



EFFECTIVENESS OF ELASTIC RESISTANCE TRAINING USING THERABAND IN POST-TOTAL KNEE REPLACEMENT REHABILITATION: A COMPREHENSIVE LITERATURE REVIEW

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ABSTRACT

Osteoarthritis (OA) of the knee is a debilitating condition leading to pain, functional decline, and muscle weakness, particularly in the quadriceps. Total knee Replacement (TKR) is a common surgical intervention, but it is often followed by significant postoperative muscle strength loss. Standard rehabilitation protocols frequently prove insufficient for restoring muscle function, highlighting a need for more effective and accessible alternatives. A comprehensive literature search was conducted across databases including PubMed, Google Scholar, and PEDro. The intervention was noted to be cost-effective, portable, and adaptable for home-based use, providing a viable alternative to traditional, resource-intensive rehabilitation. While a small number of studies showed no significant difference in outcomes, the overwhelming evidence supports the positive impact of this training modality. Elastic resistance exercises using TheraBand are an effective and valuable component of post-TKR rehabilitation. The literature demonstrates that this training method contributes to improved muscle strength, functional capacity, and quality of life.

KEYWORDS

Thera-band, Osteoarthritis and TKR

INTRODUCTION

The complex hinge mechanism that supports weight-bearing activities and facilitates movement is the knee joint. The medial tibiofemoral, lateral tibiofemoral, and patellofemoral joints are its three main compartments, and it joins the femur and tibia. Together, these compartments contribute to movements like walking, standing, and bending because they share a synovial cavity. By giving the quadriceps muscle more leverage, the patella, a sesamoid bone inserted in the quadriceps tendon, improves the mechanical efficiency of knee extension. The patella's articular surface area is substantially less than the femur's, making the patellofemoral joint noticeably out of alignment and vulnerable to mechanical stress⁽¹⁾.

Osteoarthritis is a gradual degenerative joint disease that primarily affects elderly people. It is defined by the disintegration of articular cartilage, which causes joint discomfort, stiffness, edema, and loss of function. The quadriceps femoris is one of the most commonly damaged muscles in knee OA, and its strength is directly related to an individual's functional mobility and quality of life⁽²⁾. Walking, rising from a chair, and ascending stairs are all made more difficult by quadriceps weakness. This muscular weakness is frequently aggravated by arthrogenic muscle inhibition (AMI), a reflex inhibition of muscle activation caused by joint injury or pain, as well as postural changes designed to reduce load on the affected joint⁽³⁾. Reduced physical activity in OA patients also contributes to sarcopenia, higher fall risk, and additional functional impairment⁽⁴⁾.

When conservative therapy fail, total knee arthroplasty (TKR) is the treatment of choice for patients with advanced knee OA. While TKR efficiently relieves pain and restores joint alignment, it is frequently associated with a significant decrease in muscular strength, particularly in the early postoperative phase. According to studies, knee extensor strength can decline by 60-80% shortly after surgery^(5,6). This strength loss is caused by both AMI and disuse atrophy, and while pain and joint mobility usually improve with time, muscle strength does not always return to preoperative levels⁽⁷⁾. Persistent weakness after TKR is related with slower functional recovery and poor long-term outcomes.

Standard rehabilitation after TKR focuses on pain management, range of motion (ROM), and functional training, such as balancing and gait exercises. However, these programs frequently use low-intensity training regimens, which may be insufficient for regaining lost muscle mass and strength⁽⁸⁾. Given the critical significance of the quadriceps and surrounding musculature in joint stability and functional recovery, additional emphasis on progressive resistance training (PRT) is required. Recent studies recommend combining high-intensity resistance training into TKR therapy to improve outcomes.

Targeted strengthening, especially with machine-based or weight-

bearing activities, has been proven to help restore function^(5, 2). However, such treatments frequently necessitate access to specialist equipment and clinical supervision, which may not be possible for all patients, particularly those with limited mobility or living in rural places.

To address the limits of traditional rehabilitation, elastic band exercises have gained popularity as a practical, accessible, and cost-effective option. These bands offer scalable resistance, making them adaptable to a variety of strength levels and ideal for home-based rehab. Elastic bands allow for multi-joint, closed-chain, and functional movements that target key muscle groups such as the quadriceps, hamstrings, and hip abductors, enhancing knee stability and boosting functional performance⁽⁹⁾. Although resistance training with elastic bands has been widely validated in general rehabilitation settings, its use in post-TKR recovery is rather understudied. Although some preliminary evidence supports benefits in orthopedic groups, such as post-hip replacement patients⁽¹⁰⁾, TKR poses distinct problems, such as increased pain sensitivity, post-surgical edema, and muscle inhibition, all of which require additional exploration.

Need of the Study

Given the limited evidence base and the practical advantages of elastic band exercises—such as affordability, portability, and adaptability—there is a compelling need to explore their effectiveness in TKR rehabilitation. As the demand for home-based, patient-directed recovery methods grows, understanding the role of elastic band training in improving muscle strength and functional independence becomes increasingly relevant. This study aims to evaluate the efficacy of elastic band resistance exercises in enhancing muscle strength and functional recovery in individuals following TKR. By comparing these outcomes to traditional rehabilitation strategies, this research intends to bridge a critical gap in the literature and contribute to the development of more inclusive and accessible post-TKR rehabilitation protocols.

