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Kinesiology Taping After Tissue-Expander Breast Reconstruction: A Randomized Single-Blind Pilot Trial

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ABSTRACT

Background: *Immediate tissue-expander breast reconstruction may be followed by pain, edema, upper-limb dysfunction, and scar-related concerns that complicate postoperative recovery. Kinesiology taping (KT) is a low-cost, noninvasive adjunct, but evidence in this surgical setting remains limited.*

Objective: *To assess the feasibility, safety, and exploratory clinical outcomes of a standardized KT protocol after immediate unilateral tissue-expander breast reconstruction.*

Methods: *This randomized single-blind pilot trial was conducted at two tertiary referral hospitals from May 2023 to July 2024. Thirty-four women undergoing immediate tissue-expander reconstruction were allocated to KT plus routine postoperative care (n=17) or routine postoperative care alone (n=17). Pilot domains included feasibility, adherence, retention, protocol completion, and adverse events. Exploratory outcomes included pain, DASH/QuickDASH, Vancouver Scar Scale, limb circumference and volume, drainage outcomes, grip strength, and FACT-B.*

Results: *All 34 randomized participants were included in the available analysis. KT was associated with lower pain scores during the first four postoperative weeks ($p<0.005$), improved DASH scores during the first three weeks ($p<0.001$), and better Vancouver Scar Scale scores from week 3 onward ($p<0.001$). Limb circumference and volume were reduced after four weeks ($p=0.012$ and $p=0.015$), but these differences were not maintained at 1-month follow-up ($p>0.05$). Grip strength, QuickDASH, and FACT-B did not differ significantly between groups ($p>0.05$).*

Conclusion: *Standardized KT appeared feasible and showed exploratory short-term benefits after immediate tissue-expander breast reconstruction. Larger prospectively registered trials are needed.*

Keywords
Athletic Tape, Rehabilitation, Breast Neoplasms, Mammaplasty, Upper Extremity.

Introduction
Breast cancer remains one of the most common malignancies affecting women worldwide and represents a major cause of cancer-related morbidity and mortality. Its management is complex and multidisciplinary, often involving surgery, systemic therapy, radiotherapy, endocrine therapy, targeted therapy, and rehabilitation [1]. The reconstructive process is therefore not merely an aesthetic component of care, but an integral part of functional, psychological, and social recovery after oncologic treatment.

Women undergoing mastectomy should receive counseling regarding the available breast reconstruction options and should be evaluated by an interdisciplinary team to determine oncologic prognosis, surgical feasibility, and individualized risk factors [2,3]. Despite the benefits of reconstruction, many patients do not undergo reconstructive surgery because of fear of additional procedures, postoperative pain, increased scarring, concerns about complications, or acceptance of their postmastectomy condition [2].

In postoperative care and rehabilitation after reconstructive breast surgery, kinesiology taping (KT) has been proposed as an adjunct for pain control, lymphatic drainage, soft-tissue support, and scar management [4,5]. KT is composed of cotton fibers with a heat-sensitive acrylic adhesive and can stretch approximately 30-40%. Its proposed mechanism involves lifting the epidermis and dermis to create skin convolutions, thereby increasing subcutaneous space and potentially improving blood and lymphatic flow [4].

Although KT has been evaluated in several musculoskeletal and lymphatic conditions, evidence on its use in patients undergoing immediate breast reconstruction with tissue expanders remains limited. Its effects on postoperative pain, early upper-limb function, edema control, skin adaptation, and scar evolution after immediate implant-based reconstruction have not been adequately characterized.

Because the current evidence base is limited and heterogeneous, a pilot-trial framework is appropriate before a definitive trial. The objective of this randomized single-blind pilot trial was to assess the feasibility, safety, and preliminary rehabilitation outcomes of a standardized KT protocol as a reproducible, low-cost adjunct after immediate tissue-expander breast reconstruction.

Methods
Study Design, Setting, and Participants
This randomized single-blind pilot trial was conducted at two tertiary referral hospitals from May 2023 to July 2024. The study included 34 women with unilateral breast cancer undergoing immediate breast reconstruction with a tissue expander.

