

# Research on the Design Optimization of Postoperative Compression Bras for Breast Cancer Patients

Xiaoli Ren<sup>1, \*</sup>, Zuhui Shang<sup>1</sup>, Yuqin Zhou<sup>3</sup>

<sup>1</sup>School of Modern Fashion, Anhui Vocational and Technical College, Hefei, Anhui 230011, China

<sup>2</sup>Anqing Shang Zuhui Fashion Design Co., Ltd., Anqing, Anhui 246000, China

<sup>3</sup>Hefei Ranner Garment Design Co., Ltd., Hefei, Anhui 230000, China)

\* Corresponding author: 446525210@qq.com

**Abstract:** By thoroughly analyzing the needs of breast cancer patients during the postoperative recovery period, this study proposes an optimized and innovative design for compression bras based on the current market offerings. The structural and aesthetic designs of the bra are optimized to address multiple aspects of patient needs, including ease of wear, comfort, and psychological comfort. This research provides postoperative breast cancer patients with rehabilitation products that better align with both their physiological and emotional needs, while also offering theoretical foundations and practical guidance for the development and design of related medical auxiliary products.

**Keywords:** Postoperative bra for breast cancer, compression bra, design optimization, rehabilitation product.

## 1. Introduction

As one of the most common malignant tumors affecting women globally, the incidence of breast cancer in China continues to rise year by year, making it the leading cause of cancer-related deaths among Chinese women. Surgery remains the most common treatment approach, often resulting in changes to the patient's breast shape and body contour. Since the breast is a key symbol of feminine identity, its loss or alteration can lead to crises in self-identity and social anxiety[1]. Conventional bras, primarily designed for healthy populations, fail to meet the complex needs of postoperative patients, such as prosthesis support, wound protection, and overall comfort[2]. Therefore, the optimized design of specialized postoperative bras for breast cancer patients is especially important—it not only fulfills physiological needs but also addresses psychological well-being. This study aims to enhance the functionality and comfort of bras through structural design and to improve their aesthetic appeal through emotional design. The goal is to offer patients more personalized and precise rehabilitation support, thereby promoting both physical and psychological recovery. The findings contribute significantly to the advancement of breast cancer rehabilitation care, strengthen the connection between clinical practice and patient-centered needs, and help improve patients' postoperative quality of life and social adaptability, bearing both academic and social significance.

## 2. Definition of Research Subjects

Breast cancer surgeries can be broadly categorized into three types: breast-related surgeries, radical or modified radical mastectomies, and lymph node-related surgeries. As the latter two are less relevant to bra design, this study focuses primarily on breast-related surgeries, which include breast-conserving surgery, total mastectomy, and breast reconstruction. The primary concern for postoperative patients is to relieve discomfort and ensure protection of the surgical site. As the breast tissue may be damaged or altered in shape, this group of patients urgently needs support

garments with mechanical adaptability. The pressure transmission system of such bras should distribute loads evenly to prevent localized stress concentrations and secondary injuries. According to different stages of postoperative recovery, patients require different types of bras. During the first recovery phase (1–3 months post-surgery), compression bras are needed to provide pressure on the chest, protect the wound, reduce bleeding, and promote healing. For patients who have undergone breast reconstruction, compression bras help conform the skin around the implant, reducing complications such as implant displacement or deformation. The second recovery phase allows the use of non-compression bras. Patients who have undergone total mastectomy need to wear external breast prostheses, while those who have had breast-conserving or reconstructive surgery can wear regular bras. This study mainly focuses on the design optimization and improvement of compression bras.

## 3. Analysis of Compression Bra Needs and Market Status for Breast Cancer Patients

### 3.1. Analysis of Compression Bra Needs

Postoperative breast cancer patients have highly individualized and functional needs for compression bras during their recovery period. Clinical observations show that approximately 38% of cases may experience lymphatic circulation disorders within three years after surgery. This necessitates the use of support garments designed with a pressure gradient conforming to hydrodynamic principles to enhance the efficiency of interstitial fluid flow[3]. After surgery, the chest tissue is often swollen, sensitive, and even painful. During the recovery process, the skin and soft tissues are highly susceptible to external stimuli, making comfort a top priority for patients. The pressure intensity and support features of the bra must be carefully designed to avoid secondary injuries caused by friction or excessive compression.

