

Utility of Local Tissue Water Measurements to Assess Breast Cancer Treatment-Related Lymphedema

HN Mayrovitz College of Medical Sciences, NSU, Ft. Lauderdale FL

Postmastectomy Lymphedema

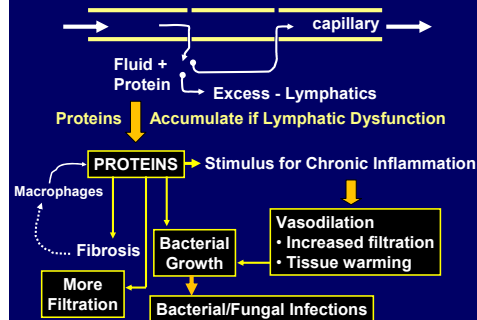


- Develops secondary to surgery and/or radiation therapy
- Occurs in 20-40% of persons treated for breast cancer
- Onset can be from months to years after surgery
- If untreated, gets progressively worse

"Recognizing lymphedema early and treating it promptly is the best way to manage the condition"

Judith R. Casley-Smith & J.R. Casley-Smith

Complications



Available Assessment Methods

Limb Volume or Girth Assessments

Mainly for Tracking and Documenting



Circumference
If unilateral then lymphedema if difference > X cm



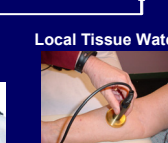
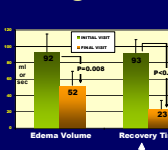
Automated Multiple Circumferences Manual

Geometric Model or Algorithm

Limb Volumes
www.limbvolumes.org

If unilateral then lymphedema if volume difference > Y ml

Tissue Property Changes

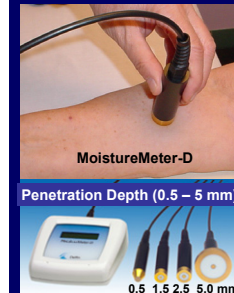


Tissue Electrical Resistance

Dielectric Constant

Main Method Used in this Study

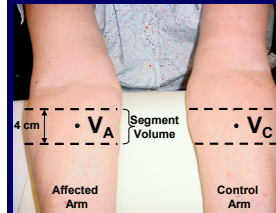
Tissue Water via Dielectric Constant



- Low power 300 MHz incident wave
- Reflected wave depends on the tissue's dielectric constant
- Dielectric constant depends on total tissue water (free + bound)
- Pure water has a dielectric constant of about 80
- Calibrated for each probe from 1 - 80

SUBJECTS and PROTOCOL

18 women with unilateral arm lymphedema (74 ± 16 yrs)
15 premenopausal women (26.2 ± 3.9 yrs)
15 postmenopausal women (59.1 ± 6.7 yrs)

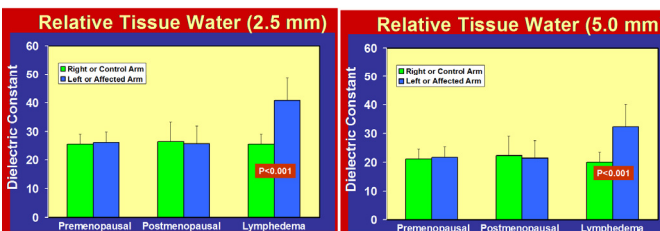
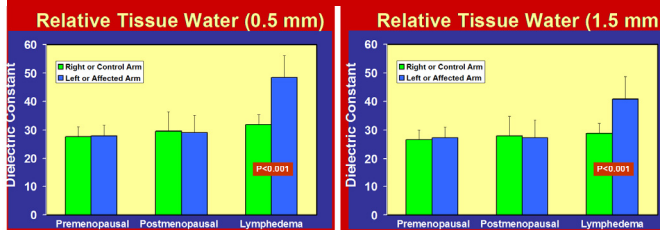


- Triplicate dielectric values on each arm with each probe
- Segment volumes determined based on frustum model
- Segmental percentage edema

$$100 \times \frac{V_A - V_C}{V_C}$$

Measurements on lymphedema patients prior to treatment
Measurements on premenopausal 4 days after menses

RESULTS

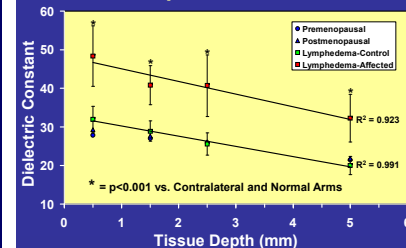


Depth	0.5 mm	1.5 mm	2.5 mm	5.0 mm
TDC	>42	>37	>34	>30

Dr. Mayrovitz welcomes your comments and feedback!
Please contact him via e-mail at: mayrovit@nova.edu

RESULTS (cont)

Depth Variation



Diagnostic Utility

No overlap between Patients vs. Controls

Patient Arms
Affected/Control
1.64 ± 0.30
N=18

Control Arms (Max/Min)

Premenopausal
1.04 ± 0.04
N=15

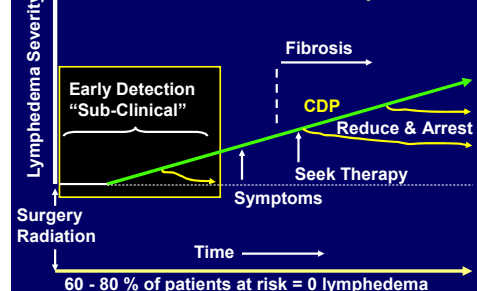
Postmenopausal
1.04 ± 0.04
N=15

CONCLUSIONS

- This local tissue water method can rapidly detect and document lymphedema presence
- May also have utility for early detection
- Criteria for such early detection as of now for the limited data set:
- For at-risk unilateral cases:
Arm TDC ratio > 1.2
- For bilateral cases (or with absolute values):
- Threshold depends on depth
- Based on +3 SD of data, estimates are shown in Table 1

Ultimate Goal - Catch it Early

More Treatable - Less Complications



60 - 80 % of patients at risk = 0 lymphedema