Eligible participants met the following inclusion criteria: (1) unilateral breast cancer, (2) grade I or II breast cancer, (3) immediate breast reconstruction with a tissue expander, and (4) no chemotherapy or radiotherapy during at least the previous year. No additional exclusion criteria were documented in the submitted manuscript file.

The trial is reported according to the CONSORT extension for randomized pilot and feasibility trials [6]. A participant flow summary is provided in Table 1; a full CONSORT checklist is provided separately.

Randomization, Allocation Concealment, and Blinding
Computer-generated random numbers were used to allocate patients to standardized KT plus routine postoperative rehabilitation (KT group, n=17) or routine postoperative rehabilitation alone (control group, n=17). Assignment was performed using sealed envelopes before surgery. The submitted manuscript file did not specify whether envelopes were opaque, sequentially numbered, or prepared by an independent allocator; this is acknowledged as a reporting limitation.

The study was single-blind. Outcome data were transferred to a coded database by a technician, and assessments were performed using coded records. Because KT is a visible intervention, participants and treating clinicians could not be fully blinded. The available file supports blinded handling of outcome data but does not provide enough detail to confirm whether outcome assessors, data analysts, or both were blinded throughout the study.

Interventions
Both groups received routine surgical care and the standard postoperative rehabilitation schedule. The reconstructive procedures were performed by four board-certified plastic surgeons after mastectomy by oncologic surgeons. Using monopolar electrocautery, the tissue-expander pocket was created by elevating the pectoralis major muscle, incorporating a 1-2 cm slip of rectus abdominis fascia or muscle inferiorly, and dissecting the serratus muscle laterally. The pocket was irrigated with saline solution. Two drains were placed: one infrapectoral and one axillary outside the pocket. The tissue expander was inserted, the pocket was closed with simple 3-0 Monocryl sutures, and the skin was closed in layers using the same suture material.

Postoperative care included skin protection and physical therapy twice weekly. At each visit, VAS pain score, Vancouver Scar Scale, DASH score evaluated by a physiotherapist, drainage output, and time to drain removal were assessed.

Kinesiology Taping Protocol
Patients in the KT group underwent standardized, tension-free KT application beginning in the immediate postoperative period. The protocol included one tape application designed to stabilize the shoulder and support antiedema drainage, and a second horizontal application intended to relax the pectoralis major muscle, promote

antiedema effects, and reduce tension on the scars. The KT was replaced weekly using the same technique. Color sequence was rotated at each visit until all four colors had been used. A survey was applied at each visit to evaluate the patient-perceived sensation associated with each color application (Figure 1).

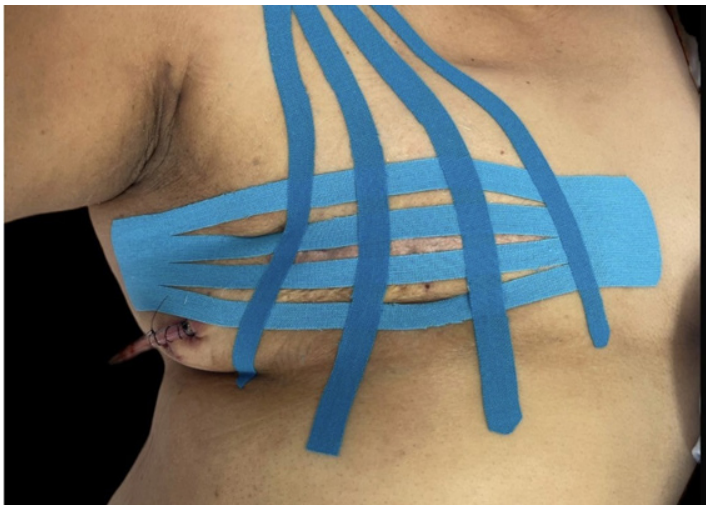

Figure 1: Standardized anonymized kinesiology taping application with horizontal and vertical tape components.

Pilot Feasibility, Safety, and Exploratory Clinical Outcomes

The pilot outcomes were recruitment and eligibility flow, retention, adherence to scheduled visits and KT applications, protocol completion, and adverse events related to KT. The original dataset available for this revision did not include a separate screening log or detailed adherence log; therefore, these feasibility outcomes are reported descriptively from the available manuscript record.

