrane Central Register of Controlled Trials, EMBASE Web of Science, and PEDro databases were searched in 2023 - January 2024. Each search included terms such as exercise, physical therapy, rehabilitation, post - operative knee stiffness, knee arthroplasty, and physiotherapy. The abstracts of the studies were studied to decide about inclusion of the article in my study.

Volume 13 Issue 1, January 2024

Fully Refereed | Open Access | Double Blind Peer Reviewed Journal

www.ijsr.net

Study selection articles were eligible if they included: (1) Post - operative knee stiffness, (2) post - operative physiotherapy/rehabilitation protocols, and (3) systematic review, clinical suggestion, a literature review, clinical commentary, case report, prevalence, and original articles.

4. Physiotherapy interventions to prevent post - operative knee stiffness: relevant studies and literature analyses

Given the potential positive influence of post - operative rehabilitation, short - and long - term outcomes after TKA may be related to the type and intensity of postoperative rehabilitation the patients receive, although evidence supporting this relationship has been sparse. Many of relevant literature for rehabilitation after total knee arthroplasty have found good results.

Postoperative management of TKA, to prevent stiffness, has been approached in a variety of different ways. Physical therapy (PT) and continuous passive motion (CPM) machines have been used with variable results, and home basic exercises. Herbold et al (17) found in a recent randomized controlled trial, that CPM machines do not provide an additional benefit over the conventional interventions in patients undergoing TKA. This is consistent with most series in the literature regarding the use of CPM. (18 - 20) In a meta - analysis of randomized, controlled trials that evaluated the effectiveness, PT demonstrated no benefit for ROM at 1 year, and minimal effect was seen at 3 months. (21) Kumar et al in the randomized prospective study compared 46 total knee arthroplasties in which a continuous passive motion machine was used with 37 total knees that were rehabilitated with early passive flexion of the knee (named drop and dangle protocol). Postoperative physical therapy regimens were otherwise the same for both groups. Surgical technique was the same for both groups except for closure which was performed in the drop and dangle group with the knee at 90 ° to 95 ° flexion. ROM increases for the booth group in the different period of time after rehabilitation program. Max range of motion was with CPM 135° and for Drop and Dangle technique was 140°. (22) In 2019, a randomized controlled trial investigated early exercise therapy protocols after TKR surgery and was published in the Journal of Bone and Joint Surgery. It showed that a simple self - directed, low - cost, three - exercise bike pedaling-based protocol was superior to a therapist - led standard multi - exercise regimen, for both functional and patient reported outcomes Artz at Al in this study suggest long - term benefit for outpatient physiotherapy improved long - term ROM extension. Benefit was only evident in 2 studies with follow up at 3 months after total knee replacement. For ROM flexion there was evidence of improved flexion in patients receiving physiotherapy exercise, particularly after 6 and 12 months. Benefit was seen in studies with low risk of bias but this was based on a small number of studies. (23) However, systematic review indicated that CPM had small, short - term effects on active and passive knee flexion ROM and no evidence support the presence of long - term effects of CPM on active or passive knee extension ROM, pain, swelling, and quadriceps strength. (24) Based on the results of this trial, patients who have had a TKR can complete a few

simple home - based exercises focusing on bike pedaling, knee extension and heel - toe walking practice for the first two weeks following their knee surgery and expect optimal outcomes. Following this early recovery period, patients yet to gain 90 - degree knee flexion or those who are having difficulty progressing with their mobility may benefit from some supervised physiotherapy treatment, with no significant difference shown between patients supervised in the home or outpatient setting. (25) Klement at Al in the study at 1 year after surgery 129 (5%) patients in intervention group had a significant increase in their stiffness symptoms (20%, 95%) confidence interval, Patient satisfaction was significantly lower for the increased stiffness group, associated with a worse functional outcome. (26)

5. Discussion

This literature review provides support for the use of physiotherapy exercise interventions with exercises based on functional activities after TKRs to prevent stiffness.

Stiffness is a frustrating complication after total knee arthroplasty. Its precise definition is still debated (27, 28). Several factors contribute to its development and may be divided into preoperative, intraoperative, and postoperative. Literature shows that to obtain better and faster outcomes, early knee mobilization should be apply as soon as possible to prevent stiffness, DVT, and other secondary complications. Moreover, studies recommend that intensive rehabilitation and pre - rehabilitation (pre - operative ROM) program must be incorporated and considered as first treatment to reduce post - operative knee stiffness. (29, 30, 31)

6. Conclusion

After recent primary total knee replacement, physiotherapy exercise interventions show short - term improvements in physical function. However this conclusion is based on meta - analysis of a few small studies and no long - term benefits of physiotherapy or exercise intervention were identified. The paucity and heterogeneity of existing studies that examine early supervised exercise therapy following TKR surgery makes it challenging for clinicians to deliver high - quality evidence - based exercise programs in the early postoperative period. Although superior knee flexion range was found across differing regimes, the meta - analysis showed no significant difference in this outcome between groups at 6 weeks. The results of this review show high quality randomized clinical trials are urgently needed to evaluate the impact of early exercise following TKR surgery.

