Human Subjects Research Proposal

I. Study Title：

Effects of Combined Upper Extremity Exercise and Pneumatic Compression Therapy on Breast Cancer–Related Upper Extremity Lymphedema: A Single-Group Pretest–Posttest Follow-Up Study

II. Principal Investigator：

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IV. Background：

Breast cancer–related lymphedema (BCRL) is a common long-term complication following breast cancer treatment. It is characterized by upper limb swelling, heaviness, pain, and restricted shoulder range of motion, which may significantly impair daily functioning and quality of life.

Previous studies have demonstrated that regular and moderate upper extremity exercise does not exacerbate lymphedema; instead, it may improve shoulder mobility and muscle strength and contribute to edema control (McKenzie & Kalda, 2003). In addition, pneumatic compression therapy and manual lymphatic drainage have been shown to reduce limb swelling and improve patient comfort (Moattari et al., 2013; Huang et al., 2013). Systematic reviews further indicate that exercise-based interventions have positive effects on upper limb function and quality of life in breast cancer survivors (Chan et al., 2010).

Therefore, combining upper extremity exercise with pneumatic compression therapy may represent a promising integrative rehabilitation strategy to improve lymphedema and associated functional impairments following breast cancer surgery.

V. Study Objectives：

This study aims to investigate the effects of combined upper extremity exercise and pneumatic compression device (PCD) therapy in patients with BCRL:

A. To evaluate the effects of 12 sessions of combined upper extremity exercise and mechanical intermittent pneumatic compression therapy on upper limb lymphedema.

B. To compare changes across three time points—baseline (T0), immediately after the 12th session (T1), and one-week follow-up (T2)—in:

1. Limb circumference measurements
2. Shoulder range of motion (ROM)

3. Disabilities of the Arm, Shoulder and Hand (DASH) scores

4. Functional Assessment of Cancer Therapy–Breast (FACT-B) scores

C. To assess short-term maintenance effects (T2), safety, and patient acceptability.

VI. Methods：

A. Eligibility Criteria and Sample Size

1. Sample Size:

20 participants will be recruited from this institution; no additional centers will participate.

2. Inclusion Criteria：

(1) Female breast cancer patients aged 20–70 years

(2) Unilateral breast cancer surgery with clinically diagnosed Stage I or II lymphedema (≥2 cm and <8 cm inter-limb difference at least one measurement site)

(3) Completion of adjuvant chemotherapy and/or radiotherapy at least 3 months prior

(4) Ability to complete 12 treatment sessions and all assessments and provide written informed consent

3. Exclusion Criteria：

(1) Evidence of breast cancer recurrence or metastasis

(2) Severe upper limb infection (e.g., cellulitis)

(3) Uncontrolled heart failure, deep vein thrombosis (DVT), or severe peripheral vascular disease

(4) Stage III lymphedema, bilateral lymphedema, or use of medications affecting upper limb glandular function

(5) Other upper limb musculoskeletal disorders, joint deformities, or prior upper limb surgery

(6) Pregnancy or other contraindications

4. Recruitment：

Participants will be recruited from the outpatient Rehabilitation Department of Far Eastern Memorial Hospital. Recruitment announcements will be posted in the electrotherapy room. Eligible patients diagnosed with BCRL will be screened according to inclusion and exclusion criteria. A total of 20 participants will be enrolled.

B. Study Design：

This is a single-group prospective interventional study.

Study Procedures:

1. Screening and eligibility confirmation
2. Informed consent obtained in a private meeting room
3. Collection of baseline demographic and medical data
4. Study location: Rehabilitation Department electrotherapy room

Baseline Assessment (T0)

1. Primary Outcome: Limb Circumference Measurement

Measured using a standard flexible tape at predefined anatomical landmarks:

- Elbow joint
- 5, 10, 15 cm above elbow
- 5, 10, 15 cm below elbow
- Wrist

Standardization includes:

- Same assessor
- Same time of day (e.g., 9:00–12:00 AM)
- 10-minute seated rest prior to measurement
- Same body position

2. Shoulder Range of Motion (ROM)

Measured using a standard goniometer (active flexion, extension, abduction, adduction, internal and external rotation).

Two trials averaged; maximum pain-free range recorded.

3. DASH Questionnaire
4. FACT-B Questionnaire

Intervention Protocol

Total Sessions: 12

Frequency: 3 sessions per week

Duration: Approximately 4 weeks

Session Duration: ~50 minutes

1. Upper Extremity Exercise (30 minutes)

- Warm-up (5 min): shoulder flexion, abduction, circular motion

- Active and resistance training (20 min): using elastic bands or 0.5 kg weights：

  Seated rowing/Chest press/Lat pulldown/Single-arm row/Biceps curl/Triceps extension

  Two sets of 10 repetitions (or up to 3 sets depending on tolerance)

- Stretching (5 min): overhead stretch, lateral flexion, biceps/triceps stretch

2. Pneumatic Compression Therapy (20 minutes)

Multi-chamber upper limb sleeve

Sequential distal-to-proximal inflation

Pressure range: 20–40 mmHg (adjusted according to tolerance and safety limits)

Monitoring for pain, numbness, pallor, or circulatory compromise

Post-Intervention Assessment (T1)

Same measurements as baseline.

One-Week Follow-Up (T2)

Same measurements repeated.

Statistical Analysis

- Repeated Measures ANOVA

  To assess overall differences across T0, T1, and T2.

  Post hoc analysis will be conducted if significant.

- Paired t-test

  To compare T0 vs. T1 and T0 vs. T2.

All tests will be two-tailed with significance set at $\alpha = 0.05$.

VII. Data Management

All data will be coded and de-identified.

Paper documents will be stored in locked cabinets.

Electronic data will be password-protected.

Data will be retained for five years and destroyed thereafter.

VIII. Participant Protection

Minor muscle soreness may occur.

If discomfort occurs three times, participation will be discontinued.

Participants may withdraw at any time without affecting clinical care.

Participants who complete the study will receive NT$500 transportation reimbursement.

IX. Expected Outcomes

Significant improvements are anticipated in limb circumference, ROM, DASH, and FACT-B at T1, with partial maintenance at T2.

If confirmed, the findings may support a 12-session treatment protocol and inform future RCTs or cost-effectiveness studies.

X. Ownership of Results

Research results will belong to Far Eastern Memorial Hospital.

Findings may be published in academic journals or conferences.

No identifiable personal data will be disclosed.

XI. Conflict of Interest This study is investigator-initiated.

All investigators declare no conflicts of interest.

Any potential conflicts will be reported to the IRB.

XII. Reference

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5. Huang, T. W., Tseng, S. H., Lin, C. C., Bai, C. H., Chen, C. S., Hung, C. S., Wu, C. H., & Tam, K. W. (2013). Effects of manual lymphatic drainage on breast cancer-related lymphedema: A systematic review and meta-analysis of randomized controlled trials. World Journal of Surgical Oncology, 11, 15. https://doi.org/10.1186/1477-7819-11-15
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