Exploratory clinical outcomes included postoperative pain using VAS, upper-limb function using DASH and QuickDASH, scar quality using the Vancouver Scar Scale, limb circumference and volume, drainage output and timing of drain removal, grip strength, and quality of life using FACT-B. Clinical outcomes were assessed during the first four postoperative weeks and at 1-month follow-up.

Sample Size

The sample size was selected as a pilot sample based on the number of eligible patients undergoing immediate tissue-expander breast reconstruction during the study period and the feasibility of completing repeated postoperative assessments. The study was not powered to detect definitive between-group efficacy differences.

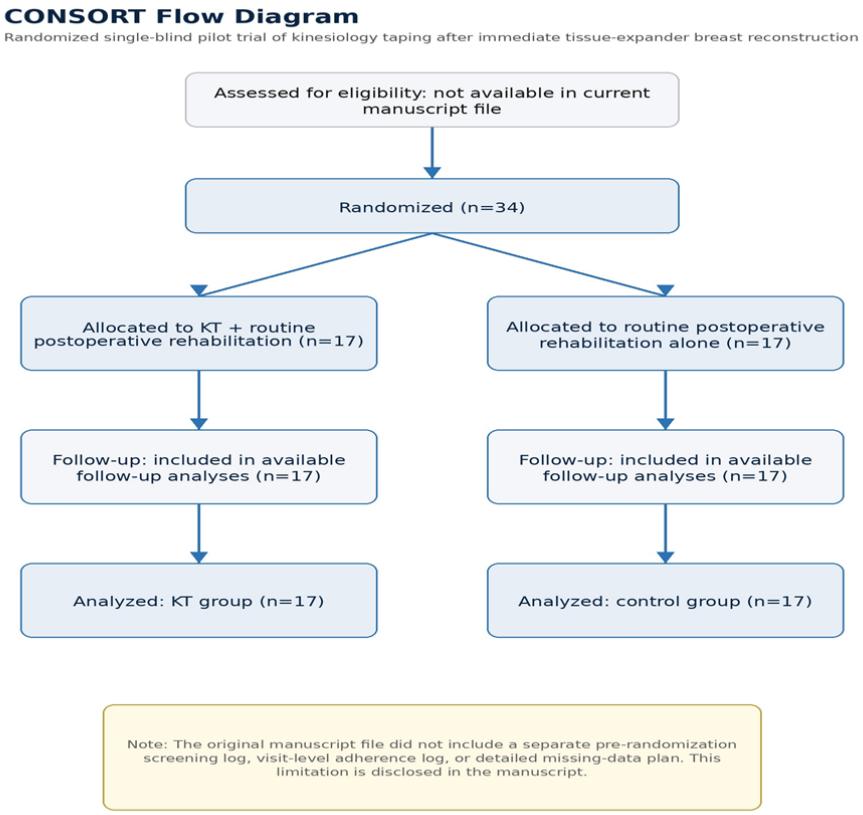

Figure 2: CONSORT flow diagram.

Statistical Analysis

Continuous variables were summarized using appropriate descriptive statistics according to distribution. The Wilcoxon test was used for non-parametric comparisons, and the chi-square test was used for categorical variables. Two-sided p values <0.05 were considered statistically significant. Because this was a pilot trial with multiple exploratory clinical outcomes, p values were interpreted as hypothesis-generating rather than confirmatory. Analyses were conducted using the available complete data for each outcome; the submitted file did not document an imputation procedure for missing data.

Ethics and Registration

The study was approved by a local ethics and research committee; full approval details are provided in the title page file for editorial review. This pilot trial was not prospectively registered, which limits external appraisal of prespecified outcomes and is acknowledged as a methodological limitation. Current ICMJE recommendations require clinical trials to be registered in a public registry at or before first participant consent for enrollment [7].

Results

Thirty-four patients were randomized: 17 to the KT group and 17 to the control group. According to the available manuscript record, all 34 randomized participants were included in the available outcome analyses. The submitted manuscript file did not include a screening log documenting the number assessed for eligibility before inclusion; this limits full CONSORT flow reporting (Table 1).

