Review

Breast Reconstruction and its Impact on Movement: Considerations for Physiotherapy Management

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Abstract:
Breast reconstruction following mastectomy has become an integral component of comprehensive breast cancer care, offering significant psychosocial and quality-of-life benefits. However, reconstructive procedures may also lead to movement limitations and functional impairments, primarily affecting the upper limb and, in autologous reconstructions, the donor site. This article provides an overview of the impact of different breast reconstruction techniques on movement and functional outcomes, with an emphasis on implications for physiotherapy intervention. A literature review was conducted using peer-reviewed articles, systematic reviews, and clinical guidelines published between 2000 and 2025, focusing on implant-based and autologous reconstruction methods. The findings indicate that upper limb and shoulder girdle dysfunction, including reduced shoulder range of motion, muscle weakness, pain, altered scapular kinematics, and compensatory movement patterns, is common after breast reconstruction. Implant-based procedures are mainly associated with pectoralis muscle tightness and shoulder dysfunction, while autologous techniques such as latissimus dorsi and abdominal flaps may result in additional deficits at the donor site. Evidence supports the effectiveness of structured, individualized, and progressive physiotherapy in improving functional recovery and preventing long-term impairment. Integrating reconstruction-specific rehabilitation into multidisciplinary breast cancer care is essential for optimizing long-term functional outcomes and overall quality of life.

Keywords: Breast reconstruction; Mastectomy; Upper quarter dysfunction; Shoulder biomechanics; Movement impairment; Physiotherapy

1. Introduction

Breast cancer is one of the most common cancers, primarily affecting women, though men are not exempt. Its incidence is rising, and consequently, so is the demand for breast reconstruction surgery. In high-income countries, particularly in the United States, population-based analyses indicate that 32–40% of women undergoing mastectomy receive breast reconstruction. Implant-based techniques account for approximately 75–80% of procedures, while autologous reconstructions comprise the remainder (Albornoz et al., 2013; Saldanha et al., 2021). In Europe, reconstruction rates after mastectomy are generally lower and more variable. Multinational surveys and registry studies indicate that immediate reconstruction is performed in fewer than 40% of mastectomy cases in most European countries. In some nations, reported rates are as low as 1–20%, despite guideline recommendations advocating broader access. Implant-based reconstruction is the most common approach, while autologous procedures constitute a smaller but stable proportion (Däster et al., 2024). In Slovenia, population-based data on post-mastectomy reconstruction are not captured by the national cancer registry (SLORA). Institutional and cohort studies suggest that approximately 20–25% of surgically treated breast cancer patients in Slovenia undergo breast reconstruction. These procedures are divided between implant-based (~10–11%) and autologous (~12–13%) approaches; however, the data do not yet reflect true population-level incidence (Grasic Kuhar et al., 2023; SLORA, 2025).

Breast cancer treatment depends on disease stage and tumor subtype. A multimodal, patient-tailored approach is essential for optimal outcomes. In early-stage disease, treatment typically includes surgical removal of the primary tumor, followed by adjuvant systemic therapy (Qari et al., 2024). Systemic treatment selection is guided by tumor biology and may include chemotherapy, hormone therapy, antibody–drug conjugates, or immunotherapy (Abdulkareem & Zurmi, 2012; Privšek et al., 2024). In severe cases, mastectomy of one or both breasts is performed for both therapeutic and preventive purposes. Both immediate and delayed breast reconstruction following mastectomy have been shown to improve quality of life, body image, and psychosocial well-being. These findings underscore that reconstruction is not merely a cosmetic procedure but contributes to meaningful patient-centered outcomes (Pačarić et al., 2022). These benefits are associated with an increasing number of women opting for reconstructive surgery after breast cancer treatment (Jagsi et al., 2014).