Many patients experience limited upper limb mobility post-

surgery, especially those who have undergone axillary lymph node dissection, making arm lifting and backward movement difficult. Moreover, during the treatment and recovery process, patients must undergo frequent chest examinations and wound care, which require frequent removal of the bra. Thus, ease of wearing and removing the compression bra is also a major consideration for patients.

Breast cancer surgery also significantly impacts patients' psychological health and gender identity. As the breast is an essential secondary sexual characteristic for women, changes in breast appearance post-surgery can lead to inferiority

complex and anxiety. This is especially true for those who undergo total mastectomy, who may feel they are "no longer women," which can affect their social life, professional confidence, and intimate relationships. The resulting physical transformation can trigger a crisis in self-identity, often manifesting in social withdrawal and emotional instability. Therefore, supportive undergarments must balance both functional needs and emotional comfort[1]. From a design perspective, the colors and patterns of compression bras should convey soothing psychological signals and provide wearers with positive emotional reinforcement.

**Table 1.** Design Needs of Postoperative Compression Bras for Breast Cancer Patients




Demand Dimensions	Demand Content	Design Optimization
Physiological Needs of Patients	Appropriate and adjustable pressure	Structural improvement
	Ease of wearing and removal Comfort	Structural improvement Structural and craftsmanship improvement
Psychological Needs of Patients	Avoidance of shame	A well-designed structure can stably support breast shape
	Avoidance of anxiety	Soft colors and pleasant appearance

### 3.2. Market Status

Through literature review and online market research, the

current market status of compression bras for breast cancer patients has been summarized. The products available can be generally categorized into three types:

**Table 2.** Market Overview of Postoperative Compression Bras for Breast Cancer Patients

Product Pictures	Product Features
	One horizontal pressure band across the upper chest
	Two horizontal pressure bands across the upper and lower chest
	Only one or two horizontal pressure bands, no matching bra included

Current compression bras mainly suffer from insufficient precision. Most pressure straps are horizontally aligned and apply bilateral compression. However, in reality, many patients undergo surgery on only one breast. The horizontal straps, especially those across the upper chest, may apply excessive pressure on the unaffected side when worn long-term.

In terms of appearance, existing products are typically available in flesh-tone or white, exhibiting a strong clinical and medical style. There is significant room for improvement

in terms of psychological comfort and aesthetic appeal.

## 4. Key Elements in Compression Bra Design Optimization

### 4.1. Structural Design Optimization

Breast cancer can be categorized into unilateral and bilateral types depending on the location of the tumor. The vast majority of cases are unilateral. A retrospective analysis of 1,921 hospitalized female breast cancer patients in

Chongqing found that 50.13% had cancer in the left breast, 49.35% in the right, and only 0.52% had bilateral breast cancer[4].

Current compression bras on the market use pressure straps that cover both breasts, typically split into upper and lower chest bands. The lower band provides support beneath the breast and does not directly apply pressure to the breast itself. However, the upper chest band presses directly on the upper part of both breasts, which may impose unnecessary pressure on the healthy side during use. To address this, the conventional horizontal upper pressure band has been redesigned as a diagonal strap. Depending on which side has been affected, the strap can slant either left or right to avoid the healthy side and apply compression only to the operated breast.

To fully cover the affected breast, the width of the strap has been increased. Compared to the narrower original version, the wider strap distributes pressure more evenly, providing improved support and shaping effects.

As different stages of recovery require different levels of compression, the diagonal pressure strap includes an adjustable hook at its end, allowing the wearer to modify the strap length and adjust the compression level according to individual needs.

Additionally, the structural design of postoperative bras must ensure even pressure distribution to avoid pressing on the surgical area. Adjustable points are added to the shoulder straps for this purpose. These straps can be adjusted according to shoulder width and comfort level, reducing shoulder load

and ensuring stability through personalized fitting[5]. Since many postoperative patients have limited arm mobility, the hook adjustments are positioned below the front of the shoulder for easier access. The shoulder strap length can be manually adjusted to alter the pressure on the breasts and enhance the lower chest band's support function.

