

## IMPACT OF POSTMASTECTOMY RADIATION THERAPY ON IMPLANT-BASED BREAST RECONSTRUCTION OUTCOMES IN BREAST CANCER PATIENTS

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### **Abstract**

Breast reconstruction has become an essential component of modern breast cancer management, significantly improving psychosocial well-being and postoperative quality of life. However, the integration of postmastectomy radiation therapy (PMRT) into reconstructive treatment remains clinically challenging due to its association with postoperative complications and compromised aesthetic outcomes. This thesis evaluates the influence of radiation therapy on immediate implant-based breast reconstruction in patients treated for breast cancer. The analysis is based on a retrospective clinical cohort of 132 patients who underwent one-stage reconstruction after mastectomy. The findings indicate that PMRT is strongly associated with an increased incidence of postoperative complications, particularly capsular contracture, while implant-based reconstruction remains a practical and acceptable option for selected patients. The study also highlights the possible protective value of polyurethane implants and additional lower-pole coverage in reducing radiation-related morbidity. These data support a personalized reconstructive

strategy that balances oncologic safety, technical feasibility, and long-term quality of life.

**Keywords:** breast cancer, breast reconstruction, radiation therapy, capsular contracture, implant-based reconstruction, mastectomy, quality of life

## **Introduction**

Breast cancer remains one of the most common malignant diseases among women worldwide and continues to be a major challenge in oncologic surgery and rehabilitation. Over recent decades, advances in breast cancer treatment have shifted clinical priorities from survival alone toward long-term quality of life, body image restoration, and psychosocial recovery. In this context, immediate breast reconstruction following mastectomy has become an increasingly preferred surgical approach.

Implant-based breast reconstruction offers several practical advantages, including reduced operative time, avoidance of donor-site morbidity, and faster postoperative recovery. Nevertheless, one of the most debated issues in reconstructive breast surgery is the interaction between immediate reconstruction and adjuvant radiation therapy. PMRT plays a crucial role in locoregional control and may improve survival in selected breast cancer patients. At the same time, radiation exposure can adversely affect reconstructed tissues and prosthetic devices, resulting in fibrosis, inflammation, wound complications, implant failure, and deformity.

From a reconstructive standpoint, PMRT introduces both biological and technical concerns. Biologically, irradiation promotes chronic tissue remodeling, vascular impairment, and scar formation. Technically, reconstructed anatomy may complicate radiation planning and dose distribution. Therefore, identifying the most appropriate reconstructive method in patients who may require PMRT is of major clinical importance.

The purpose of this thesis is to analyze the effect of radiation therapy on immediate implant-based breast reconstruction and to assess which factors may contribute to minimizing complications while preserving functional and aesthetic outcomes.

### **Materials and Methods**

This thesis is based on a retrospective clinical analysis of breast cancer patients who underwent immediate implant-based reconstruction following mastectomy in a specialized oncologic and reconstructive surgery center between June 2013 and November 2017

A total of **132 patients** were included in the study. All patients underwent surgical treatment with immediate reconstruction using endoprosthesis techniques. In most cases, subcutaneous or skin-sparing mastectomy was followed by one-stage implant placement. In selected patients, additional reconstructive support was provided using mesh implants, acellular dermal matrix (ADM), thoracodorsal flaps, latissimus dorsi flaps, or other coverage methods to reinforce the lower pole of the reconstructed breast

The study population included patients with different clinical stages of breast cancer, predominantly stages I–IIIA, with a smaller number of advanced cases and rare sarcoma cases. Some patients received neoadjuvant chemotherapy based on tumor burden and prognostic factors, while others underwent adjuvant systemic treatment after surgery. Radiation therapy was administered to **47 patients**, with a cumulative dose of **45 Gy**, according to postoperative pathological findings and multidisciplinary treatment planning

Clinical follow-up ranged from **6 to 48 months**, with a mean observation period of approximately **28 months**. Outcomes assessed in this analysis included:

- postoperative surgical complications,
- incidence and severity of capsular contracture,

implant-related morbidity,  
reconstructive stability,  
and patient-reported quality of life.

Quality of life was assessed using the **Breast-Q reconstruction module**, which provided additional insight into patient satisfaction and functional well-being after reconstruction

## Results

The results demonstrate that immediate implant-based reconstruction remains technically feasible in breast cancer patients receiving multimodal therapy; however, radiation therapy substantially increases the risk of postoperative complications.

