

COMMENTARY

Physiotherapy Exercise After Fast-Track Total Hip and Knee Arthroplasty: Time for Reconsideration?

Thomas Bandholm, PhD, Henrik Kehlet, PhD

ABSTRACT. Bandholm T, Kehlet H. Physiotherapy exercise after fast-track total hip and knee arthroplasty: time for reconsideration? *Arch Phys Med Rehabil* 2012;93:1292-4.

Major surgery, including total hip arthroplasty (THA) and total knee arthroplasty (TKA), is followed by a convalescence period, during which the loss of muscle strength and function is considerable, especially early after surgery. In recent years, a combination of unimodal evidence-based perioperative care components has been demonstrated to enhance recovery, with decreased need for hospitalization, convalescence, and risk of medical complications after major surgery—the fast-track methodology or enhanced recovery programs. It is the nature of this methodology to systematically and scientifically optimize all perioperative care components, with the overall goal of enhancing recovery. This is also the case for the care component “physiotherapy exercise” after THA and TKA. The 2 latest meta-analyses on the effectiveness of physiotherapy exercise after THA and TKA generally conclude that physiotherapy exercise after THA and TKA either does not work or is not very effective. The reason for this may be that the “pill” of physiotherapy exercise typically offered after THA and TKA does not contain the right active ingredients (too little intensity) or is offered at the wrong time (too late after surgery). We propose changing the focus to earlier initiated and more intensive physiotherapy exercise after THA and TKA (fast-track physiotherapy exercise), to reduce the early loss of muscle strength and function after surgery. Ideally, the physiotherapy exercise interventions after THA and TKA should be simple, using few and well-chosen exercises that are described in detail, adhering to basic exercise physiology principles, if possible.

Key Words: Arthritis; Arthroplasty, replacement; Leg; Muscle strength; Outcomes assessment; Rehabilitation.

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THE STUDY BY Liebs et al,¹ recently published in *Archives of Physical Medicine and Rehabilitation*, suggested that early commenced (postoperative day 6 vs day 14) aquatic exercise therapy might improve functional recovery after total knee arthroplasty (TKA), but not total hip arthroplasty (THA). Hence, the Liebs study¹ indicated that timing of

physiotherapy exercise after TKA may be important when low(er) intensity aquatic exercise is used early after surgery. However, the aquatic exercise program used in the Liebs study¹ appeared to have been of low and nonprogressive intensity, and the program did not hold a detailed description of, for example, repetitions, range of motion, and relative loading for the specific exercises. This exercise physiology information is particularly important when physiotherapy exercise is intended to be “strengthening,” as stated in the Liebs study,¹ and generally when considering future rehabilitation research within fast-track THA and TKA.

Major surgery, including THA and TKA, is followed by undesirable sequelae such as catabolism and the risk of cardiopulmonary and thromboembolic complications, as well as pain, which may limit early (and late) functional recovery. Consequently, major surgery is followed by a convalescence period, where different types of physiotherapy exercise interventions have been common praxis. However, in recent years, a combination of unimodal evidence-based perioperative care components has been demonstrated to enhance recovery, with decreased need for hospitalization, convalescence, and risk of medical complications (the fast-track methodology or enhanced recovery programs).^{2,3} These efforts have included stress reduction with regional anesthetic techniques, pharmacologic reduction of stress responses, optimized multimodal nonopioid analgesia, antiemetics, optimized fluid management, and enforced early mobilization and oral nutrition.²⁻⁴ The pathophysiologic and clinical consequences of these interventions include less catabolism and loss of postoperative muscle mass and function, improved pulmonary function, enhanced recovery of gastrointestinal function, and reduced thromboembolic complications,^{2,3} including patients undergoing THA and TKA.^{5,6} Furthermore, enforced and early mobilization has been shown to enhance muscle functional recovery after major abdominal surgery,^{2,3,7} which has also been reported recently for the knee extensors and flexors after an early versus a late start of low(er) intensity physiotherapy exercise after TKA.⁸ The rehabilitation efforts in THA and TKA are of interest, since early strength and functional performance losses are considerable, and, for knee extension strength, amounting to about 80% after TKA⁹ and about 30% after THA.¹⁰

The 2 most recent meta-analyses on the effectiveness of physiotherapy exercise after THA and TKA concluded that “insufficient evidence exists to establish the effectiveness of physiotherapy exercise following primary hip replacement for osteoarthritis,”¹¹ and “interventions including physiotherapy functional exercises after discharge result in short term benefit after elective primary total knee arthroplasty.”¹² From this, one may be led to conclude that physiotherapy exercise after THA

From the Clinical Research Centre, and Departments of Orthopedic Surgery and Physical Therapy, Copenhagen University Hospital, Hvidovre (Bandholm); Section of Surgical Pathophysiology, Rigshospitalet, Copenhagen University, Copenhagen (Kehlet); and the Lundbeck Centre for Fast-Track Hip and Knee Arthroplasty Copenhagen University Hospital, Hvidovre (Kehlet), Denmark.

