

21. The New Era of Wellness and the Lymphatic System

The Importance of Fat Mass Percentage Change in Lymphedema Care: A Retrospective Analysis of Body Composition Trends Using Bioimpedance Spectroscopy

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Abigail Donofrio, OTR/L, CLT; Jocelyn Blatchley, OTR/L, CLT-LANA, Dr. Nicholas Panetta, MD, FACS

ABSTRACT

Purpose: Lymphedema is an accumulation of protein-rich fluid in an affected extremity that causes swelling. Lymphedema is a potential result of cancer treatment that affects approximately 1 in 1000 cancer survivors in America¹⁸. The gold standard of lymphedema treatment is complete decongestive therapy (CDT), which includes compression, exercise, manual lymphatic drainage, and skin care to manage symptomology. Bioimpedance spectroscopy (BIS) is a tool often used in treatment for lymphedema that measures fluid accumulation and computes an L-Dex score, which is a ratio comparing the resistance of fluid from the affected extremity to the unaffected extremity⁶. BIS also measures body composition values⁹, however this still a developing practice and is not regularly integrated into lymphedema treatment^{5, 6, 11, 14-17, 19}. The purpose of this chart review is to identify trends in body composition using BIS that can impact fluid measurement in affected extremities and potentially lead to more comprehensive and holistic care for lymphedema patients.

Method: A retrospective electronic data analysis was conducted of data collected from patients that have been diagnosed with lymphedema and were receiving treatment services at Moffitt Cancer Center outpatient lymphedema clinic over a multi-year period. A comparative analysis of body composition values and L-Dex (fluid measurements) score was completed using ImpediMed's SOZO machine. L-Dex scores were correlated with body composition values to determine if fluid accumulation in the affected extremity was influenced by each specific body composition value. Body composition values including weight, fat mass percentage change (FM% change), skeletal muscle mass percentage change (SMM% change), body mass index (BMI), hydration (Hy-Dex), and phase angle.

Results: Only one body composition value, FM% change, was significant ($p < 0.05$) when compared to L-Dex value, indicating that FM% change significantly impacts lymphedema bioimpedance scores. Skeletal muscle mass percentage change, body mass index (BMI), Hy-Dex, and phase angle did not significantly impact L-Dex score.

Conclusion: L-Dex score decreases significantly with decreased FM% change, suggesting it is important for lymphedema patients to continuously reduce fat mass to lower L-Dex scores. Lymphedema therapists may use this data to educate patients on the importance of on FM% change, rather than BMI or weight, during treatment. Future studies should include a prospective study of body composition values and L-Dex scores.

21. The New Era of Wellness and the Lymphatic System

How A Lymphologist Can Cure Series: IX. Treating lymph can revive renal parenchyma in the ageing kidneys

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Background: Thailand has 12% of its population, 8 out of 66 million, suffering from chronic kidney disease (CKD), and 40,000 depending on dialysis. At Day Care Center, we have noticed an unprecedented observation that adult kidneys, which gradually degrade as we age, can be reversed after lymph treatment, shedding a new light to millions of CKD patients currently living with little hope from conventional medicine.

Patients and Methods: We have 9,750 patients in database, two thirds of which underwent whole-body MRI, including a TRUFI modality for upper/lower abdomen. These provided us an overview covering thousands of kidneys in life with varying medical conditions. Some have repeated MRI scan during follow-up, allowing us to identify renal parenchyma reviving upon decrement of visceral and/or retroperitoneal fat deposition. Our protocol comprised three elements: i) compression-decompression therapy by Twisting Tourniquet[©] Technique using certified *Schnogh*[®]; ii) cryo/cooling therapy; iii) vegan diet therapy. We have developed a proprietary set of cool gel pack, 1,500 g in a palisade type, for wrapping around the torso with a purpose-built waist band, to apply three hours a day. The device was intended to cool the lymph in lumbar spines, retroperitoneum, perirenal Gerota fat body, and cisterna chyli, so as to induce contraction of regional lymphatics. The crown-rump length (CRL) of each kidney was measured and, in some cases, evaluated with reference to his/her known clinical staging of eGFR.

Results and Discussion: The kidney morphology in life was diverse. Located at costovertebral angles, the right kidney often was inferior to and smaller than left kidney, owing to the presence of the liver whose size occupied

more spaces than the spleen. In younger or slender individuals, there was nil or only trace amount of visceroretroperitoneal fat; the latter was hyperintense in T1W, hypointense in T2W, and in TRUFI white, appearing as “empty” spaces in between organs. With age, the fat mass increased, whereas the kidney mass decreased, contracted, atrophic, deformed, and displaced. The typical shape of kidneybean-shaped kidney could show up variously in any form reminiscent of such as, a mango, papaya, tamarind, dragon fruit, dried shrimp, dog poo, lancet, spearhead, polygon, worm, pupa, and millipede, to state, but a few. Such multitude of morphotransformation occurred in the abundance of fat. Each form was further complicated by concurrent cyst formation, solitary or multiple, small (<1 cm) or large or even huge (>5 cm), or mixed. Lymphatic proliferation in fat tissue was discernible. Characteristically in patients with diabetes or hypertension, the renal capsule became uneven, corrugated, and shaggy, leaving fibrotic bands radiating or binding with adjacent organs, thus rendering capsular lymph more distinguishable. Average CRL at above 10, 11, and 12 cm were graded as Grade C, B, and A, respectively, equivalent to eGFR >90 ml/min per 1.73m². Above 13 and 14 cm were Grade AA and AAA; in the latter we found only two kidneys at 14.7 cm, female, and 14.3 cm, male. On the other hand, below 10 and 9 cm were Grade D and E, which were marked as “Attention” and “Emergency.” Lower than 8 cm, Grade F, were those failure judged by hospitals elsewhere, eGFR stage 5, <15 ml/min per 1.73m². Patients with dialysis, hemo- or peritoneal, unmistakably had CRL 7.0~7.3 cm. Kidneys at Grade D, C, and B exhibited an increase of 0.3~0.7 cm one year after lymph treatment; the kidneys became elongated and expanded thicker, and some cysts vanished. In conclusion, the ageing kidneys are upgradable. That the liver can regenerate is well known, but that the kidney can revive is totally new. We regard this phenomenon as a millennium class discovery!

Title: The Role of a Nurse Navigator in a Lymphatic Comprehensive Center of Excellence

Author List: Sarah Thomson, RN, James Fanning, BS, Rosie Friedman, BS, Angela Chen, BS, Aaron Fleishman, MPH, Weiliang Sun, BS Dhruv Singhal, MD

Background:

Lymphatic centers and clinics typically do not have nurse navigators as part of their care teams. Programs lacking a nurse navigator may cause patients seeking care to feel undue anxiety surrounding their illness and care. There is a lack in lymphatic centers worldwide and with this patients travel from afar to seek care. The Boston Lymphatic Center built a business model to include a nurse navigator to mitigate patient barriers and increase patient compliance and follow-up. Beginning in January 2021, the center was assigned a full-time nurse navigator. The purpose of this study is to identify the impact a nurse navigator had on the monthly volume of new patients and surgeries.

Methods:

We conducted a retrospective review of online medical records in our Lymphedema Quality Improvement database. The number of new patients enrolled and number of surgeries performed in each fiscal year were collected. Changes to these key performance indicators (KPI) were compared between three time periods at our lymphatic center: pre-pandemic (October 2016-December 2019), early pandemic (January 2020-December 2020), and our current phase (January 2021-September 2022) with a nurse navigator assigned to the Lymphatic Center. One-way ANOVA tests with post-hoc Tukey HSD test were performed to compare the monthly number of new patients and surgeries between these three periods, respectively.