Breast reconstruction is therefore an integral component of comprehensive care for women with breast cancer; however, patient suitability for surgery and the risk of postoperative complications must be carefully considered (Wilkins et al., 2018). Reconstruction may be performed either simultaneously with mastectomy or as a delayed procedure following completion of adjuvant therapy, using either implant-based techniques or autologous tissue reconstruction. Studies using the BREAST-Q questionnaire indicate that women undergoing autologous reconstruction report higher overall well-being, quality of life, and sexual well-being than those receiving implant-based reconstruction (Broyles et al., 2022; Toyserkani et al., 2020). In addition, prospective studies have shown that quality of life scores can be significantly higher in key areas such as breast satisfaction and physical well-being after autologous fat transfer or autologous reconstruction compared to implants (Piatkowski et al., 2023).

The purpose of this literature review is to examine the impact of breast reconstruction on movement and functional outcomes, and to summarize evidence-based recommendations for physiotherapy intervention.

2. Design of the Review

We conducted a literature review aimed at gathering current evidence regarding breast reconstruction following breast carcinoma focusing on the surgery's impact on movement and its implications for physiotherapy treatment. The review included articles published between 2000 and 2025, selecting only studies published in English and Slovene to ensure thorough comprehension. The literature search incorporated a range of sources, including peer-reviewed articles, systematic reviews, meta-analyses, academic textbooks, and clinical guidelines. Peer-reviewed scientific articles comprised the primary evidence base, offering elaborate analyses of surgical techniques, biomechanical consequences and expected rehabilitation outcomes. Systematic reviews and meta-analyses were used to provide comprehensive summaries of existing research and to identify prevailing trends in clinical practice.

3. Breast reconstruction and its impact on movement

Three main methods of breast reconstruction are currently used in clinical practice: implant-based reconstruction, autologous reconstruction using the patient's own tissue, and a combination of both approaches. Implant-based reconstruction involves the placement of silicone or saline implants placed either above or beneath the pectoralis major muscle (Sinnott et al., 2018). Autologous reconstruction utilizes tissue harvested from other regions of the body and transfers it to the breast; most commonly, a latissimus dorsi muscle (LAT) flap, a deep inferior epigastric perforator (DIEP) flap, and a transverse rectus abdominis muscle (TRAM) flap. The choice of reconstructive technique is ultimately determined by patient preference, individual patient characteristics, cancer stage, and the potential need for adjuvant radiation therapy (Platt et al., 2011).

Cancer patients often have functional deficits after treatment. Since breast reconstruction follows mastectomy, it is necessary to consider the associated conditions to fully understand the functional impact of treatment on patients. Evidence indicates that these procedures predominantly affect the upper quarter of the body. Upper quarter dysfunction may manifest as pain, lymphedema, restricted mobility, reduced sensation, and decreased muscle strength. Common postoperative conditions include tightness of the chest musculature persisting for up to six months, the presence of lymphedema for up to one year, and frequent impairments in the rotator cuff region (Hayes et al., 2012). In addition, scapular dyskinesis is frequently observed following mastectomy, even in the absence of pain, and may contribute to limitations in upper limb mobility (Crosbie et al., 2010).

Movement dysfunctions of the shoulder girdle and scapular dyskinesis may persist for several years following breast surgery (Shamley et al., 2009). Patients frequently experience reduced range of motion of the glenohumeral joint, alterations in the activation patterns of scapular stabilizing muscles – particularly the descending part of trapezius and rhomboids (Shamley et al., 2007) – as well as a reduction in muscle size, predominantly affecting the pectoralis major and minor (Borstad & Ludewig, 2005), and impaired eccentric muscle control of the shoulder (Shamley et al., 2007). These biomechanical alterations may result from compensatory movement strategies and protective limb behavior (Crosbie et al., 2010), as well as from scar tissue formation and muscle shortening. Each surgical approach selectively affects distinct anatomical structures, resulting in differing impacts on shoulder mobility, muscle activation, and muscle tightness.