Table 1: CONSORT participant flow summary from available study records.

Trial phase	KT group	Control group
Randomized	17	17
Allocated to assigned intervention	17	17
Received assigned intervention	17	17
Included in available outcome analyses	17	17
Screening log before randomization	Not available in current file	Not available in current file

Patients treated with KT showed lower VAS pain scores than patients who did not receive KT during the four consecutive postoperative weeks (p<0.005). DASH functional scores improved significantly during the first three weeks in the KT group (p<0.001). The Vancouver Scar Scale showed a significant between-group difference from the third postoperative week onward in favor of KT (p<0.001).

KT appeared to facilitate circumferential edema control and was associated with decreased drainage requirements and earlier progression toward rehabilitation milestones; however, exact drainage data and timing of drain removal should be reported in a dedicated table if available.

Limb circumference and limb volume were significantly reduced in the KT group after four weeks of treatment compared with the control group (p=0.012 and p=0.015, respectively). These differences were not sustained at the 1-month follow-up (p>0.05). No significant between-group differences were observed in grip strength, QuickDASH scores, or FACT-B scores after treatment or at 1-month follow-up (p>0.05) (Tables 2 and 3).

Table 2: CONSORT pilot-trial feasibility and safety reporting.

Domain	Required reporting	Current status
Recruitment	Assessed, eligible, excluded, refused, randomized	34 randomized; screening log not available in current file
Retention	Completed weekly visits and 1-month follow-up	All randomized participants included in available analyses; visit-level retention requires source verification
Adherence	KT applications completed, missed visits, premature tape removal	Weekly KT replacement described; detailed adherence log not available in current file
Protocol deviations	Any deviations from planned KT or assessment protocol	No protocol deviations documented in submitted file
Adverse events	Skin irritation, allergy, infection, pain worsening, tape-related events	No KT-related adverse events documented in submitted file

Table 3: Summary of exploratory clinical outcomes.

Outcome	Exploratory finding	Statistical result
Pain (VAS)	Lower postoperative pain scores with KT during four consecutive weeks	p<0.005
Upper-limb function (DASH)	Improvement during the first three postoperative weeks	p<0.001
Scar characteristics (Vancouver Scar Scale)	Difference from week 3 onward in favor of KT	p<0.001
Limb circumference	Reduction after 4 weeks; no sustained difference at 1 month	p=0.012; follow-up p>0.05
Limb volume	Reduction after 4 weeks; no sustained difference at 1 month	p=0.015; follow-up p>0.05
Grip strength	No significant between-group difference	p>0.05
QuickDASH	No significant between-group difference	p>0.05
FACT-B	No significant between-group difference	p>0.05

Discussion

This randomized single-blind pilot trial suggests that standardized KT is a feasible adjunct to early postoperative rehabilitation after immediate tissue-expander breast reconstruction and may be associated with short-term improvements in pain, early upper-limb function, edema-related measures, and scar appearance. The clinical findings should be interpreted as exploratory because the study was designed and sized as a pilot trial rather than a definitive efficacy trial.

Implant-based reconstruction is one of the most frequently used methods in breast reconstruction and became more common than autologous techniques in the early 21st century [8,9]. Its advantages include shorter operative time, faster recovery, and avoidance of donor-site morbidity. However, implant-based reconstruction is also associated with potential complications such as capsular contracture, infection, implant malposition, less natural breast feel, and concerns related to breast implant illness [8,9]. Autologous reconstruction remains an important option, particularly in selected patients and in cases requiring salvage or revision after implant-based reconstruction [9].

Prosthetic breast reconstruction may be performed in one or two stages and may be immediate or delayed. Important risk factors for complications include smoking, diabetes, obesity, large breast size, and radiotherapy [9]. Immediate breast reconstruction preserves the native skin envelope and breast contour, may reduce the need for multiple surgical stages, improves aesthetic outcomes, and can increase patient satisfaction by reducing the psychological impact of mastectomy and improving self-image [9,10].