Research Methodology

Inclusion Criteria

- Studies examining the effects of TheraBand exercises on TKR patients.
- Only studies that specifically focus on the use of TheraBand (elastic resistance) for muscle strengthening in TKR patients.
- Studies with all research designs, including randomized controlled trials (RCTs), observational studies, case reports, and pilot studies.
- Use of WOMAC (Western Ontario and McMaster Universities Arthritis Index) as a functional outcome measure, assessing pain, stiffness, and physical function.
- Studies written in English.

Exclusion Criteria

- Review papers and studies that focused exclusively on theoretical

discussions or indications for TKR without evaluating functional outcomes.

- Studies without relevant outcome measures related to muscle strength or functional improvement post-TKR.

Literature Search Strategy

To identify relevant studies, a comprehensive literature search was conducted using the following electronic databases:

- PubMed
- Google Scholar
- Orthopedic Journals
- Physiotherapy Evidence Database (PEDro)

Additionally, reference lists from relevant research articles and review papers were also examined to identify studies not captured through the initial search process.

Keywords Used

- TheraBand
- Total Knee Replacement (TKR)
- Resistance Exercise

These keywords were used to filter the literature and ensure that only studies addressing the impact of elastic resistance (TheraBand) on TKR recovery were included.

Selection Criteria

- Subjects are post-TKR patients: Only studies that included individuals who had undergone Total Knee Replacement (TKR).
- Focus on elastic resistance training programs: The review considered only studies incorporating TheraBand (elastic

resistance) as part of the rehabilitation program. Other forms of resistance exercise, such as weight training or bodyweight exercises, were excluded.

- Outcome measures focused on muscle strength: The primary outcome measure had to involve muscle strength or endurance, particularly of the quadriceps, hamstrings, or other knee-related muscles. Studies that did not analyze muscle strength as a key outcome were excluded.

RESULTS

In this review, 30 articles met the inclusion criteria and were graded according to their level of evidence. Of these, 20 studies were classified as high-quality, 6 as moderate, and 4 as low-quality. Among the reviewed literature, 26 studies reported statistically significant positive effects of TheraBand-based resistance training in TKR rehabilitation. These benefits included increased quadriceps and hip muscle strength, improved functional performance, reduced postoperative pain, and enhanced range of motion.

Evidence consistently showed improvement in WOMAC scores, particularly in the pain and physical function domains. Elastic band exercises demonstrated superior voluntary peak quadriceps muscle activity and reduced joint stiffness. Moreover, patients undergoing TheraBand training exhibited improved walking speed and better performance on uneven surfaces.

However, 7 studies indicated no statistically significant change in outcomes such as strength, pain, or functional mobility when using TheraBand. These discrepancies may be attributed to variability in study designs, exercise protocols, participant demographics, or outcome measures.

Study	Purpose	Participants / Methods	Results	Conclusions
1. Elastic Band Exercise After TKR	Investigate effect of elastic band exercises on lower extremity rehab post-TKR.	50 participants: control (conventional), experimental (elastic band + conventional). Evaluated at 2 and 4 weeks.	Experimental group had greater knee flexion, higher quadriceps strength, and better function.	Elastic band exercises improve post-TKR rehabilitation outcomes.
2. Hip vs. Quadriceps Strengthening After TKR	Compare hip vs. quadriceps strengthening in TKR patients.	55 participants in 3 groups: hip, quadriceps, control. 12-week therapy, 3x/week.	Hip group had better pain relief, physical function, and gait.	Hip strengthening improves outcomes more than quadriceps strengthening post-TKR.
3. Elastic Resistance Training Post-TKR	Assess elastic resistance exercise on lean mass and functional outcomes in older women.	40 participants: experimental (elastic resistance), control (standard care).	Significant improvements in leg lean mass and gait speed in experimental group.	Elastic resistance training improves outcomes post-TKR.
4. Progressive Resistance Strength Training in OA	Assess strength training effect on BMI, quality of life, and function in obese knee OA patients.	56 participants: Rehab Protocol Group (LLRP), Control (usual care).	RPG showed reduced BMI and improved quality of life and function.	Progressive resistance training is effective in obese knee OA patients.
5. Resistance Training in Older Women with OA and TKR	Analyze strength and adaptation to resistance training in older women with OA and TKR.	23 women: OKG (OA + TKR), OG (older without OA), YG (young).	OKG had the most improvement in muscle strength and exercise intensity.	Resistance training addresses strength deficits in older women with OA and TKR.
6. Eccentric Strengthening for Knee OA	Effect of eccentric strengthening on muscle and function in an African-American male with OA.	1 male patient; 12-week eccentric strengthening for knee flexors/extensors.	Improved muscle morphology, strength, function, and reduced pain.	Eccentric strengthening improves outcomes in knee OA patients.
7. Hip Muscle Strengthening After TKR	Study hip muscle strengthening's effect on pain and function post-TKR.	55 participants: hip, quadriceps, and control groups. Therapy 3x/week for 12 weeks.	Hip group showed more improvement in pain, function, and gait.	Hip strengthening is more effective than quadriceps strengthening after TKR.