3.1. Implant- based reconstruction

Expander-implant reconstruction is the most used technique for breast reconstruction (Nelson et al., 2018). This approach involves total or partial submuscular placement, with the expander positioned underneath the pectoralis major muscle. Patients frequently report postoperative pain and muscle spasms involving the pectoralis major. De Haan et al. (2007) also reported a reduction in torque muscle strength in the affected limb. Pain leads to protective behaviors and compensatory movement patterns, which may further impair shoulder function. Additionally, patients are more prone to excessive muscle tightness and scar tissue formation (Bot et al., 2005).

3.2. Latissimus dorsi muscle flap

LAT flap is a musculocutaneous flap, detaching the muscle from its spinal attachments and transferring it to the breast region while preserving its original vascular supply (Leonardis et al., 2019). Given that the latissimus dorsi is a large and powerful muscle with a substantial role in shoulder joint movements, notable functional deficits are expected following this procedure. Muscle disinsertion results in impairments of both muscle strength and shoulder mobility (Forthomme et al., 2010; Kim et al., 2013). Patients also frequently report a sense of shoulder instability (Giordano et al., 2011).

LAT flap reconstruction has been associated with long-term reductions in isometric shoulder adduction, internal rotation, and extension strength, persisting for up to 3.5 years postoperatively (van Huizum et al., 2016). Nonetheless, evidence suggests that functional morbidity following the LAT flap reconstruction improves over time, ultimately leading to minimal limitations in activities of daily living (Adams et al., 2004; Lee & Mun, 2014). Because the latissimus dorsi plays a critical role in forceful and high-demand arm movements, residual impairments tend to primarily affect athletic performance and other vigorous upper-limb activities rather than routine functional tasks (Adams et al., 2004; McAnaw & Harris, 2002).

3.3. Abdominal autologous reconstruction

The TRAM flap harvested from the lower abdomen was previously a common option for autologous breast reconstruction. However, due to the increased risk of donor-site complications such as abdominal hernia and bulge, surgical practice has increasingly shifted toward the use of the deep inferior epigastric perforator (DIEP) flap to minimize functional impairment of the abdominal wall (Futter et al., 2000).

The DIEP flap consists of skin and subcutaneous fat harvested from the lower abdomen and vascularized by perforating branches of the deep inferior epigastric vessels, while preserving the rectus abdominis muscle. By maintaining abdominal muscle integrity, DIEP flap reconstruction is associated with reduced donor-site morbidity compared with the TRAM flap. In addition, DIEP reconstruction may incorporate vascularized lymph node transfer as a strategy to prevent or reduce lymphedema (Spiegel et al., 2020). Despite these advantages, some degree of postoperative abdominal weakness may still be present following DIEP reconstruction (Futter et al., 2000).

In contrast, TRAM flap reconstruction involves partial or complete use of the rectus abdominis muscle, resulting in greater disruption of abdominal wall function (Pataky et al., 2025). This technique has been associated with significantly reduced strength of the abdominal musculature and back extensors, particularly affecting trunk flexors and extensors (Atisha & Alderman, 2009; Seidenstuecker et al., 2016). Patients reconstructed with TRAM flaps can develop deficits in rectus abdominis and oblique muscle function and frequently report higher levels of postoperative pain and greater functional impairment compared to patients with a DIEP flap (Atisha & Alderman, 2009).

4. Considerations for physiotherapy intervention

Regardless of the reconstructive approach used, some degree of functional impairment is common, particularly during the early postoperative period. Reducing these impairments and improving functional outcomes after treatment may depend not only on the chosen surgical method but also on the integration of physiotherapy into postoperative care (Nelson et al., 2018). Physiotherapy, in combination with structured home exercise programs, plays an important role in alleviating pain, preventing persistent shoulder dysfunction, restoring range of motion, and facilitating a safe return to functional and recreational activities. The optimal type, intensity, and timing of exercise interventions following reconstructive surgery remain unclear (Mazuquin et al., 2021).