Results:

We observed a statistically significant difference in the monthly number of new patients at our center between the three time periods ($F(2,69) = 34.80773$, $p < .00001$). Post hoc comparisons using the Tukey HSD test indicated that the monthly number of new patients since the assignment of a nurse navigator in the Center (49.1 ± 12.7) was statistically significant from both the pre-pandemic (22.7 ± 10.7) and pandemic (28.7 ± 13.4) time periods. The pre-pandemic and pandemic time periods were not statistically significant from one another.

We observed a statistically significant difference in the monthly number of surgeries performed at our center between the three time periods ($F(2,69) = 5.36296$, $p = .006841$). Post hoc comparisons using the Tukey HSD test indicated that the monthly number of new surgeries since the assignment of a nurse navigator in the Center (7.9 ± 2.9) was statistically significant from the pre-pandemic (5.4 ± 3.0) time period but not the pandemic (6.9 ± 2.0) time period. The pre-pandemic and pandemic time periods were not statistically significant from one another.

Conclusions:

Despite the COVID-19 pandemic's disruption to healthcare services in 2020, we did not observe a statistically significant decrease in the monthly number of new patients or surgeries performed at the Boston Lymphatic Center compared to the pre-pandemic period. We observed a statistically significant increase in the monthly number of new patients since the addition of a nurse navigator in January 2021. We did not observe a statistically significant increase in the monthly number of surgeries performed which may be due to limited OR availability. The organization provided to patients and the multidisciplinary care team afforded by a nurse navigator has improved patient care and center performance in several ways. Establishment of clinical pathways by a nurse navigator has streamlined many of our center's programs, including surgical care, lymphedema surveillance, and clinical research. The presence of a nurse navigator has been vital to our center's steadily increasing patient and surgical volume.

24. The Voice of Patients Affected by Lymphatic Disorders & Quality of Life Issues

The Effect of A Mobile-Based Lymphedema Self-Care Support Program on Self-Care, The Quality of Life and Lymphedema Symptoms in Women with Breast Cancer-Related Lymphedema: A Single-Blind Randomized Co

Zeynep Deveci Koçbilek⁽¹⁾ - Özgül Karayurt⁽²⁾ - Özlem Bilik⁽³⁾ - Sibel Eyigör⁽⁴⁾

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The Effect of A Mobile-Based Lymphedema Self-Care Support Program on Self-Care, The Quality of Life and Lymphedema Symptoms in Women with Breast Cancer-Related Lymphedema: A Single-Blind Randomized Controlled Study

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Purpose: To examine the effect of a mobile-based lymphedema self-care support program (m-LSSP) on self-care, the quality of life, and lymphedema symptoms in women with breast cancer-related lymphedema (BCRL).

Methods: The study has a single-blind, randomized, controlled design, and data were collected between January and December 2021. Ethical approval was obtained from the ethical board and permission was taken from the institution where the study was performed. Informed consent was obtained from the participants. The m-LESSP was developed by researchers and the help of a software company. The m-LESSP aims to help

women with BCRL access information about lymphedema, facilitate their routine self-care practices and allow them to receive support from the program manager and share their experiences with the program. A control group (n=35) was offered online standard lymphedema education and an intervention group (n=37) was provided with the m-LSSP in addition to the standard education. Data were collected on the phone with a sociodemographic and clinical features form, the Breast Cancer Related Lymphedema Self-Care Scale, the Quality of Life Measure for Limb Lymphedema –Arm, the Lymphedema Symptom Intensity And Distress Survey-Arm and arm circumference measurements. The scales used in the research have validity and reliability. Obtained data were analyzed with SPSS 24 and numbers, percentages, mean values, Student's t-test, Chi-square test, variance analysis of repeated measures with one factor and two factors, Mann-Whitney U test, Friedman test, and Wilcoxon test. The present study was registered on ClinicalTrials.gov and assigned the project number NCT05058495. This study with project number 2020.KB.SAG.069 was funded by Dokuz Eylül University Scientific Research Projects Coordination Unit.

Results: The intervention and control groups were similar in sociodemographic and clinical features at baseline ($p>0.05$). Group ($F= 4.171$, $p= 0.045$), time ($F= 15.958$, $p< 0.001$), and group-by-time, ($F= 3.709$, $p= 0.027$) interactions in the mean score on the BCRLSS were statistically significant. The effect size was moderate for group interactions ($\eta^2= 0.06$), large for time interactions ($\eta^2= 0.18$), and small for group-by-time interactions ($\eta^2= 0.05$). There was no significant difference in the mean scores on the quality of life and lymphedema symptoms ($p>0.05$). The mean scores on self-care ($F= 17.350$, $p< 0.001$) and the quality of life ($F= 24.980$, $p< 0.001$) increased, lymphedema symptoms ($F= 14.371$, $p< 0.001$) and arm circumferences ($p\leq 0.001$) decreased significantly across time in the intervention group. The mean scores on lymphedema symptoms ($F= 7.741$, $p= 0.002$) and arm circumferences ($p<0.05$) also significantly decreased across time in the control group.

Conclusions: The m-LSSP is a beneficial method to enhance self-care and the quality of life and decrease symptoms in women with BCRL. Breast cancer survivors can increase their self-care practices, prevent an increase in their symptoms and arm circumferences, and improve the quality of their lives by using the m-LSSP.

Key Words: breast cancer-related lymphedema, mobile application, self-care, quality of life, symptom

24. The Voice of Patients Affected by Lymphatic Disorders & Quality of Life Issues

The Effect of Time in Compression on Quality of Life in Patient with Lymphedema

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Beth Israel Deaconess Medical Center, Division of Plastic and Reconstructive Surgery, Boston, United States Of America⁽¹⁾

Background:

Quality of life is an important dimension to measure in patients with lymphedema, in order to understand the impact of the disease and to assess the effect of conservative or surgical treatment. Compression is the primary component of conservative management and plays a role in pre and post operative care for patients undergoing surgical management. Patients often identify a wish to reduce time spent in compression as one of the reasons for pursuing surgical treatment, and it would be important to understand the impact of compression on quality of life. The purpose of this study is to evaluate the effect of amount of time in compression on quality of life in patients with lymphedema.

Methods:

We performed a retrospective review of online medical records in our Lymphedema Quality Improvement database. We analyzed patients who have conservatively managed their lymphedema with compression to correlate their most recent compression therapy regiment (hours per week) and lymphedema quality of life (QOL) scores. The Quality of Life Measure for Limb Lymphedema (LYMPHQOL) has 4 sub-scores; Function, Appearance, Symptoms and Mood.¹ Patients were grouped into four levels of compression hours per week: compression free (0 hours), intermittent compression (1-42 hours), day time compression (43-84 hours), or day and night compression (85-168 hours). One-way ANOVA tests with post-hoc Tukey HSD tests were performed to compare QOL scores between these treatment groups.

Results:

We identified 194 patients with upper extremity lymphedema and 382 patients with lower extremity lymphedema using QOL scores and reported hours of compression from database search. We observed a statistically significant difference in average arm function QOL scores at our center when compared between hours of compression ($F(3, 187) = 4.96854$, $p = .002432$). Post hoc comparisons using Tukey HSD test clarified that average arm function QOL scores were significantly different between the intermittent compression (2.23) and daytime compression (1.53) groups ($p = .0021271$), as well as the daytime compression (1.53) and day and night compression (1.89) groups ($p = .0283121$). We observed a statistically significant difference in average leg function QOL subscores at our center when compared between hours of compression ($F(3, 378) = 5.17054$, $p = .001637$). Post hoc comparisons using Tukey HSD test clarified that average leg function QOL subscores

were significantly different between the compression free (2.46) and daytime compression (2.13) groups ($p = .0181835$), as well as the compression free (2.46) and day and night compression (2.08) groups ($p = .0011775$).

Conclusions:

We only observed statistically significant differences in the average arm and leg function subscores when comparing patients' hours in compression. We did not see a decrease in function subscores with increasing hours of compression for patients with upper extremity lymphedema. The amount of time spent in compression is only one factor of a patient's compression regimen. The type of garment, material, amount of compression, and fit are also factors that can affect effectiveness and comfort to contribute to quality of life. More research is needed to fully understand the effect of all dimensions of compression on the quality of life in patients with lymphedema.