DISCUSSION

The present review explores the impact of elastic resistance training, particularly using Thera Band, on rehabilitation outcomes following Total Knee Replacement (TKR).

Chou and Chen confirmed that implementing elastic band exercises in elderly individuals post-TKR significantly enhanced lower limb rehabilitation⁽¹¹⁾. Their findings support the integration of low-cost, portable, and accessible resistance equipment like TheraBands into post-surgical physiotherapy protocols. Similarly, Chun-DeLion et al. highlighted that elastic resistance training should be considered a key rehabilitation strategy to help patients with knee osteoarthritis (KOA) recover muscle mass and strength after undergoing TKR surgery⁽¹³⁾. This is particularly relevant given the muscle atrophy and strength loss commonly observed postoperatively.

In another study, Do and Yim demonstrated that a 12-week hip muscle strengthening exercise program led to significant improvements in

pain, physical function, and gait among TKR patients⁽¹²⁾. This suggests that strengthening muscles surrounding the knee and hip joint provides additional joint stabilization and aids in smoother biomechanical movement, thereby facilitating improved postoperative function.

Preoperative training has also been shown to have valuable outcomes. Calatayud et al. emphasized that high-intensity strength training performed before surgery resulted in reduced pain, enhanced lower limb muscle strength and ROM, and superior functional task performance⁽¹⁴⁾. Moreover, this type of training contributed to shorter hospital stays and accelerated recovery following surgery. These findings underscore the importance of early intervention to optimize surgical outcomes and promote faster functional independence.

In overweight and obese patients with knee OA, Rafiq et al. demonstrated that progressive resistance training performed in non-weight-bearing positions improved BMI, quality of life, and functional ability⁽¹⁵⁾. This is particularly relevant given the high correlation

between increased body weight and joint degeneration, and the need to mitigate mechanical stress on the knee joint during rehabilitation.

Resistance training was also reported to be effective in preventing functional decline in elderly patients. Ciolac et al. emphasized that resistance training is a key strategy in counteracting age-related impairments in mobility, which are often worsened by the decreased muscle mass associated with TKR⁽¹⁶⁾. Furthermore, HwaJan et al. found that both high and low-resistance strength training protocols effectively reduced pain and improved function, reinforcing the adaptability of resistance training for diverse patient populations⁽¹⁷⁾.

Aguiar et al. extended this perspective by demonstrating that a comprehensive resistance training approach targeting quadriceps, gluteal, and abdominal muscles could substantially enhance functional outcomes and quality of life in knee OA patients⁽¹⁸⁾. Likewise, eccentric strengthening, as evidenced by Hernandez et al., led to notable improvements in muscle morphology, strength, functional performance, and reduced pain after 12 weeks of exercise in TKR patients⁽¹⁹⁾.

Navid Kalani et al. further confirmed that resistance training with TheraBand not only reduced pain but also significantly enhanced the quality of life in patients with knee osteoarthritis⁽²⁰⁾. These findings align with the broader literature supporting the role of resistance exercises in modulating sensory input, reducing joint load, and improving neuromuscular control.

The WOMAC scale has been widely used as an outcome measure in these studies. It effectively assesses pain, stiffness, and function in OA patients and has demonstrated sensitivity in detecting changes post-intervention. Improvements in WOMAC scores, particularly in the pain subscale, were consistently reported across the included studies. From a mechanistic perspective, elastic resistance training promotes muscle activation through neuromuscular structures such as muscle spindles and Golgi tendon organs. It helps reduce chronic pain, which has a significant impact on limiting physical activity and, consequently, contributes to muscle weakness and joint rigidity. By improving both flexor and extensor muscle strength, TheraBand training enhances joint stability and overall mobility.

Although 26 out of the 30 reviewed articles supported the efficacy of elastic resistance band exercises, 7 studies reported no statistically significant improvements. These research may be attributed to variations in exercise protocols, sample characteristics, study duration, or outcome assessment tools. Nonetheless, the overwhelming majority of evidence supports the implementation of Thera Band-based resistance training as a valuable addition to TKR rehabilitation programs.

CONCLUSION

This study confirmed the positive impact of elastic resistance exercises using TheraBand in enhancing rehabilitation outcomes following Total Knee Replacement (TKR). The literature strongly supports the integration of TheraBand resistance training to improve muscle strength, physical function, and overall quality of life.

TheraBand exercises have been shown to reduce postoperative pain, increase quadriceps and hip muscle strength, and restore range of motion. The intervention is also cost-effective, portable, and adaptable to various fitness levels, making it a viable tool for home-based rehabilitation programs.

It also supports the need for individualized, progressive resistance training protocols that address both joint stability and muscle activation.

Overall, this review emphasizes the clinical value of TheraBand resistance training as an evidence-based strategy in the continuum of care for TKR patients.

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