

Assessment of Tissue Fibrosis and Oxygenation before and after CDP Therapy in Women with Postmastectomy Arm Lymphedema

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Background and Purpose

- Previous reports suggest that skin blood flow is reduced in arms of women with lymphedema due to breast cancer treatment.
- Since tissue oxygenation depends on blood flow, we sought to determine if tissue oxygen tension ($TcPO_2$) is also reduced and if so, if therapy that reduces edema and tissue hardness has a beneficial effect.

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Methods Overview

- Transcutaneous oxygen tension ($TcPO_2$) was measured on fibrotic tissue areas of 16 breast cancer survivors who had developed unilateral arm lymphedema.
- Measurements were done on both the affected arm and the control arm with arms down and with arms raised.
- Done prior to starting CDP therapy and at the end of the treatment sequence

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Region of greatest fibrosis identified and marked



Transcutaneous Oxygen Tension ($TcPO_2$) probe* put on center to record oxygen levels

*<http://respironics.com>

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Inducing Changes in Perfusion



Resting TcPO₂



Reduced TcPO₂

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Methods Overview

- Properties of the fibrosis were assessed by indentation recovery times after applying an indenter-like device* to tissue.



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*<http://bioscience-research.net/tissupress.html>



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Methods Overview

- Volumes of whole arm and of the target fibrotic segments were determined by software (LVP3.0)* that automatically calculated volume and edema percentages from measured circumferences.
- Measurements were made before and after standard CDP therapy sequences.

*<http://bioscience-research.net/lymphedema.html>

Initial Visit

Visit 1		Notes: Tx is affected limb undergoing treatment; Norm is contralateral limb for comparison		View	
Limb Length	42	Segment Length (cm)	4	Total # Segments	11
From data there are	10	Full segments plus one partial segment of length =	2		
Enter Circumferences in yellow cells below (columns C and D)					
cm Note that the first circumference pair to be entered from for "0" cm corresponds to either the wrist or ankle					
wrist/ankle	Circumferences (cm)	segment	Volume (ml)		
	Tx	Norm	number	Tx	Norm
0	19	14.6		133	65
4	21.8	14	1	133	65
8	24	16	2	167	72
12	26.8	18.8	3	206	97
16	29	21	4	248	126
20	29	21.8	5	268	146
24	28.5	22	6	263	153
28	30.5	24.5	7	277	172
32	30	25.5	8	291	199
36	29	27.5	9	277	224
40	29.4	28.5	10	272	250
42	29.9	30	11	140	136

Limb Volumes	Tx	Norm	Edema	%Edema
Total Volume (ml)	2968	1961	1008	51.4
Limb only (ml)	2542	1639		
Hand only (ml)	426	321		

Therapist: N Sims | Pt. Name: Study Patient 012 | Date: 12-Mar-04
 ID: L1A012 | Tx number: 1

Final Visit

Visit 10		Notes: Tx is affected limb undergoing treatment; Norm is contralateral limb for comparison		View	
Limb Length	42	Segment Length (cm)	4	Total # Segments	11
From data there are	10	Full segments plus one partial segment of length =	2		
Enter Circumferences in yellow cells below (columns C and D)					
cm Note that the first circumference pair to be entered from for "0" cm corresponds to either the wrist or ankle					
wrist/ankle	Circumferences (cm)	segment	Volume (ml)		
	Tx	Norm	number	Tx	Norm
0	16	14.5		89	65
4	17.5	14	1	89	65
8	20.4	15.5	2	115	69
12	22.8	18.4	3	149	92
16	25.5	20.5	4	186	121
20	26	21.5	5	211	140
24	26.5	21.8	6	219	149
28	27.9	23.9	7	236	166
32	28.5	24.4	8	253	186
36	27.8	27	9	252	211
40	28.5	30	10	252	259
42	28.5	30.4	11	129	145

Limb Volumes	Tx	Norm	Edema	%Edema
Total Volume (ml)	2431	1928	502	26.1
Limb only (ml)	2092	1603		
Hand only (ml)	339	326		

Therapist: Therapist name | Pt. Name: Study Patient 012 | Date: 3-Jan-04
 ID: L1A012 | Tx number: 1

Progression

Patient	Study Patient 012	ID	L1A012	Unilateral Upper Extremity	8/23/2004 12:17							
Visit	1	2	3	4	5	6	7	8	9	10	11	12
Tx Limb Volume (ml)	2968	2819	2746	2674	2589	2559	2529	2515	2492	2431	0	0
Norm Limb Volume (ml)	1961	1961	1961	1961	1961	1961	1961	1961	1961	1928	0	0
Edema (ml)	1008	858	785.7	713.5	679	598	568	554	521	502		
%Edema	51.4	43.8	40.1	36.4	32.1	30.5	29.0	28.3	27.1	26.1		
Tx: % Vol change		-5.0	-7.5	-9.9	-12.8	-13.8	-14.8	-15.3	-16.1	-18.1		
Norm: % Vol change		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.6		