24. The Voice of Patients Affected by Lymphatic Disorders & Quality of Life Issues

Lymphedema after vulvar and cervical cancer – is it truly a problem?

Iwona Gabriel ⁽¹⁾ - ***Wiktor Chmielewski*** ⁽¹⁾ - ***Adrianna Borowkow-Bulek*** ⁽¹⁾ - ***Anita Olejek*** ⁽¹⁾ - ***Marek Paul*** ⁽²⁾

Medical University of Silesia, Dept of Gynecology, Obstetrics and Oncological Gynecology, Bytom, Poland ⁽¹⁾ - *Dr Paul Clinic, Plastic and Reconstructive Surgery, Bytom, Poland* ⁽²⁾

Lymphedema after vulvar and cervical cancer – is it truly a problem?

Iwona Gabriel [1], Adrianna Borowkow-Bulek [1], Wiktor Chmielewski [1], Anita Olejek [1], Marek Paul [2]

1. Katedra i Oddział Kliniczny Ginekologii, Położnictwa i Ginekologii Onkologicznej, Śląski Uniwersytet Medyczny, Bytom, Poland
2. Klinika DrPaul, Bytom, Poland

Introduction

Secondary lymphedema remains a debilitating problem for cancer survivors. Yet, the incidence of this problem in Poland is unknown. We are lacking strategies to help raise awareness about secondary lymphedema. Furthermore, we need to develop plans for early detection and proper surveillance including all modalities of treatment.

Aim of study

As there is no national database for lymphedema after gynecological cancer in Poland, we aimed to investigate its incidence based on data from one gynecological oncology site.

Material and methods

We conducted a retrospective study on all women operated at the Department of Gynecology, Obstetrics and Oncological Gynecology, Bytom, Poland due to vulvar or cervical cancer between 2017 and 2022. A standard phone calls including questions about presence of lymphedema and subsequent treatment (no, physiotherapy, surgery) were made to each patient. The phone calls were made twice with 3-days gap in case of no response. All data were collected by a trained gyn intern.

Results

We collected data from 90 women with vulvar cancer and 57 with cervical cancer. 30 out of 90 patients (33%) and 18 out of 57 patients (31.5%) had secondary lymphedema. Half of women with vulvar cancer and 2/3 of women with cervical cancer had lymphedema treatment. Types of lymphedema treatment included: compression therapy, manual lymphatic drainage.

Conclusions

Our results indicate that 1/3 of women with vulvar and cervical cancer suffer from secondary lymphedema. In case of women with vulvar cancer only half of them seek or were offered treatment. The same situation is seen for 1/3 of women after cervical cancer surgery. We need strategies to better inform patients of possible sequelae of surgeries, so the patients search for help immediately after noticing the problem.

Results from a Pilot Clinical Study to Assess Safety and Feasibility of a New Implantable Device in the Management of Arm Lymphedema

Mazzolai L., Staubli S., Triacca V.*, Brochu-Vez M.J., Boucard V.,
Aberle M., Ferrari V., Pisano M., Déglise S.

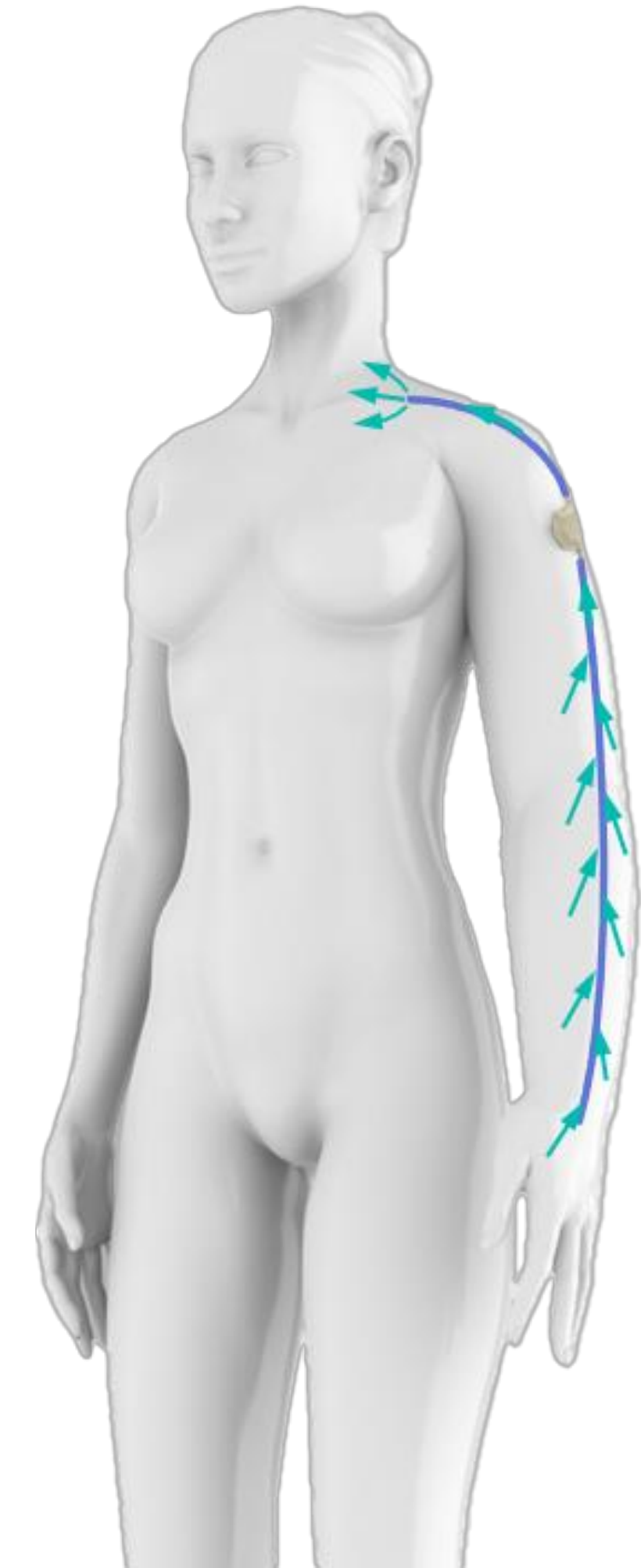


FIRST-IN-HUMAN PILOT CLINICAL TRIAL TO ASSESS SAFETY AND FEASIBILITY OF LYMPHOPILOT



- Trial registry number: NCT04858230 (ClinicalTrials.gov)
- Principal Investigator: Prof. Lucia Mazzolai
- Study Sponsor: Lymphatica Medtech
- Study Site: Lausanne University Hospital (CHUV – Switzerland)
- Device under investigation: **LymphoPILOT**
- Study population:
 - **Arm lymphedema post breast cancer**
- Study aim:
 - **Assess device safety and preliminary performance**

Preclinical results published in: [Triacca et al., EJVES, 2019](#)