The most frequently observed complication in the postoperative period was **capsular contracture**, which emerged as the principal adverse outcome associated with implant reconstruction. Additional complications included:

**seroma formation,**  
**hematoma,**  
**marginal skin necrosis,**  
**implant protrusion,**  
and **postoperative infection**

Among these complications, capsular contracture represented the most clinically relevant late adverse effect. The majority of severe cases corresponded to **Baker grade III contracture**, indicating substantial firmness and visible distortion of the reconstructed breast. The average time to development of contracture was approximately **7.6 months**, suggesting that radiation-related fibrotic changes become clinically evident relatively early in the postoperative follow-up period

One of the important findings of this analysis is that **radiation therapy significantly increased the likelihood of capsular contracture**. This supports

the current understanding that PMRT induces fibrosis and tissue stiffening around the implant, leading to both aesthetic deterioration and patient discomfort.

At the same time, not all implant-based reconstructions were equally affected. The data suggest that **polyurethane-coated implants** were associated with a **lower rate of severe capsular contracture** compared with conventional textured implants. This observation may indicate a more favorable interaction between implant surface properties and irradiated tissue response.

Another relevant observation concerns implant coverage techniques. Patients whose reconstructions included **additional lower-pole support**—such as ADM, mesh, or flap-based coverage—tended to demonstrate **better quality-of-life scores** compared with those reconstructed without additional implant support. Although these measures did not completely eliminate radiation-associated complications, they appeared to improve reconstructive comfort, contour stability, and patient satisfaction.

Importantly, bilateral reconstruction did not appear to create major technical barriers to radiation planning in the analyzed cohort, suggesting that appropriately planned reconstructive surgery can remain compatible with oncologic radiotherapy requirements.

## Discussion

The relationship between radiation therapy and breast reconstruction continues to be one of the most complex issues in oncoplastic breast surgery. The present analysis confirms that PMRT is a major risk factor for adverse reconstructive outcomes, particularly in implant-based procedures. This is consistent with current oncologic and reconstructive literature, where radiation is repeatedly associated with fibrosis, delayed wound healing, implant exposure, and contracture.

Despite these risks, implant-based reconstruction should not be considered contraindicated in all irradiated patients. In real clinical practice, implant reconstruction remains widely used because it is less invasive than autologous tissue transfer, more accessible in many institutions, and often more acceptable to patients. The key clinical challenge is therefore not whether reconstruction should be performed, but rather **how to optimize reconstruction in the context of expected or possible radiation therapy.**

The present findings support a **risk-adapted reconstructive approach.** In patients with a high probability of requiring PMRT, preoperative planning should include:

- careful patient selection,
- implant choice optimization,
- reinforcement of soft-tissue coverage,
- and close multidisciplinary coordination between oncologic surgeons, reconstructive surgeons, and radiation oncologists.

The lower incidence of severe contracture in patients with polyurethane implants deserves special attention. Although this observation requires further prospective validation, it suggests that implant biomaterial characteristics may influence tissue behavior after irradiation. Likewise, the use of ADM, mesh, or flap-assisted support may help preserve breast contour and improve patient-reported outcomes, even if these strategies do not fully prevent fibrotic complications.

Another clinically meaningful point is the role of **quality of life.** Breast reconstruction should not be evaluated only by complication rates or reoperation frequency. For many patients, restoration of body image, femininity, confidence, and psychosocial balance is a central therapeutic objective. Therefore, even in cases where complication risks are moderately increased, immediate reconstruction may still provide substantial long-term benefit if patients are appropriately counseled and managed.

Overall, this study supports the concept that PMRT and implant-based reconstruction can coexist successfully, but only under conditions of individualized planning and evidence-based surgical decision-making.

### Conclusion

Postmastectomy radiation therapy has a significant negative effect on immediate implant-based breast reconstruction, primarily by increasing the incidence of capsular contracture and other postoperative complications. Nevertheless, implant reconstruction remains a clinically relevant and acceptable option in the comprehensive treatment of breast cancer.

The best reconstructive outcomes are likely achieved through:  
individualized treatment planning,  
appropriate implant selection,  
reinforcement of soft-tissue coverage,  
and multidisciplinary cooperation.

In patients at risk for PMRT, the use of **polyurethane implants** and **additional implant coverage techniques** may contribute to improved reconstructive tolerance and better postoperative quality of life. Future prospective studies with longer follow-up are needed to refine reconstructive protocols and establish the most effective strategies for patients undergoing radiation therapy after mastectomy.

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