Physiotherapy after breast reconstruction should be grounded in the standard rehabilitation principles applied after mastectomy and breast reconstruction. However, effective rehabilitation also requires an understanding of the procedure-specific characteristics of each reconstructive technique, enabling therapists to appropriately tailor exercise prescription, progression, and precautions (Rietjens et al., 2015). In the immediate postoperative period, temporary restrictions in shoulder movement may be necessary to protect surgical sites and minimize the risk of complications such as wound dehiscence or seroma formation. However, prolonged periods of restricted shoulder mobility can increase the likelihood of dysfunction in the upper body (McNeely et al., 2012). To facilitate and accelerate recovery, patients should be encouraged to perform gentle shoulder extension and adduction exercises, as tolerated (Spear & Hess, 2005). During the first two postoperative weeks, shoulder exercises are typically limited to a maximum of 90° of elevation. Once adequate wound healing is achieved, full shoulder range of motion may be gradually restored between weeks 2 and 4 (Richmond et al., 2018). Progressive strengthening exercises are generally introduced after approximately one month, with return to sports and higher-load activities encouraged after three months, depending on individual recovery (Bruce et al., 2018; Ammitzbøll et al., 2019; Schmitz et al., 2010). A Cochrane systematic review evaluated structured postoperative exercise interventions, including supervised physiotherapy, in comparison with usual care, such as the provision of exercise leaflets. Structured exercise programs were shown to significantly improve shoulder mobility in both the short and long term (McNeely et al., 2010).

Following implant-based reconstruction, physiotherapy should focus on restoring shoulder mobility while addressing altered muscle activation patterns associated with submuscular implant placement. Early rehabilitation should include gentle range-of-motion exercises, relaxation and re-training of the pectoralis major muscle, and gradual correction of compensatory movement strategies (McAnaw & Harris, 2002; Nelson et al., 2018). As healing progresses, strengthening exercises targeting the rotator cuff and scapular stabilizers should be progressively introduced to support optimal shoulder biomechanics (Nelson et al., 2018).

Patients who undergo LAT flap reconstruction are at a higher risk of developing shoulder dysfunction compared with those who receive implant-based reconstruction or other types of autologous tissue reconstruction (Rindom et al., 2019). Up to 73% of patients with LAT flap reconstruction report difficulties in performing activities of daily living that involve arm movement after surgery (Nelson et al., 2018). Rehabilitation should therefore emphasize strengthening of the scapular stabilizers, correction of scapular dyskinesis, and activation of muscles acting as primary synergists of the latissimus dorsi (McAnaw & Harris, 2002). In addition, targeted back strengthening and postural exercises are recommended to reduce the risk of postural alterations, including thoracolumbar scoliosis (Kim & Glazer, 2000).

Abdominal-based reconstructions require additional consideration of donor-site morbidity and trunk function. In patients undergoing TRAM flap reconstruction, rehabilitation should address deficits in abdominal and trunk muscle strength to support posture and functional movement (Atisha & Alderman, 2009; Seidenstuecker et al., 2016). Although DIEP flap reconstruction preserves the rectus abdominis muscle, some degree of abdominal weakness may persist (Futter et al., 2000). Preoperative physiotherapy focusing on abdominal muscle strength, particularly the rectus abdominis, may contribute to improved postoperative functional outcomes and faster recovery following DIEP flap reconstruction (Seidenstuecker et al., 2016).

Adjunctive therapies such as massage therapy may help reduce postoperative pain, anxiety, and fatigue, thereby facilitating participation in active rehabilitation (Dion et al., 2016). Pulsed electromagnetic field therapy has also been reported to reduce pain and inflammation following TRAM flap reconstruction and may decrease the need for narcotic analgesics in selected patients (Rohde et al., 2015). These modalities should be considered complementary to, rather than replacements for, active physiotherapy interventions.

5. Discussion

Breast reconstruction following mastectomy plays a crucial role in improving quality of life, body image, and psychosocial well-being in individuals treated for breast cancer (Pačarić et al., 2022). However, findings across the reviewed literature indicate that reconstructive procedures are frequently associated with postoperative movement and functional impairments. These impairments predominantly affect the upper quarter of the body, including the shoulder girdle and scapulothoracic region, and, in the case of autologous reconstructions, may additionally involve the donor site (Crosbie et al., 2010; Hayes et al., 2012).