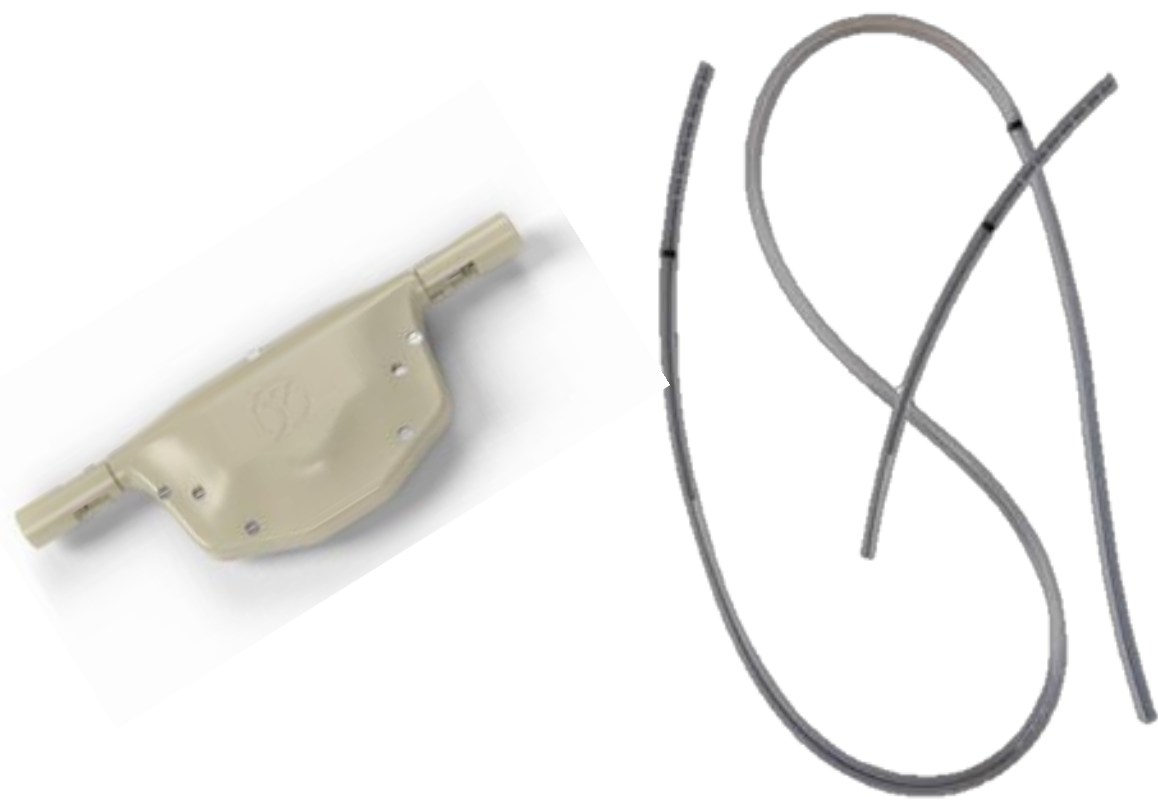


LymphoPilot



The First Lymphatic Active Bypass for Lymphedema Treatment

Class 3 Implantable Device

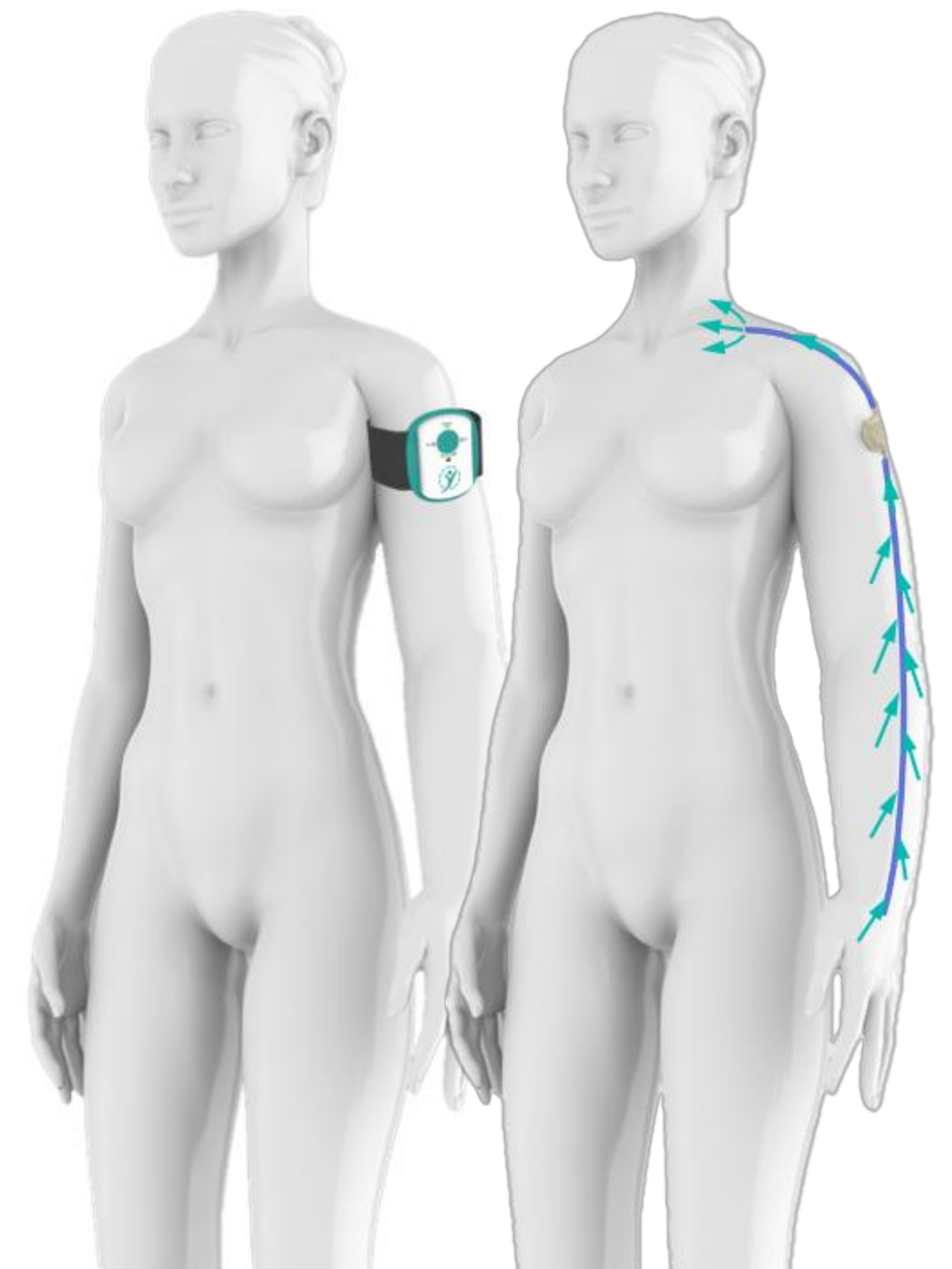


SUBCUTANEOUS PUMP AND CATHETERS

- Passive, no implanted electronic
- Activated by magnetic coupling
- No connection to veins or lymphatic vessels
- Implanted in outpatient settings

WEARABLE CONTROLLER

- Provides the energy to the implanted pump
- Discrete, can be worn under clothes
- Rechargeable battery



FIRST-IN-HUMAN PILOT CLINICAL TRIAL TO ASSESS SAFETY AND FEASIBILITY OF LYMPHOPILOT



- 11 patients enrolled, **9 patients** implanted
- **Stage I** and **Stage II** BCRL
- Device **implanted for 8 weeks**
- **Fixed drainage speed**
- The device is **used alone** (no compression, no manual drainage) – unless deemed necessary during the course of the study
- **Main study outcomes:**
 - Safety events
 - Limb volume
 - Device functionality evaluated via ultrasounds