7. Future Scope of Study

Most of the studies do not have specific standardized physiotherapy and rehabilitation protocols; therefore, controversies remain regarding the choice and effectiveness of different techniques. There is a need for well - designed RCTs to assess the effectiveness of specific techniques according to stage of healing which are recommended on larger sample size. The need for further research in these

areas is apparent. In other word, there is a need to analyze the effectiveness of certain exercise techniques over others, specifically in relation to attaining short - term and long - term goals.

Abbreviations

CPM: Continuous passive movement

ROM: Range of motion

TKR: Total knee replacement

RCT - Randomized Controlled Trials

PT - Physiotherapist

DTV - Deep Vein Thrombosis

References

- [1] Kolbakhova, S. N., Koneva, E. S., Kulchitskaya, D. B., Strukov, R. N., &Khaptagaev, T. B. (2022). The use of stability training in rehabilitation programs in patients after total knee replacement in the late recovery period.99 (6. Vyp.2), 31–35. <https://doi.org/10.17116/kurort20229906231>
- [2] Carr, A. J., Robertsson, O., Graves, S., Price, A. J., Arden, N. K., Judge, A., & Beard, D. J. (2012). Knee replacement. *Lancet (London, England)*, 379 (9823), 1331–1340. [https://doi.org/10.1016/S0140-6736\(11\)60752-6](https://doi.org/10.1016/S0140-6736(11)60752-6)
- [3] Price, A. J., Alvand, A., Troelsen, A., Katz, J. N., Hooper, G., Gray, A., Carr, A., & Beard, D. (2018). Knee replacement. *Lancet (London, England)*, 392 (10158), 1672–1682. [https://doi.org/10.1016/S0140-6736\(18\)32344-4](https://doi.org/10.1016/S0140-6736(18)32344-4)
- [4] Kladny B. (2021). Rehabilitation nachknieendoprothetischer Versorgung [Rehabilitation following total knee replacement]. *Der Orthopade*, 50 (11), 894–899. <https://doi.org/10.1007/s00132-021-04175-9>
- [5] Hamilton, D. F., Lane, J. V., Gaston, P., Patton, J. T., Macdonald, D., Simpson, A. H., & Howie, C. R. (2013). What determines patient satisfaction with surgery? A prospective cohort study of 4709 patients following total joint replacement. *BMJ open*, 3 (4), e002525. <https://doi.org/10.1136/bmjopen-2012-002525>
- [6] Scott, C. E., Bugler, K. E., Clement, N. D., MacDonald, D., Howie, C. R., & Biant, L. C. (2012). Patient expectations of arthroplasty of the hip and knee. *The Journal of bone and joint surgery. British volume*, 94 (7), 974–981. <https://doi.org/10.1302/0301-620X.94B7.28219>
- [7] Cheuy, V. A., Foran, J. R. H., Paxton, R. J., Bade, M. J., Zeni, J. A., & Stevens - Lapsley, J. E. (2017). Arthrofibrosis Associated With Total Knee Arthroplasty. *The Journal of arthroplasty*, 32 (8), 2604–2611. <https://doi.org/10.1016/j.arth.2017.02.005>
- [8] Vanlommel, L., Luyckx, T., Vercruyse, G., Bellemans, J., & Vandenuecker, H. (2017). Predictors of outcome after manipulation under anaesthesia in patients with a stiff total knee arthroplasty. *Knee surgery, sports traumatology, arthroscopy: official journal of the ESSKA*, 25 (11), 3637–3643. <https://doi.org/10.1007/s00167-016-4413-6>
- [9] Sharkey, P. F., Lichstein, P. M., Shen, C., Tokarski, A. T., & Parvizi, J. (2014). Why are total knee arthroplasties failing today - - has anything changed after 10 years?. *The Journal of arthroplasty*, 29 (9), 1774–1778. <https://doi.org/10.1016/j.arth.2013.07.024>
- [10] Kalson, N. S., Brock, T. M., Mangino, M., Fabiane, S. M., Mann, D. A., Borthwick, L. A., Deehan, D. J., & Williams, F. M. K. (2018). Reduced telomere length is associated with fibrotic joint disease suggesting that impaired telomere repair contributes to joint fibrosis. *PLoS one*, 13 (1), e0190120. <https://doi.org/10.1371/journal.pone.0190120>
- [11] Paish, H. L., Kalson, N. S., Smith, G. R., Del Carpio Pons, A., Baldock, T. E., Smith, N., Swist - Szulik, K., Weir, D. J., Bardgett, M., Deehan, D. J., Mann, D. A., & Borthwick, L. A. (2018). Fibroblasts Promote Inflammation and Pain via IL - 1 α Induction of the Monocyte Chemoattractant Chemokine (C - C Motif) Ligand 2. *The American journal of pathology*, 188 (3), 696–714. <https://doi.org/10.1016/j.ajpath.2017.11.007>
- [12] Daisuke U, Hitoshi K, Yuuka Y, Aya K; Factors associated with subjective knee joint stiffness in people with knee osteoarthritis: A systematic review; 26 December 2022 <https://doi.org/10.1111/1756-185X.14536>
- [13] Schiavone Panni, A., Cerciello, S., Vasso, M., & Tartarone, M. (2009). Stiffness in total knee arthroplasty. *Journal of Orthopedics and Traumatology*, 10 (3), 111 - 118.
- [14] Manrique, J., Gomez, M. M., & Parvizi, J. (2015). Stiffness after total knee arthroplasty. *The journal of knee surgery*, 28 (02), 119 - 126.
- [15] Kumar, R., Kaushal, K., & Kaur, S. (2020). Role of physiotherapy in post - operative knee stiffness: A literature review. *Adesh University Journal of Medical Sciences & Research*, 2 (1), 31 - 35.
- [16] BOA, BASK. Knee replacement: a guide to good practice. London: British Orthopedic Association; 1999.
- [17] Herbold JA, Bonistall K, Blackburn M, et al. Randomized controlled trial of the effectiveness of continuous passive motion after total knee replacement. *Arch Phys Med Rehabil* 2014; 95 (7): 1240–1245
- [18] Alkire, M. R., & Swank, M. L. (2010). Use of inpatient continuous passive motion versus no CPM in computer - assisted total knee arthroplasty. *Orthopedic nursing*, 29 (1), 36–40. <https://doi.org/10.1097/NOR.0b013e3181c8ce23>
- [19] Maniar, R. N., Baviskar, J. V., Singhi, T., & Rathi, S. S. (2012). To use or not to use continuous passive motion post - total knee arthroplasty presenting functional assessment results in early recovery. *The Journal of arthroplasty*, 27 (2), 193–200. e1. <https://doi.org/10.1016/j.arth.2011.04.009>
- [20] Leach, W., Reid, J., & Murphy, F. (2006). Continuous passive motion following total knee replacement: a prospective randomized trial with follow - up to 1 year. *Knee surgery, sports traumatology, arthroscopy: official journal of the ESSKA*, 14 (10), 922–926. <https://doi.org/10.1007/s00167-006-0042-9>