KT is used in physical rehabilitation as a therapeutic tool for various conditions.4 Its proposed clinical effects include pain modulation, soft-tissue support, and facilitation of lymphatic drainage [4,5]. Available evidence regarding KT in women with breast cancer is limited and primarily focuses on breast-cancer-related lymphedema after lymph-node dissection, with mixed results. Selcuk Yilmaz and Ayhan reported that KT, manual lymphatic drainage, and low-level laser therapy were safe and effective for stage II breast-cancer-related lymphedema up to 12 weeks after treatment; KT was as effective as low-level laser therapy and more effective than manual lymphatic drainage in reducing volume after treatment [11].

In contrast, Smykla et al. compared KT with multilayer compression therapy in a randomized single-blind pilot study and found KT to be ineffective for treating lymphedema secondary to breast cancer treatment [12]. Similarly, Taradaj et al. reported that KT was not effective in reducing stage II and III upper-limb lymphedema after breast cancer treatment, although it improved joint range of motion and muscle strength in some patients [13].

Pilot evidence has suggested that KT may reduce early upper-limb lymphedema after breast cancer treatment, although results vary according to population, stage, comparator, and application technique [14]. A 2024 systematic review and meta-analysis by Yang et al. found that KT did not significantly reduce lymphedema severity but was associated with significant improvement in upper-limb function, quality of life, and perceived comfort [15]. These findings suggest that KT may be considered a potential adjunct in the management of breast-cancer-related lymphedema, but larger and better-designed randomized trials are still required [15].

The present study contributes to this field by evaluating KT in a different postoperative context: immediate breast reconstruction with tissue expanders. Unlike studies focused exclusively on established lymphedema [11-15], this protocol assessed early postoperative pain, functional recovery, edema evolution, drainage behavior, and early scar characteristics. These findings suggest that KT may be most relevant during the early rehabilitation window, when pain, swelling, soft-tissue tension, and fear of movement may delay functional recovery.

Although the observed improvements in pain, early DASH scores, edema-related measures, and Vancouver Scar Scale are clinically relevant, the absence of significant differences in grip strength, QuickDASH, and FACT-B at later follow-up suggests that KT should be viewed as an adjunct rather than a standalone intervention. Its value may lie in improving short-term comfort and facilitating early rehabilitation rather than producing sustained long-term functional or quality-of-life differences by itself.

Study Limitations

The main limitation of this study is its pilot sample size. The study was not powered to establish definitive efficacy, and the exploratory clinical outcomes should be interpreted as hypothesis-generating. The follow-up period was limited, restricting interpretation of long-term functional, scar-related, and quality-of-life outcomes.

A second important limitation is trial registration. The study was not prospectively registered before enrollment, which limits external verification of prespecified outcomes and should be acknowledged transparently. CONSORT pilot-trial reporting was strengthened in this revision, but the original manuscript file did not include a screening log, visit-level adherence log, or detailed missing-data plan.

Additional limitations include potential performance bias because KT is a visible intervention, possible subjective effects related to KT color sequence and patient perception, and incomplete documentation of the exact blinding procedures for outcome assessment and analysis. Further studies with larger samples, longer follow-up, standardized KT application techniques, and broader functional and patient-reported outcome measures are needed to optimize and validate KT in postoperative breast reconstruction.

Highlights

- Kinesiology taping was feasible after immediate tissue-expander reconstruction.
- Short-term pain and upper-limb disability scores favored kinesiology taping.
- Edema-related improvements were present at four weeks but were not sustained.
- Findings are exploratory and require confirmation in a prospectively registered trial.

Conclusion

In this randomized single-blind pilot trial, standardized KT appeared feasible as an adjunct in early postoperative rehabilitation after immediate breast reconstruction with tissue expanders and showed

exploratory short-term signals of benefit in pain, early upper-limb function, edema-related outcomes, and scar characteristics. No sustained differences were observed in grip strength or selected functional and quality-of-life scales at 1-month follow-up.

Because KT is simple, reproducible, noninvasive, and low-cost, it may be a promising adjunct for selected patients undergoing breast reconstruction. However, these findings should be confirmed in a larger, prospectively registered, adequately powered randomized trial with prespecified feasibility, safety, and clinical endpoints.

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