0

Serious Adverse
Events

No use of
compression

during implantation
time

~30 %

Excess Volume
Reduction (average)
over 8 weeks respect
to baseline

Lymph Flow
detected via
Ultrasounds

in the catheters
at each time point in
all patients

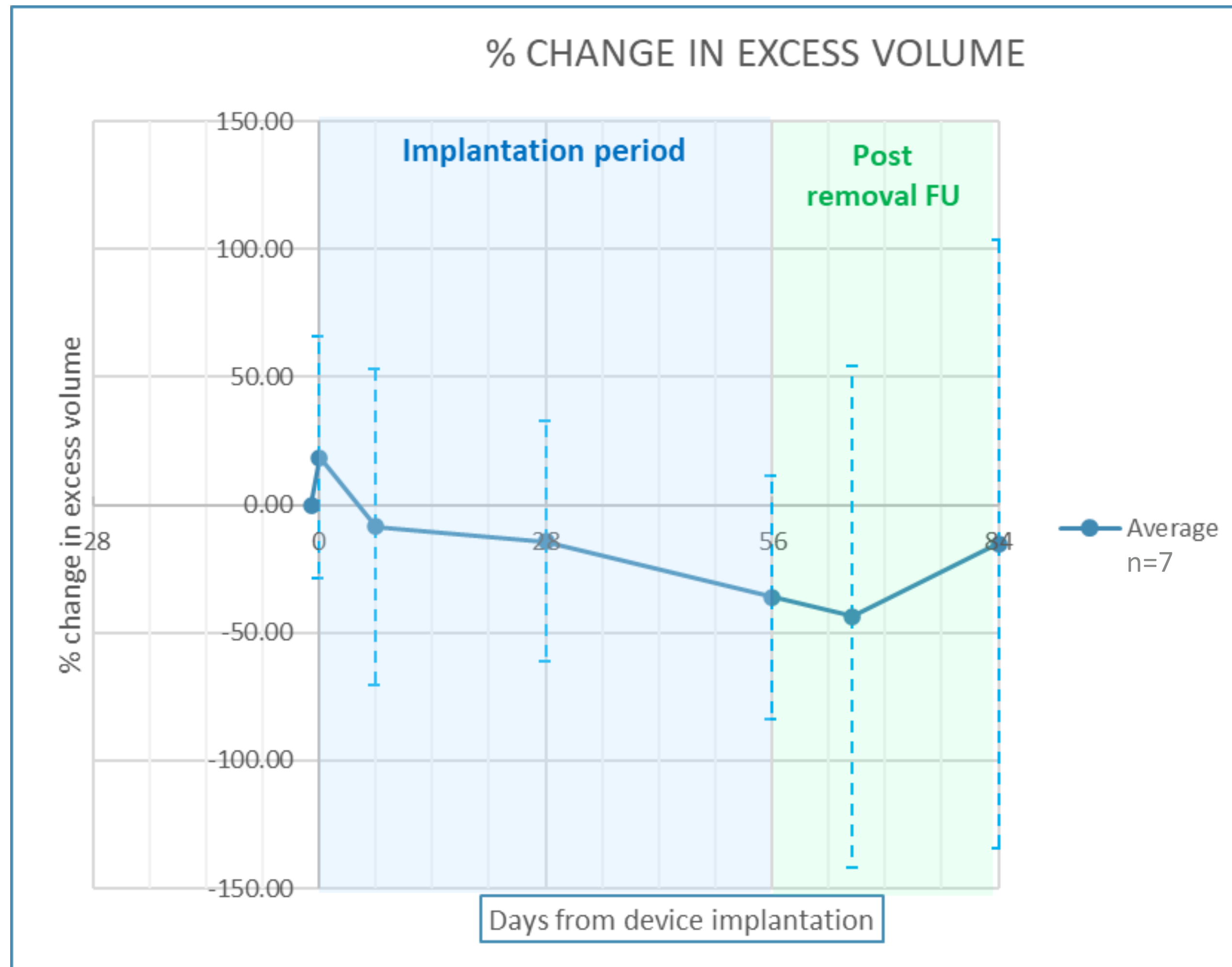
~30 min

Procedure duration
time

100%
tube patency

No sign of pump /
catheter obstruction
after device removal

LymphoPilot reduces LE excess volume of >30% after 8 weeks



- None of the patients performed any compression therapy nor MLD during the implantation period.
- The pump flow rate was fixed at 120mL/day (low flow rate). We foresee to increase the velocity of the pump in the next study, according patient need.

Confidential

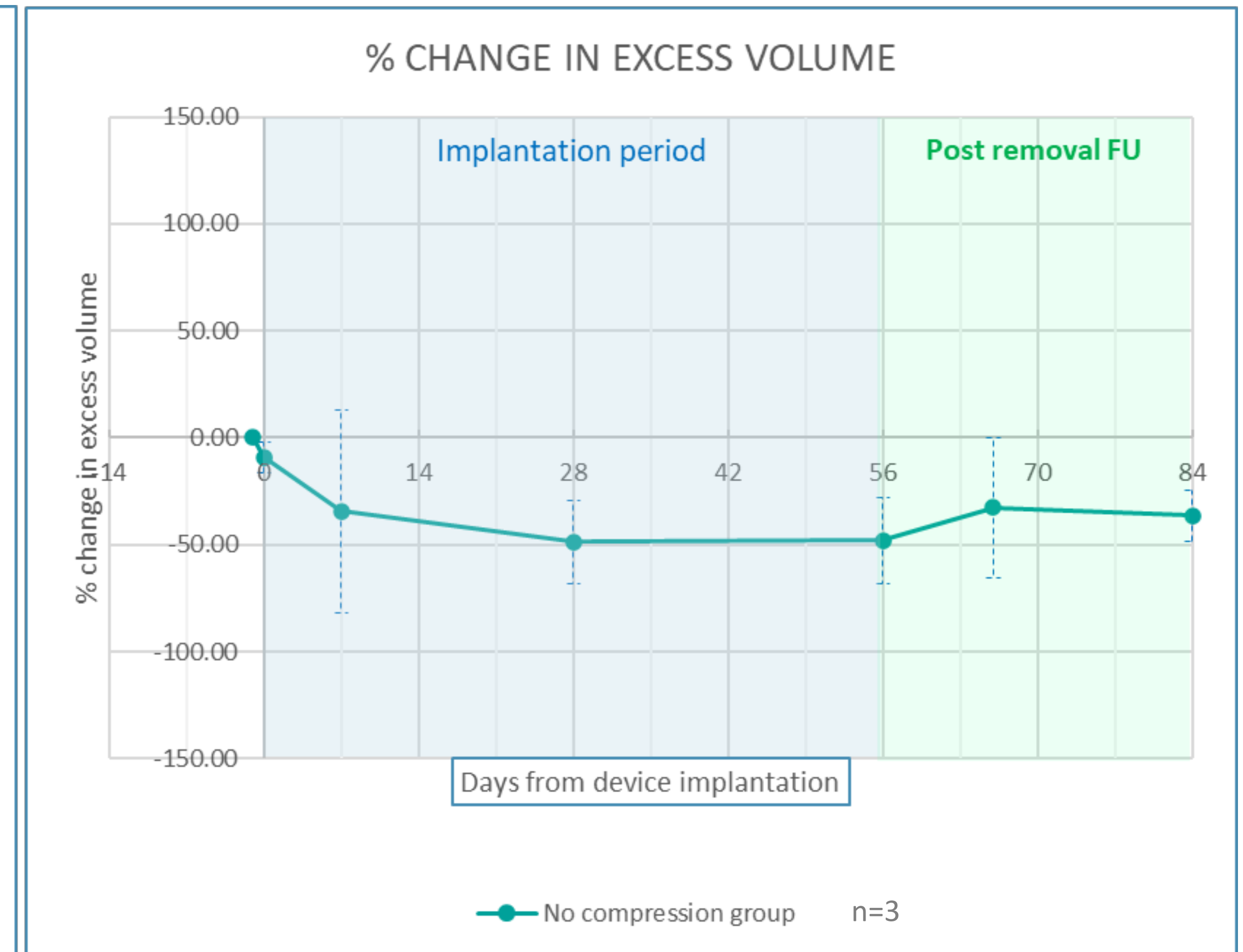
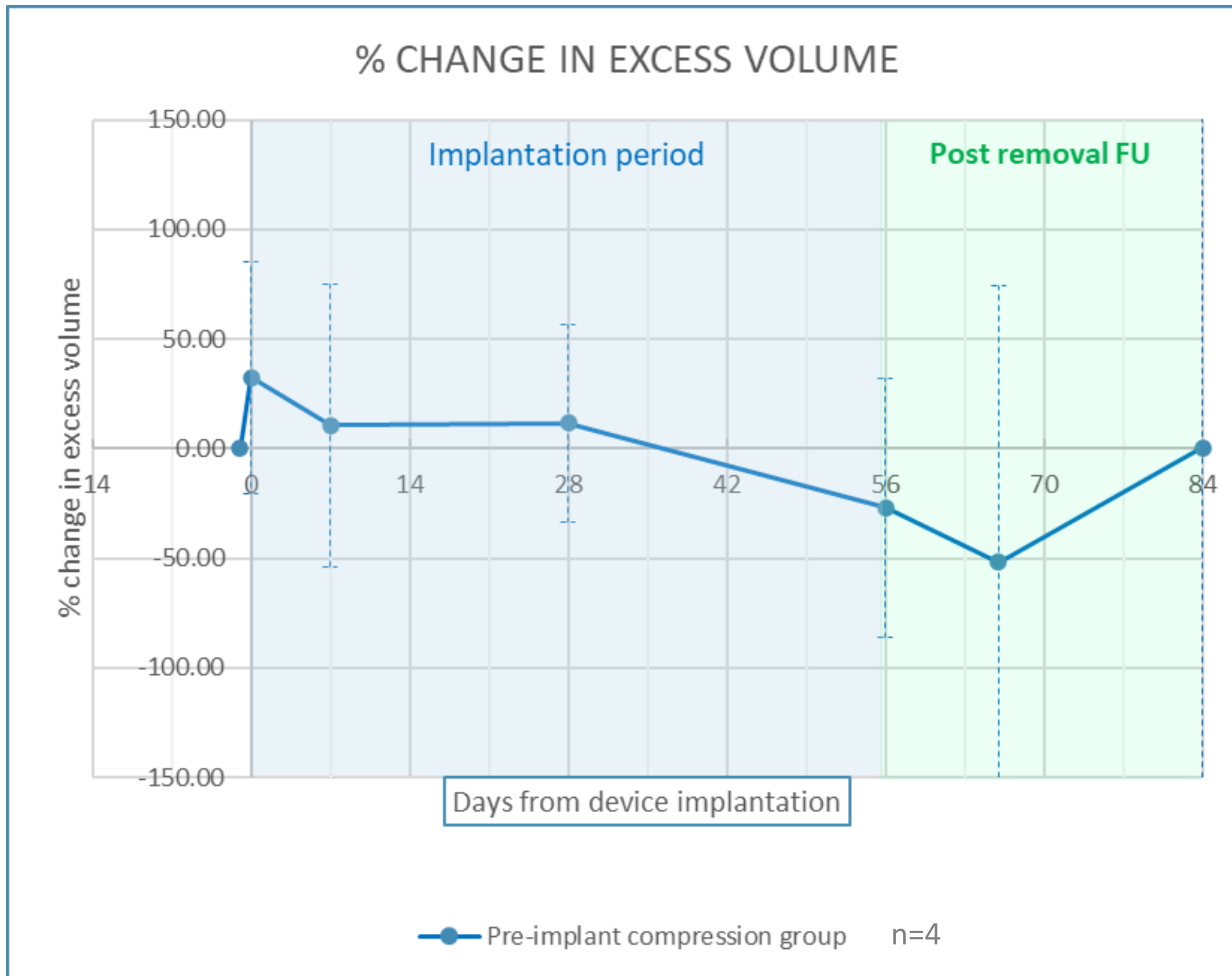
2 subgroups of patients:

Group 1: Patients that followed CDT before study initiation

LymphoPilot aim:
**MAINTAIN LIMB VOLUME +
STOP COMPRESSION**

Group 2: Patients that were not following any treatment before study initiation

LymphoPilot aim:
**REDUCE + MAINTAIN
LIMB VOLUME
WITHOUT COMPRESSION**

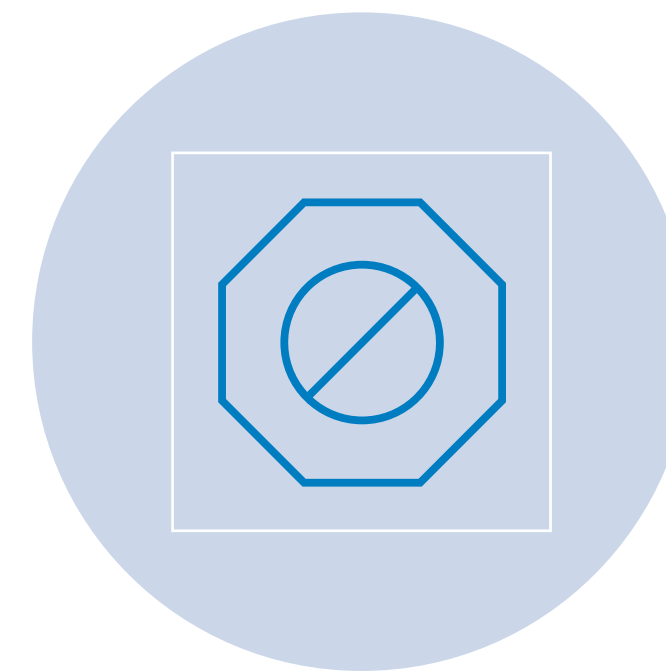




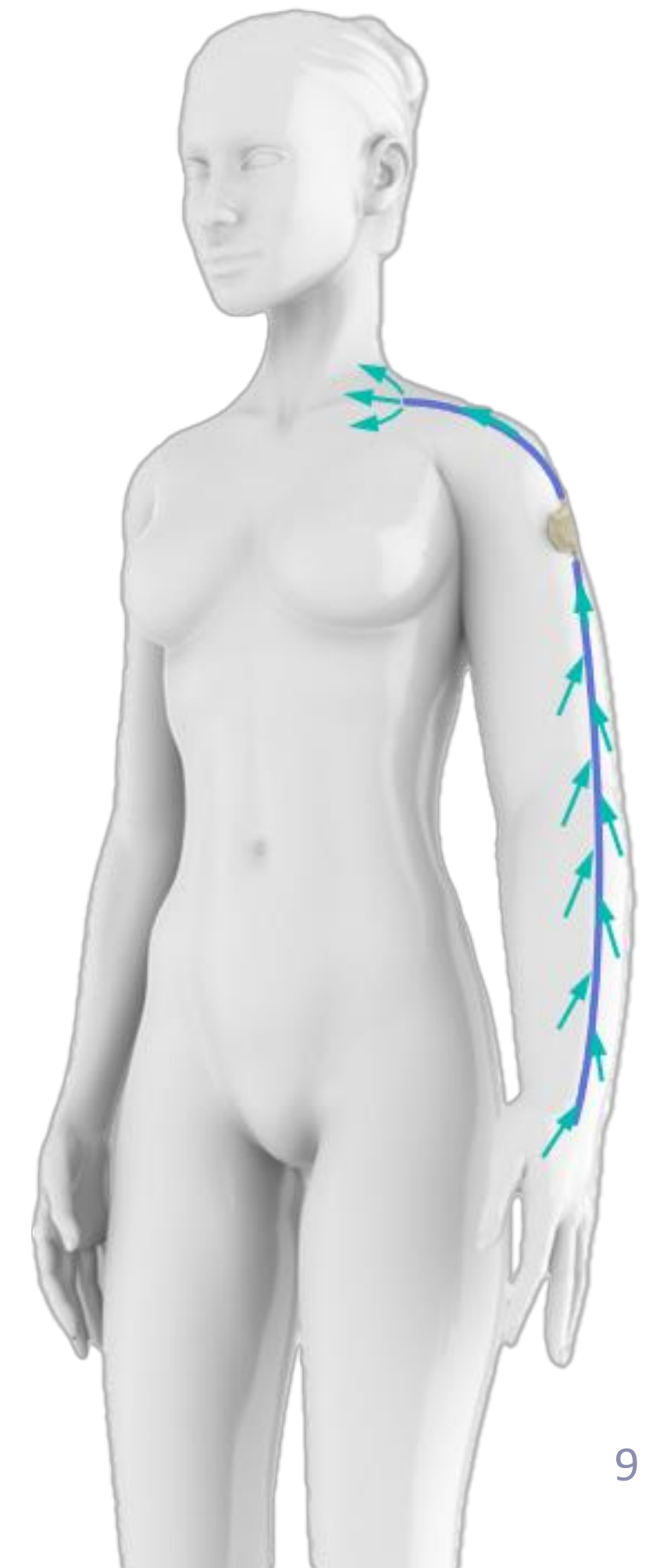
LYMPHOPILOT IS
SAFE

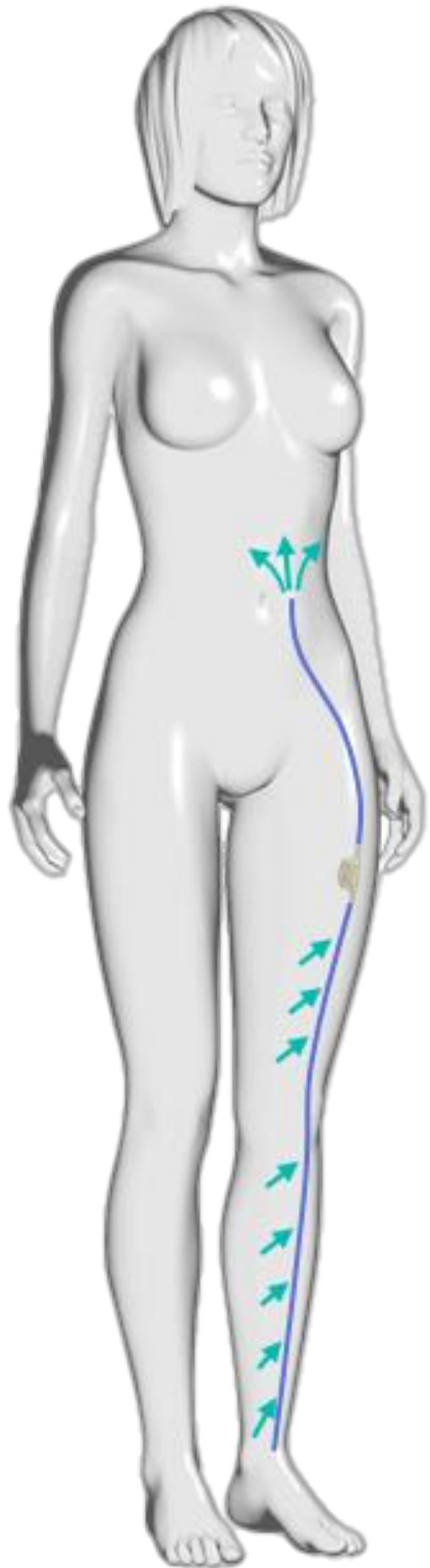


STABILIZES AND
REDUCES LIMB
VOLUME



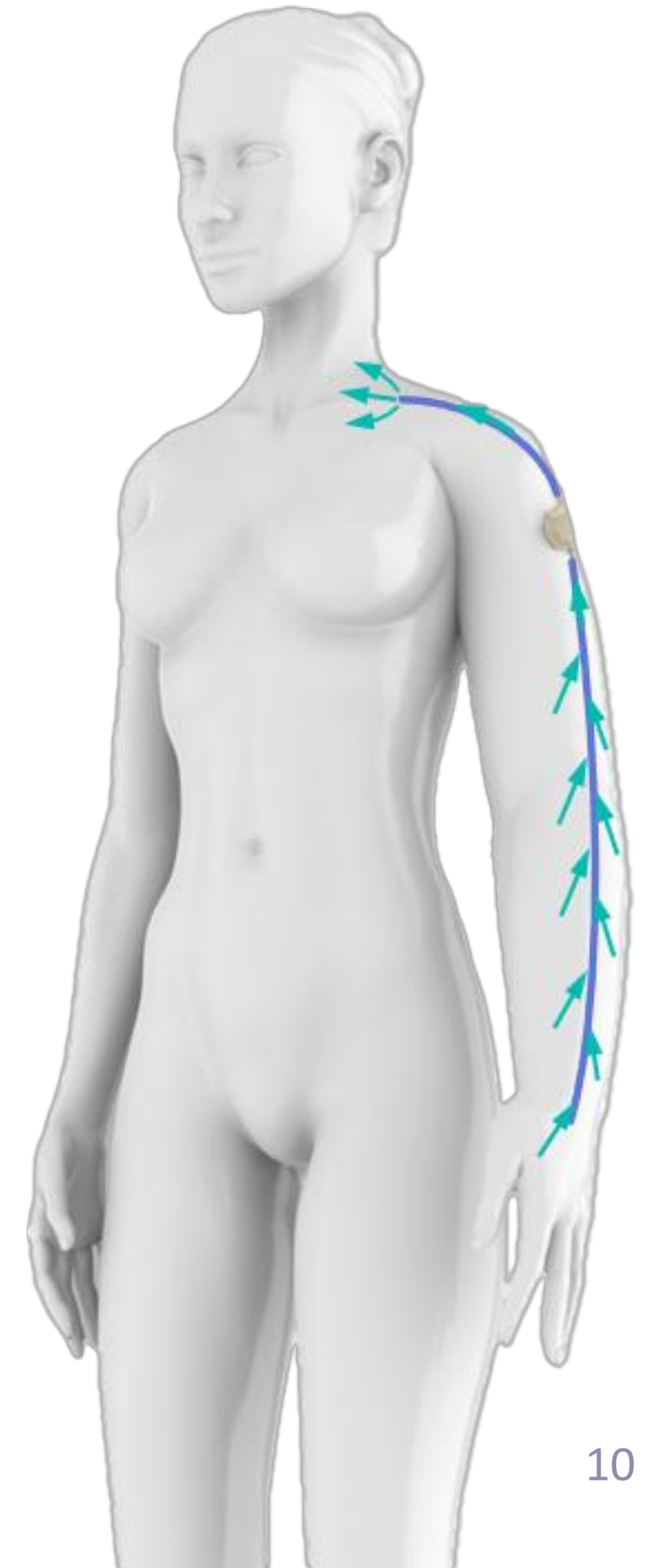
RESULTS
MAINTAINED
WITHOUT NEED
FOR COMPRESSION





PIVOTAL CLINICAL TRIAL:

- Randomized, controlled trial
- Arm and leg lymphedema
- 8-10 clinical sites between US and EU
- Aim: demonstrate **long term safety** and **performance**





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25. New Technologies for Diagnosis & Treatments of Lymphatic Disorders

Postoperative Evaluation of Upper Extremity Lymphedema Using the Cutometer

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Postoperative Evaluation of Upper Extremity Lymphedema Using the Cutometer

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Abstract

Background

Various diseases can cause edema of the extremities, including lymphedema, which is characterized by stiff edema due to fluid retention with a high protein concentration. This study aimed to determine whether skin elasticity could be used as an objective postoperative indicator for lymphaticovenular anastomosis (LVA). To this end, we evaluated skin properties using Cutometer (Courage + Khazaka, Germany), which measures skin firmness by applying negative pressure to the skin and evaluating its return to its initial state.

Methods

Patients with secondary upper extremity lymphedema who underwent LVA were included. Patients with lymphedema were defined as those with apparent dermal backflow in any part of the upper limb as indicated by the indocyanine green examination. The skin firmness of patients was measured using Cutometer 3 months postoperatively. Measurements were taken on the palmar side of the forearm on both the affected and healthy sides of each patient's upper extremity three times using Cutometer. The probe was 6 mm, the negative pressure was 400 mbar, and the suction duration was 2 seconds. Skin firmness (mm) was determined as the maximum skin height up to the negative pressure release time. Skin viscoelasticity (%) was derived by dividing the degree of delayed skin stretch displaced by the degree of skin stretch immediately after suction.

