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Prehabilitation: A Smoother Pathway to Surgery

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ABSTRACT

Prehabilitation, a proactive approach involving physical, psychological, and nutritional preparation, has gained recognition as a critical component of orthopedic surgery care. This structured intervention aims to optimize a patient's functional capacity prior to surgery, facilitating faster recovery and improved outcomes. Research demonstrates that prehabilitation enhances muscle strength, joint flexibility, and cardiovascular endurance, mitigating the loss of physical function during the postoperative phase. It also reduces the risk of complications, shortens hospital stays, and improves overall patient satisfaction. By addressing psychological factors such as anxiety and fear, prehabilitation contributes to mental readiness, which can influence recovery trajectories. This review explores the evidence supporting prehabilitation, outlines effective strategies tailored to orthopedic patients, and highlights its role in reducing healthcare costs. Integrating prehabilitation into standard preoperative protocols presents a promising opportunity to transform orthopedic care and improve patient outcomes.

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Introduction

Osteoarthritis (OA) is indeed the most common and disabling musculoskeletal disorder worldwide, and it is becoming increasingly prevalent due to an aging global population [1]. As lifespans increase and lifestyle factors such as sedentary behavior, obesity, and joint overuse become more common, the incidence of OA is projected to rise substantially. OA primarily affects the joints bilaterally, particularly weight-bearing ones like the knees, hips, and spine, leading to pain, stiffness, and decreased mobility, which can significantly impact quality of life [2]. Surprisingly OA is the most prevalent disorder affecting the elderly population in the USA [3]. As per the research by A Patel and members it is projected that in United States by 2030 the demand for primary TKA will grow by 673% while for THA it is predicted to rise by 174% [4]. Musculoskeletal surgeries, including joint replacements, ligament repairs, and spinal surgeries, often require extended recovery periods with associated pain, reduced mobility, and a temporary loss of physical function. Preoperative rehabilitation commonly termed as "Prehabilitation" is considered an important part of therapy that targets physical wellbeing of the patient prior to surgery to reduce the post-surgery risks and enhance postoperative results [5].

Prehabilitation (or prehab) is a proactive approach to preparing the body for an upcoming challenge, such as surgery, athletic performance, or physical stress. It involves tailored exercises, education, and interventions designed to optimize strength, flexibility, endurance, and overall function before a significant event [6]. The goal is to improve outcomes, reduce recovery time, and lower the risk of complications. Prehabilitation is vital as it prepares individuals physically and mentally for upcoming challenges such as surgery, intense physical activity, or managing chronic conditions. By enhancing strength, flexibility, endurance, and overall function beforehand, prehab reduces the risk of complications, speeds up recovery, and improves outcomes. It empowers patients to enter the process in optimal condition, promoting independence and resilience while reducing the likelihood of prolonged rehabilitation or setbacks. This proactive approach not only improves physical readiness but also fosters confidence and mental preparedness, making it a cornerstone of holistic care and injury prevention.

The article enhances more on the components of the Prehabilitation and how it proactively prepares patients physically and mentally for surgery or physical challenges, improving outcomes and reducing recovery time.

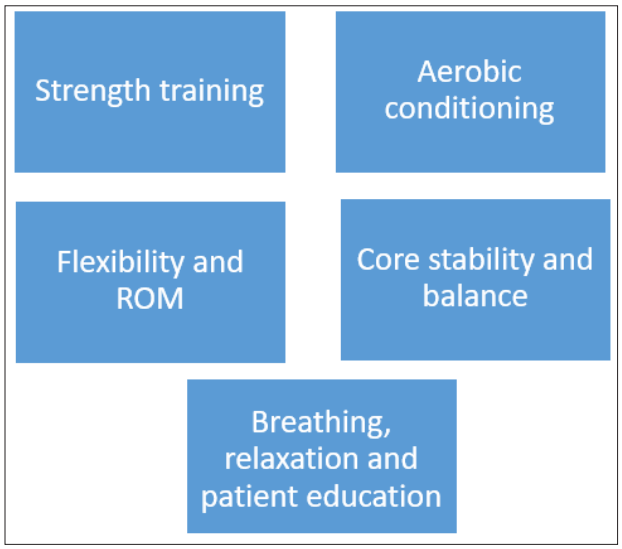

Figure 1: Various Components of Prehabilitation [6].

Components of Prehabilitation

"Prehabilitation," is designed to improve patients' physical readiness for surgery, focusing on enhancing muscle strength, flexibility, and overall functional capacity [7]. A common prehabilitation program includes the components of warm-up, a cardiovascular component, resistance training, flexibility training, and practicing functional tasks [8].

Strength Training

Targeted Muscle Groups: Strengthening exercises focus on muscles surrounding the joint or area undergoing surgery. Prehabilitation for knee surgery emphasizes knee extensors, flexors, hip abductors, adductors and knee flexors, while shoulder surgery prehabilitation focuses on deltoids, rotator cuff muscles, and upper back [9]. Progressive Resistance: As per the study by Birjit, Skoffer and team progressive resistance training with high training intensity and high frequency yields better results with less pain and lesser joint effusion post-surgery [9]. The study done by Joaquin C and team members suggests that high intensity progressive training improves leg strength, ROM, functional task performance before surgery, thus leading to a shorter hospital stay and faster and better recovery post-surgery [10].

Flexibility and Range of Motion (ROM) Training

As per the study done by Pascale Gränicher and team members, due to pain and reduced mobility the muscles tend to get stiff leading to reduced ROM and flexibility so techniques like Neuromuscular facilitation, stretching and maintaining physical activity are crucial for joint specific stretching [11]. Stretching focussing on muscles around the joint to improve flexibility, relieve tightness, and support greater ROM. 3 types of stretching – static, dynamic and PNF. Dynamic stretches (like leg swings) are often incorporated for mobility, while static stretches (holding a stretch for 15-30 seconds) help lengthen muscles. Functional Movements: Incorporating movements that mimic daily activities, like bending, reaching, and squatting as a part of maintaining a physical activity can enhance ROM and make recovery tasks easier post-surgery [11].