Note: In the above graphics, Visit refers to patient visits during which limb volume measurements were made and recorded

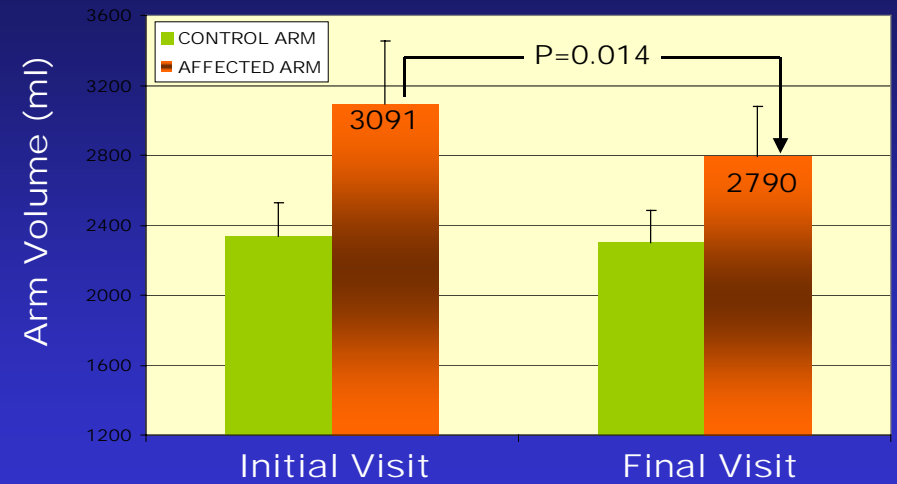
Comments: This patient is part of the Lymphedema Fibrosis-Oxygen study, 58 year old with initial lymphedema starting 2 years after primary surgery and has been present since July 2000. Initial whole arm percentage edema was determined to be 51.4% which was reduced to 26.1% with CDP.

Miscellaneous: L1A012 | Tx number: 1 | Volume: Professional V 3.0 | Copyright 2004 Bioscience Research Institute

RESULTS

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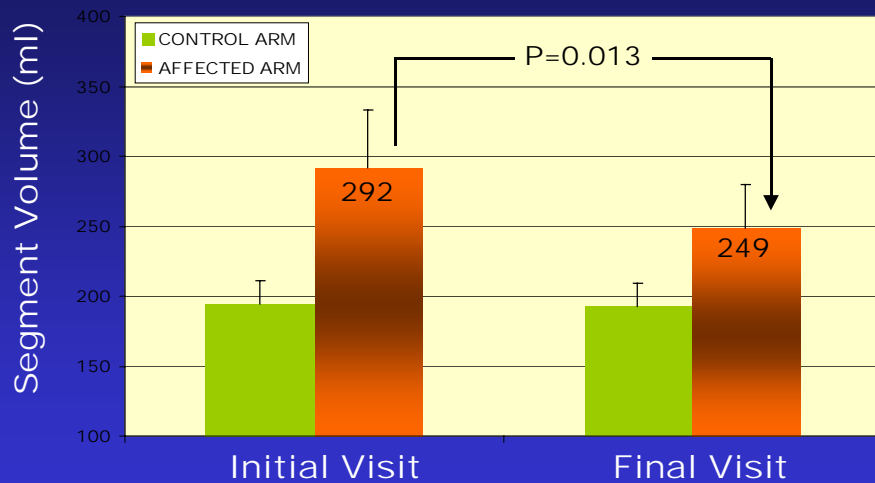
Arm Volume Reduced!



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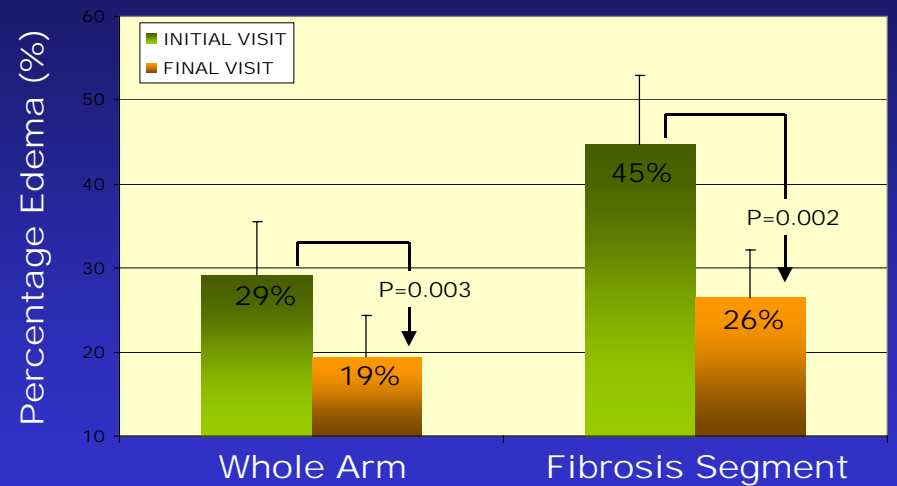
Fibrosis Segment Volume Reduced!