Results

Eleven patients underwent LVA, all of whom were ISL stages 2 and late stage 2. The patients were divided into two groups: five patients with subjective symptoms that improved after LVA and six patients with subjective symptoms of edema that did not improve after LVA. Skin firmness was 1.19 mm and 1.12 mm ($p > 0.05$) in the improved and non-improved groups, respectively. In contrast, skin viscoelasticity was significantly smaller in the improved group (34.2% vs. 46.0% ($p < 0.001$)). There was no significant difference in the viscoelasticity of the skin of the healthy limbs of the improved and non-improved groups.

Discussion

The Cutometer is a device that evaluates skin viscoelasticity using negative pressure and has been widely used in lymphedema research and cosmetic dermatology. A previous study reported that skin firmness and viscoelasticity increased, especially in patients with ISL stages 2 and late stage 2. Postoperative evaluation in LVA is generally performed using the patient's limb volume, but we often encounter that limb stiffness is relieved after LVA. These observations are usually subjective, and there has been no objective evaluation of postoperative changes in limb stiffness. In this study, skin viscoelasticity clearly decreased in patients who respond to LVA. As lymphedema worsens, patients usually experience a greater degree of stiffness. Thus, our results suggest that skin viscoelasticity could be an indicator for evaluating the progression of lymphedema, as well as evaluating postoperative results in patients undergoing LVA.

Acknowledgments: This work was supported by JSPS KAKENHI (Grant Number 22K16998).

15. Indocyanine Green – ICG Lymphography

Evaluation of the accuracy of preoperative mapping using photoacoustic lymphangiography.

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Abstract

Background: Lymphaticovenular anastomosis (LVA) is a surgical procedure used to alleviate lymphedema by redirecting congested lymphatic fluid into the

veins through the anastomosis of lymph vessels and veins. Accurate identification of lymphatic vessels and veins is crucial for successful surgical outcomes, and preoperative identification of the targeted lymphatic vessels is highly desirable. Photoacoustic lymphangiography (PAL) is a new optical imaging technique with a resolution of 0.2 mm, which allows for more precise evaluation of lymphatic vessels and veins compared to existing modalities. PAL shows promise for preoperative planning of LVA. Therefore, this study aimed to assess the accuracy of preoperative mapping using PAL.

Methods: We performed PAL using the LUB0 (Luxonus inc., Japan) in lymphedema patients scheduled for LVA. To ensure accurate confirmation of the obtained figures, multiple markers were placed on the patients' extremities. Indocyanine green was injected, followed by near-infrared fluorescence (NIRF) lymphography and PAL to detect lymphatic vessels and determine the incision sites.

Results: A total of 20 lymphedema patients were enrolled in this study, including 3 males and 17 females. All patients had secondary lymphedema, with 1 patient experiencing upper extremity lymphedema and 19 patients with lower extremity lymphedema. The mean age of the patients was 60.9 years. PAL successfully identified collective lymphatic vessels preoperatively at 45 sites, and these vessels were confirmed as the same lymphatics that identified preoperatively during the LVA procedure.

Discussion: Our study demonstrated that PAL using the LUB0 system enables reliable identification of lymphatic vessels in patients with lymphedema. PAL allows for three-dimensional visualization of lymphatic vessels and veins, and with accurate superimposition, the location of these vessels can be determined reliably. In this study, the use of multiple markers facilitated precise registration. However, it is important to note that slight changes in the surface shape of the extremities can occur during imaging due to contact with the imaging machine. Therefore, placing the markers in the appropriate position requires some expertise. Additionally, the direction of the upper limb can easily change due to internal and external rotation, necessitating consistent positioning during superimposing. The LUB0 system used in our study required approximately 5 minutes to capture each section, resulting in a total preoperative mapping time of over an hour, which remains an issue to be addressed. Nevertheless, as further advancements are made, the ability to accurately identify lymphatic vessels is expected to become more practical.

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26. Lymphedema Wound Care

How A Lymphologist Can Cure Series: VIII. Leg ulcer simply cured upon understanding its lymphological nature

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Background Various types of skin ulceration are encountered in breast/chest from cancer/radiotherapy, in body parts from physical/chemical injuries, in hand-reached spots from chronic scratches, or in bony areas as bedsores. Uniquely, leg ulcer develops, as it appears, “spontaneous” normally in the segment immediately above the ankle, the very site of most prevailing lymphedema. **Patients and Methods** About 2% of our 9,750 patients had leg ulcer(s), solitary or multiple; some habitually recurred, others had underlying conditions such as diabetes, obesity, varicosis, pes planus, ankle deformity, et cetera. Age ranged between 18~81 years. Wound dimension measured 10 cm maximum, stage II~IV. All subjects underwent compression-decompression therapy either by Twisting Tourniquet[®] Technique (Chanwimalueang et al., 2015) using certified *Schnogh*[®], and/or by a series of managed wrap. Affected leg was washed by chlorinated running water twice daily, changing wound-dressing with regular gauze. When MRI was available, film-reading lecture was given to maximize patient compliance. Foot ice bath was conducted to evacuate the old/poor lymph from the joints and bone marrow. Pure plant-based diet therapy was strongly encouraged, to not aggravate the inflammatory lymph formation in the tissue. **Results and Discussion** Typically ulcer healed within a month or two. Foul-smelling fluid stopped by next day(s) and itch terminated. Bloody debris, slough, and eschar disappeared in a few days or weeks, granulation grew, tissue filled, and normal skin approximated and closed. Sometimes when patients surreptitiously consumed their usual food of animal

products, our therapists could detect the violation by the worsening of wound odor. Sensitively painful cases were readily calmed by gentle massage and graduated compression wrap. If properly repeated, tenderness vanished in a day or two. On MRI T2W with short tau inversion recovery (STIR) and fat suppression mode, lymphedematous layer was distinctly demonstrated, thick or thin. Signs of phlebitis, with/out the presence of superficial varicose veins, were always identified. Deep veins appeared with irregular widening/narrowing, ran unusual courses, angulated, u-turned, curled, or even spiraled. As to the latter, we explained it that, macaroni can be stretched and reshaped into spaghetti by the treatment protocol and extended use of compression garments or the like. **Conclusions** Unlike bedsore/pressure ulcer, which fundamentally is determined by immobility and weight against osseous structures, leg ulcer by nature is easier to care. Since ankles are the primary source of inflammatory lymph production (Ekataksin, 2013), leg ulcer is basically cured by lymphology tools.

Topic n 26 Lymphedema Wound Care

Vincenzo Balzano

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LYMPHATIC VENUS LEG ULCER TREATMENT PROTOCOL

Objective: The purpose of this study is to plan the pathway which leads to healing of the venous leg ulcer (VLU) is achieved with a suitable dressing procedure, with management of the venous and lymphatic system and a multidisciplinary protocol, which improves healing times, reduces associated complications and increases patient compliance

Method: Lymphatic lesions require a combined local intervention which pays particular attention to the management of the exudate.

The therapeutic process is divided into three phases:

the patient with venous leg ulcer (VLU) and lymphedema was treated in the first stage according to the principles of wound bed preparation (WBP), then hydrosurgical debridement, periwound skin care; in the second stage with regenerative surgery combined with single use NPWT, plus bone marrow stem cells, plus dermal substitute and in the third and last stage with skin graft.

Lymphoedema was managed with compression bandages and/or compression stockings as clinically indicated.

Results: After 2 weeks of treatment with debridement and 30 days of NPWT the lesion was ready to proceed to dermal substitute.

21 days after the placement of the dermal substitute plus stem cells, skin graft was carried out.

In a period of 3 months, the patient recovered completely from the ulcerative lesion and lymphedema present at the first visit without complications.

Conclusion: The application of a treatment standardized in phases and helped by technology has demonstrated not only a shorter recovery time, but above all a reduction of assistance errors and consequently possible complications