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Reprint requests to Thomas Bandholm, PhD, Clinical Research Centre (136), Copenhagen University Hospital, Hvidovre, Kettegård Allé 30, DK-2650 Hvidovre, Denmark, e-mail: thomas.bandholm@hvh.regionh.dk.

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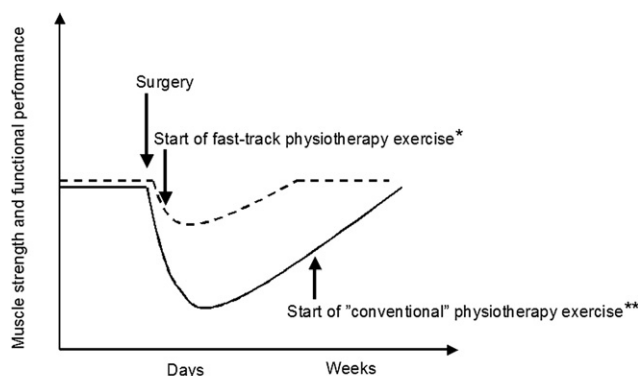
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List of Abbreviations

RM	repetition maximum
THA	total hip arthroplasty
TKA	total knee arthroplasty

and TKA either does not work or is not very effective. Another possibility is that the “pill” of physiotherapy exercise offered after surgery did not contain the right active ingredients (too little intensity) or was offered at the wrong time (too late after surgery). Traditionally, more intensive physiotherapy exercise after THA and TKA has usually been instituted in the later (2–4wk) postoperative period,^{11,12} thereby allowing considerable loss of muscle function to occur. Moreover, the type of physiotherapy exercise interventions after THA and TKA has often been based on treatment tradition and not on firm scientific evidence, basic exercise physiology principles, or both. The time may therefore be appropriate for a reconsideration of how physiotherapy exercise interventions after THA and TKA should be constructed. This is essentially the nature of the fast-track methodology,^{2,3} in which mobilization and physiotherapy exercise are important parts of the multimodal recovery program.

What then are the consequences for future research within physiotherapy exercise after THA and TKA? First of all, the timing should be right. Ideally, the intervention should start before the deficits are the greatest, if the goal is a fast recovery. A systematic recording of relevant variables, such as joint pain or swelling, can accompany the intervention, if the concern is symptom exacerbation caused by the early implementation.¹³ Second, the ingredients should be right. Given the considerable early strength and functional performance losses after THA and TKA, progressive strength training^{14,15} (in addition to training of function) seems rational, as strength training increases muscle strength over time in THA^{16,17} and TKA,¹⁸ and may improve functional performance after THA¹⁷ and TKA.¹⁸ Also, the selection of muscles and functions to be trained should be based on documented deficits (impairment-based approach). Third, the ingredients should not be too many. That is, the clinical scenario in most places is a maximum of 45 to 60 minutes per physiotherapy session. So, even though many physiotherapists would wish for time to strength train most major muscle groups of the operated leg, a few exercises that, based on functional anatomy, will have the greatest chance of transfer from strength gain to improved functional performance should be chosen. Fourth, the chosen ingredients should be well described, if others are to replicate the research or implement the intervention clinically. “Standard” or “conventional” therapy, even as an exercise-therapy control-intervention, makes little sense. For example, the description of strength-training exercises should adhere to basic exercise physiology, such as anatomic definition, contraction types, time under tension, range of motion, and always by a description of the relative load (for a review of commonly used strength-training descriptors, see Toigo and Boutellier¹⁹). “Three sets of 10 repetitions” of a given exercise makes little sense, as we lack the intensity (relative load/repetition maximum [RM]) information. That is, could the patient have continued contractions to 10 or 25 before contraction failure (muscular exhaustion), corresponding to 10 and 25RM, respectively? The muscle hypertrophy and strength-gain stimulus of the 2 scenarios are likely very different. To that end, if contractions are performed to contraction failure, the absolute load (the kilograms that are lifted) should be adjusted on a set-by-set basis, and not a week-by-week basis, to truly reflect the intended relative load (RM), especially since changes in muscle strength seem to occur very fast when progressive strength training is initiated early after TKA.¹³ Obviously, not all physiotherapy exercises can be described as easily with respect to intensity, as is the case for strength-training exercises. However, train-



*Few, but intense and well-described exercises selected on the basis of quantified deficits and basic exercise physiology. Initiated early after surgery.

**Many, less intense and less well-described exercises selected on the basis of quantified deficits and treatment tradition. Initiated late(r) after surgery.