Aerobic Conditioning

Researches show that aerobic activities like walking, cycling, swimming including an optimal combination of AE and inspiratory muscle training (IMT) significantly build endurance and cardiovascular health of the patient without straining joints, preparing them for the physical demands of rehabilitation, improve overall circulation, reduce overall morbidity rates and length of hospital stays [11]. High-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) are the most common methods of improving cardiopulmonary fitness. Studies have shown that HIIT results in substantial and rapid improvement in $\dot{V}$ O2peak and is safe in those with cardiac conditions. HIIT is also appealing for preoperative patients because it shows rapid improvement when there is a limited period of time between diagnosis and surgery [12].

Core Stability and Balance Training

Balance Exercises: Balance training as a part of prehabilitation can significantly promote balance early postoperatively and reduce the risk of falls by improving proprioception [13]. Various kinds of activities with different gym equipments like Balance boards, BOSU disc, or stability balls can be used to help improve proprioception and prevent falls during recovery. Core Strengthening Exercises: Core stability is strengthening of the muscles that surround the spine and abdominal viscera is essential for initiation of functional limb movements and kinetic chain [14]. Training core muscles with exercises like bridging, deadbugs, bird dogs, and various yoga postures is considered vital.

Breathing, Relaxation Techniques and Patient education

Preoperative breathing exercise training helps maximizes the respiratory muscle strength thus prevents postoperative pulmonary complications like infections and eventually reduces the hospital length of stay. Various different methods like diaphragmatic breathing, pursed lip breathing, spirometer training can be incorporated for respiratory muscle training. Preoperative patient education has been linked to lower anxiety levels, contributing to better overall recovery. Educating the patient on importance of prehabilitation, relaxation techniques like meditation, guided imagery, movement precautions has been considered an important step in the prehabilitation ensuring smooth journey to the surgery.

Benefits of Preoperative Strength Training

Improved Physical Function

Prehabilitation enhances functional reserve, which helps patients better withstand the stress of surgery. For orthopedic surgeries, such as joint replacements or spinal procedures, improved muscle strength and joint flexibility can facilitate faster postoperative mobilization. Reduced risk for injuries, improved stability, and safer recovery trajectory. With proper targeted prehabilitation there is improved muscle strength, reduced chances of muscle atrophy, better mobility of the joints, better maintained flexibility of the muscles and ligaments with proper stretching, better proprioception leading reduced chances of falls post-surgery as a result of better balance training.

Faster Recovery and Reduced Hospitalization

Patients who engage in prehabilitation often experience shorter hospital stays, faster and regain independence sooner. Strengthened muscles and better-prepared joints allow for smoother transitions to rehabilitation after surgery. Increased physical resilience enables these patients to better tolerate and respond to early rehabilitation protocols. With better strength training prior to surgery helps in improved blood circulation and nutrient and oxygen delivery to the tissue boosting the post-operative healing. Prehab strengthens the immune system through cardiovascular and resistance training thus reducing chances of circulatory complications and infections.

Reduced Postoperative Complications

Prehabilitation can decrease the risk of complications such as infections, blood clots, muscle atrophy or joint stiffness as a result of targeted strength training, stretching exercises, balance training and aerobic conditioning. Enhanced cardiovascular fitness also reduces the likelihood of perioperative issues like pulmonary complications. Stronger muscles help maintain blood flow thus helping for quicker tissue healing, while enhanced fitness levels generally support improved immune function.

Enhanced Mental Preparedness

Prehabilitation includes educating the patient about the surgical process, potential outcomes and possible complications thus preparing the patient mentally. Meditation and relaxation techniques, breathing exercises and imagery techniques can improve mental resilience. Physical exercises lead to release of endorphins that help improve mood and reduce the stress. Surgery is a significant stressor, and addressing psychological aspects pre-emptively can improve patient confidence and compliance by reducing anxiety.

Recommendations for Implementation
To maximize the impact of preoperative strength training, the following recommendations can be considered

Early Assessment and Individualized Programs
Patients should undergo a comprehensive physical evaluation, allowing healthcare providers to design strength programs targeting specific muscles and considering individual physical limitations.

Multidisciplinary Involvement
A good collaboration within the entire medical team involving surgeon, physical therapist, exercise physiologist, nutritionist, nursing team can enhance program design, ensuring the holistic approach to the patient.

Timeline and Duration
A good prehabilitation should ideally begin at least 4-6 weeks prior to surgery, allowing sufficient time for muscular adaptations while avoiding injury or fatigue.

Patient Education and Psychological Support
Providing information on the potential benefits and expected outcomes of preoperative training can increase patient adherence and reduce anxiety associated with the surgical process.

Conclusion
Prehabilitation represents a vital step in modern surgical care, particularly in orthopedics. By optimizing physical and mental health before surgery, patients are better equipped to handle the physiological and emotional demands of surgery and recovery. Healthcare providers should prioritize incorporating prehabilitation into preoperative protocols, ensuring a holistic approach to patient care. Prehabilitation is a proactive and essential strategy for optimizing health outcomes before surgery or physical challenges. By improving physical strength, flexibility, and endurance while addressing mental preparedness, it reduces complications, shortens recovery times, and enhances overall quality of life. Its holistic approach empowers individuals to take an active role in their care, ensuring they enter recovery with confidence and resilience. Prehabilitation is not just preparation—it's a pathway to faster healing, better outcomes, and improved long-term functionality.

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