When counseling patients, a key consideration is the extent to which surgery may affect their ability to perform everyday functional tasks. The extent and nature of movement dysfunction vary depending on the surgical technique. Implant-based reconstruction is commonly associated with shoulder pain, reduced range of motion, and altered muscle activation patterns, particularly involving the pectoralis major muscle (De Haan et al., 2007; Nelson et al., 2018).

Autologous reconstructions, particularly those involving the LAT or TRAM flap, introduce additional functional challenges by altering muscle anatomy and biomechanics. LAT flap procedures may result in prolonged deficits in shoulder strength, stability, and scapular control, which can persist for years and impact high-demand activities (van Huizum et al., 2016; Lee & Mun, 2014). Similarly, TRAM flap reconstruction is associated with long-term

abdominal weakness and reduced trunk strength, which may compromise posture and functional capacity (Atisha & Alderman, 2009; Seidenstuecker et al., 2016).
Despite these challenges, evidence suggests that functional morbidity often improves over time, particularly when appropriate rehabilitation strategies are implemented. Physiotherapy plays a vital role in mitigating postoperative impairments, restoring range of motion, and preventing chronic dysfunction. Structured postoperative exercise programs are more effective than standard care alone in improving shoulder mobility and function in both the short and long term (McNeely et al., 2010). Early but controlled mobilization, followed by a gradual progression to strengthening and functional exercises, appears to provide the best balance between tissue healing and prevention of stiffness or maladaptive movement patterns (McNeely et al., 2012; Richmond et al., 2018). Adjunctive therapies such as massage therapy and pulsed electromagnetic field therapy may further enhance recovery by reducing pain, inflammation, anxiety, and reliance on narcotic medication. These interventions may be particularly beneficial in the early phases of rehabilitation, when pain and fear of movement often limit patients' participation in exercise (Dion et al., 2016; Rohde et al., 2015). Rehabilitation should be individualized, progressive, and adapted to the specific biomechanical consequences of each reconstructive technique (Nelson et al., 2018).
In Slovenia, an increasing number of patients undergo breast reconstruction following mastectomy each year, reflecting improved surgical techniques and greater awareness of reconstructive options (Zorman, 2013). Reconstruction is performed within a multidisciplinary framework, with established collaboration between oncologic and plastic surgeons in major centers in Ljubljana and Maribor (Vrabič, 2009). In recent years, the University Medical Center Ljubljana has performed over 200 reconstructions after mastectomy per year. Approximately half of the patients decide to undergo autologous reconstruction, while the other half decide to undergo reconstruction with an implant (Zorman, 2013). As reconstruction rates continue to rise, the demand for rehabilitation services tailored to this population is expected to increase.
Overall, while breast reconstruction offers substantial psychosocial benefits, its functional consequences should not be underestimated. This review underscores the importance of individualized, progressive, and reconstruction-specific physiotherapy interventions to address postoperative movement impairments and optimize functional recovery. However, the available evidence is limited by heterogeneity in study designs, outcome measures, and follow-up durations, highlighting the need for high-quality longitudinal studies and the development of standardized rehabilitation protocols.

6. Conclusions

Breast reconstruction after mastectomy provides important psychosocial benefits but is frequently associated with movement and functional impairments, particularly affecting the shoulder girdle and, in autologous procedures, the donor site. The type and extent of dysfunction depend on the reconstructive technique used, highlighting the need for reconstruction-specific rehabilitation approaches. Evidence supports the role of structured and progressive physiotherapy in improving range of motion, strength, and functional outcomes. Physiotherapists should be familiar with the biomechanical consequences of different reconstruction methods to ensure safe, individualized, and effective postoperative care. However, the available evidence is limited by heterogeneity in study designs, outcome measures, and follow-up periods. Future research should focus on high-quality, longitudinal studies to establish standardized, reconstruction-specific physiotherapy protocols.

Conflicts of Interest: The authors declare no conflict of interest.

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