Fig 1. Principles of fast-track physiotherapy exercise after THA and TKA.

ing of function (eg, sit to stand) can always be described as number of repetitions, or minutes for a balance exercise.¹³

CONCLUSIONS

As there are recent data to indicate that physiotherapy exercise, including strength training, can be instituted early (earlier) after THA^{16,17} and TKA,^{13,18,20} and seems to be more effective compared with a lesser intensive physiotherapy control,^{16-18,20} we, in line with others,²¹ propose to change the focus to earlier initiated and more intensive physiotherapy exercise after THA and TKA (fast-track physiotherapy exercise; *fig 1*). Ideally, the physiotherapy exercise interventions after THA and TKA should be simple (few and well-chosen exercises), well described, and adhere to basic exercise physiology, if possible. Such studies are important, as they will help define the most effective type of physiotherapy exercise to enhance recovery after fast-track THA and TKA.

References

- Liebs TR, Herzberg W, Ruther W, Haasters J, Russlies M, Hasenpflug J. Multicenter randomized controlled trial comparing early versus late aquatic therapy after total hip or knee arthroplasty. *Arch Phys Med Rehabil* 2012;93:192-9.
- Kehlet H, Dahl JB. Anaesthesia, surgery, and challenges in post-operative recovery. *Lancet* 2003;362:1921-8.
- Kehlet H, Wilmore DW. Evidence-based surgical care and the evolution of fast-track surgery. *Ann Surg* 2008;248:189-98.
- Kehlet H. Fast-track surgery: an update on physiological care principles to enhance recovery. *Langenbecks Arch Surg* 2011;396:585-90.
- Husted H, Otte KS, Kristensen BB, Orsnes T, Wong C, Kehlet H. Low risk of thromboembolic complications after fast-track hip and knee arthroplasty. *Acta Orthop* 2010;81:599-605.
- Husted H, Otte KS, Kristensen BB, Orsnes T, Kehlet H. Readmissions after fast-track hip and knee arthroplasty. *Arch Orthop Trauma Surg* 2010;130:1185-91.
- Kehlet H. Fast-track colorectal surgery. *Lancet* 2008;371:791-3.
- Labraca NS, Castro-Sanchez AM, Mataran-Penarrocha GA, Arroyo-Morales M, Sanchez-Joya MM, Moreno-Lorenzo C. Benefits of starting rehabilitation within 24 hours of primary total knee arthroplasty: randomized clinical trial. *Clin Rehabil* 2011;25:557-66.

9. Holm B, Kristensen MT, Bencke J, Husted H, Kehlet H, Bandholm T. Loss of knee-extension strength is related to knee swelling after total knee arthroplasty. *Arch Phys Med Rehabil* 2010;91:1770-6.
10. Holm B, Kristensen MT, Husted H, Kehlet H, Bandholm T. Thigh and knee circumference, knee-extension strength, and functional performance after fast-track total hip arthroplasty. *PM R* 2011;3:117-24.
11. Minns Lowe CJ, Barker KL, Dewey ME, Sackley CM. Effectiveness of physiotherapy exercise following hip arthroplasty for osteoarthritis: a systematic review of clinical trials. *BMC Musculoskelet Disord* 2009;10:98.
12. Minns Lowe CJ, Barker KL, Dewey M, Sackley CM. Effectiveness of physiotherapy exercise after knee arthroplasty for osteoarthritis: systematic review and meta-analysis of randomised controlled trials. *BMJ* 2007;335:812.
13. Jakobsen TL, Husted H, Kehlet H, Bandholm T. Progressive strength training (10 RM) commenced immediately after fast-track total knee arthroplasty: is it feasible? *Disabil Rehabil* 2011 Nov 15. [Epub ahead of print]
14. Delorme TL. Restoration of muscle power by heavy-resistance exercises. *J Bone Joint Surg Am* 1945;27:645-67.
15. Delorme TL, Watkins AL. Technics of progressive resistance exercise. *Arch Phys Med Rehabil* 1948;29:263-73.
16. Husby VS, Helgerud J, Bjorgen S, Husby OS, Benum P, Hoff J. Early maximal strength training is an efficient treatment for patients operated with total hip arthroplasty. *Arch Phys Med Rehabil* 2009;90:1658-67.
17. Suetta C, Magnusson SP, Rosted A, et al. Resistance training in the early postoperative phase reduces hospitalization and leads to muscle hypertrophy in elderly hip surgery patients—a controlled, randomized study. *J Am Geriatr Soc* 2004;52:2016-22.
18. Petterson SC, Mizner RL, Stevens JE, et al. Improved function from progressive strengthening interventions after total knee arthroplasty: a randomized clinical trial with an imbedded prospective cohort. *Arthritis Rheum* 2009;61:174-83.
19. Toigo M, Boutellier U. New fundamental resistance exercise determinants of molecular and cellular muscle adaptations. *Eur J Appl Physiol* 2006;97:643-63.
20. Bade MJ, Stevens-Lapsley JE. Early high-intensity rehabilitation following total knee arthroplasty improves outcomes. *J Orthop Sports Phys Ther* 2011;41:932-41.
21. Bade MJ, Stevens-Lapsley JE. Restoration of physical function in patients following total knee arthroplasty: an update on rehabilitation practices. *Curr Opin Rheumatol* 2012;24:208-14.