- [21] Minns Lowe, C. J., Barker, K. L., Dewey, M., & Sackley, C. M. (2007). Effectiveness of physiotherapy exercise after knee arthroplasty for osteoarthritis: systematic review and meta-analysis of randomized controlled trials. *BMJ (Clinical research ed.)*, 335 (7624), 812. <https://doi.org/10.1136/bmj.39311.460093.BE>
- [22] Kumar, P; McPherson, Edward; Dorr, Lawrence; Wan, Zhinian*; Baldwin, Kyle*. Rehabilitation after Total Knee Arthroplasty: A Comparison of 2 Rehabilitation Techniques. *Clinical Orthopedics and Related Research* 331 (): p 93 - 101, October 1996.
- [23] Artz, N., Elvers, K. T., Lowe, C. M., Sackley, C., Jepson, P., & Beswick, A. D. (2015). Effectiveness of physiotherapy exercise following total knee replacement: systematic review and meta-analysis. *BMC musculoskeletal disorders*, 16, 15. <https://doi.org/10.1186/s12891-015-0469-6>
- [24] Sheppard MS, Westlake SM, McQuarrie A. Continuous passive motion where are we now? *Physiother Can* 1995; 47: 36 - 9.
- [25] Sattler LN, Hing WA, Vertullo CJ. Pedaling - based protocol superior to a 10 - exercise, non - pedaling protocol for postoperative rehabilitation after total knee replacement: A randomized controlled trial. *J Bone Joint Surg Am* 2019; 101 (8): 688–95. DOI: 10.2106/JBJS.18.00898.
- [26] Clement, N. D., Bardgett, M., Weir, D. *et al.* Increased symptoms of stiffness 1 year after total knee arthroplasty are associated with a worse functional outcome and lower rate of patient satisfaction. *Knee Surg Sports Traumatol Arthrosc* 27, 1196–1203 (2019). <https://doi.org/10.1007/s00167-018-4979>
- [27] Kim, J., Nelson, C. L., & Lotke, P. A. (2004). Stiffness after total knee arthroplasty. Prevalence of the complication and outcomes of revision. *The Journal of bone and joint surgery. American volume*, 86 (7), 1479–1484.
- [28] Christensen, C. P., Crawford, J. J., Olin, M. D., & Vail, T. P. (2002). Revision of the stiff total knee arthroplasty. *The Journal of arthroplasty*, 17 (4), 409–415. <https://doi.org/10.1054/arth.2002.32105>
- [29] Bistolfi A, Federico AM, Carnino I, Gaido C, Rold ID. Rehabilitation and physical therapy before and after total knee arthroplasty: A literature review and unanswered questions. *Int J Phys Med Rehabil* 2016; 4: 356. DOI: 10.4172/2329-9096.1000356
- [30] Mistry JB, Elmallah RD, Bhave A, Chughtai M, Cherian JJ, McGinn T, et al. Rehabilitative guidelines after total knee arthroplasty: A review. *J Knee Surg* 2016; 29: 201 - 17.
- [31] Baker CS, McKeon JM. Does preoperative rehabilitation patient - based outcomes in persons who have undergone total knee arthroplasty? A systematic review. *PM R* 2012; 4: 756 - 67.