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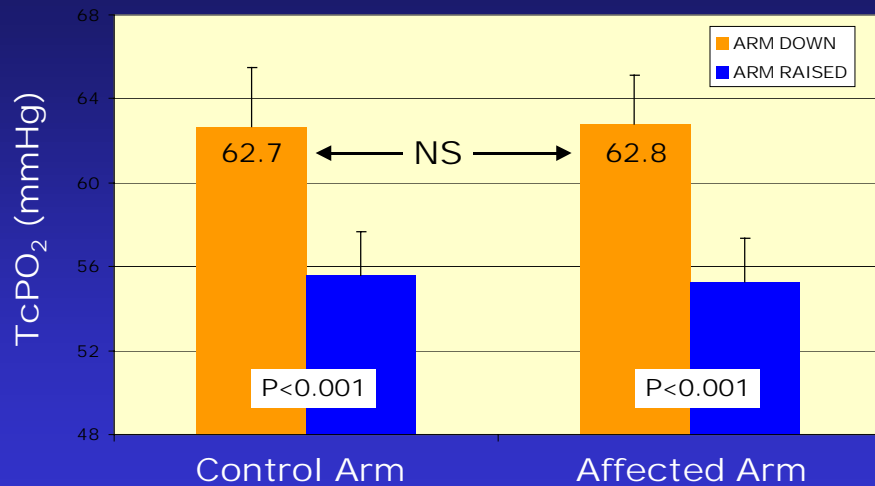
Percentage Edema Reduced!



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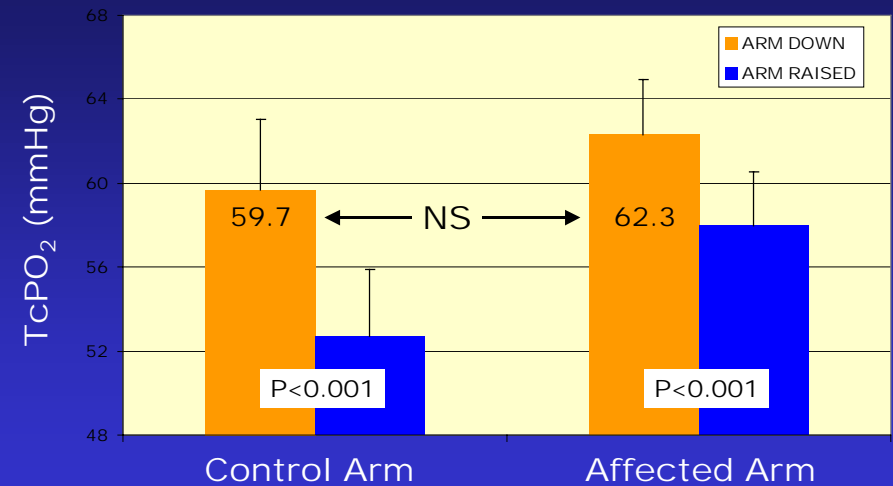
Initial Visit Oxygen No Difference!



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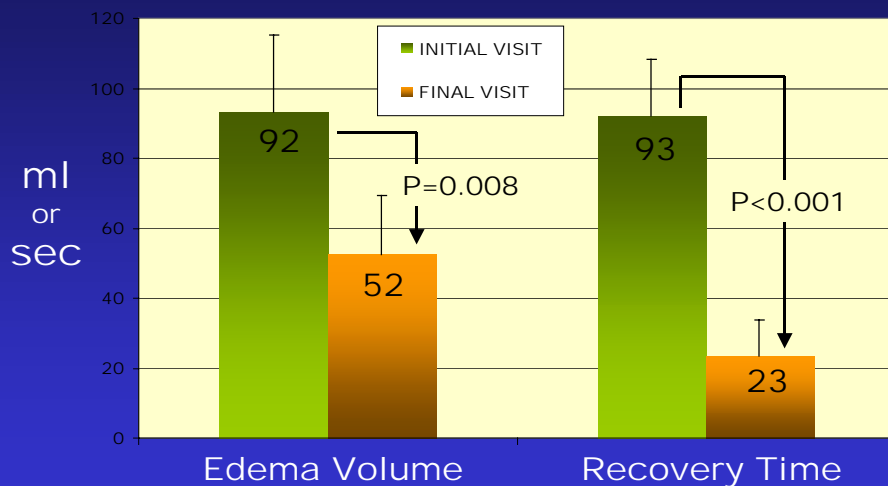
Final Visit Oxygen No Difference!



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Fibrosis Segment Features Reduced Recovery Time!



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Summary and Conclusions

- Despite significant amounts of initial edema and tissue fibrosis, TcPO₂ was not initially less in the affected arm nor was it altered by therapy that significantly improved both edema and fibrosis.
- The findings suggest that if resting skin blood flow is reduced, it has little effect on this measure of tissue oxygenation.

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