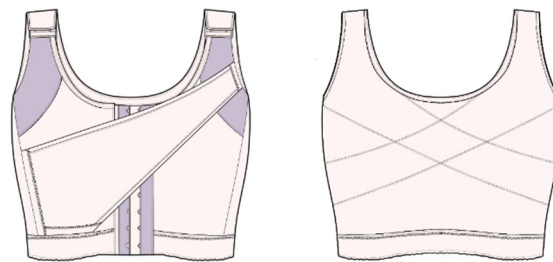
## 4.2. Aesthetic Design Optimization

In addition to physical recovery, breast cancer survivors also face emotional adjustment challenges. According to color psychology principles, soft pink is used as the primary color in the design. This warm and gentle tone helps reduce negative emotions, foster positive moods, and prevent postoperative depression and anxiety, thereby aiding both physical and psychological rehabilitation.

The overall aesthetic design draws inspiration from sports bras, using bold color-block contrasts to break away from the cold and clinical appearance of medical recovery garments. Lavender is selected as a secondary color to complement the soft pink, creating a vivid and uplifting visual appeal. This approach visually distances the product from standard medical devices and instead mimics the appearance of regular lingerie, helping to foster a sense of normalcy and boost the wearer's emotional resilience.

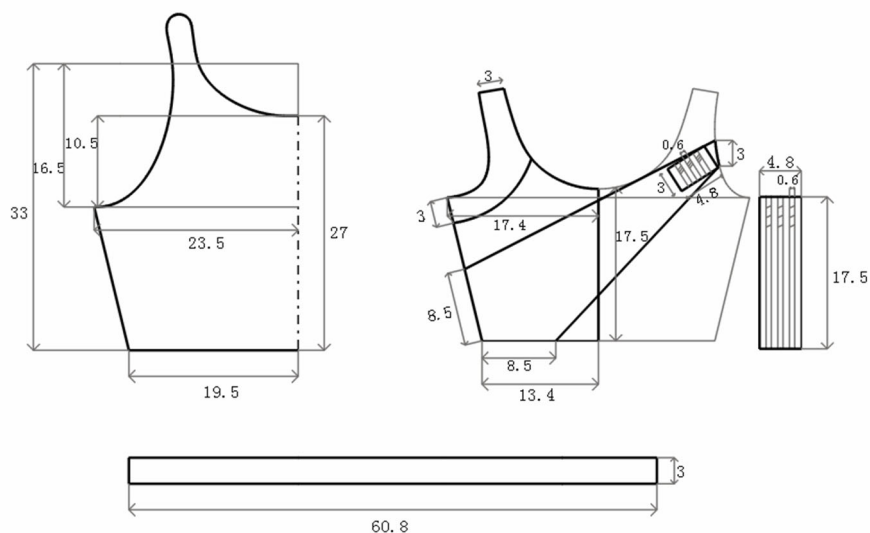
## 5. Final Product Design

The final product's style illustration is shown in Figure 1:



**Figure 1.** Style Diagram of Postoperative Compression Bra for Breast Cancer Patients

The structural layout is shown in Figure 2 (unit: centimeters):



**Figure 2.** Structural Diagram of Postoperative Compression Bra for Breast Cancer Patients

## 6. Conclusion and Outlook

Through a comprehensive analysis of the physiological and psychological needs of breast cancer patients in the postoperative period, this study proposes an innovative design for a compression bra. The design considers multiple dimensions, including aesthetic appeal, structural optimization, comfort, and ease of wear, aiming to provide more comfortable and effective rehabilitative garments for postoperative recovery. The product not only improves the quality of physical recovery but also positively impacts patients' psychological well-being, helping them rebuild confidence and alleviate anxiety and fear following surgery.

Furthermore, the study offers a new perspective for the development of postoperative care products tailored to breast cancer patients. With the continued advancement of medical technology and the growing emphasis on human-centered design, the future of compression bra design is expected to evolve toward greater personalization and intelligent functionality. This progression will contribute to innovations in postoperative care and significantly enhance the overall quality of life for breast cancer survivors.

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