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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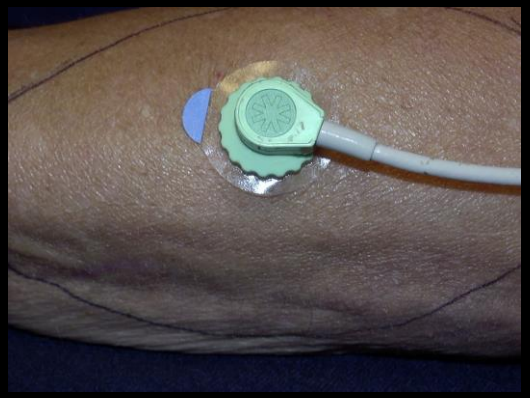
Methods Overview

- 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

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 $TcPO_2$

Reduced $TcPO_2$

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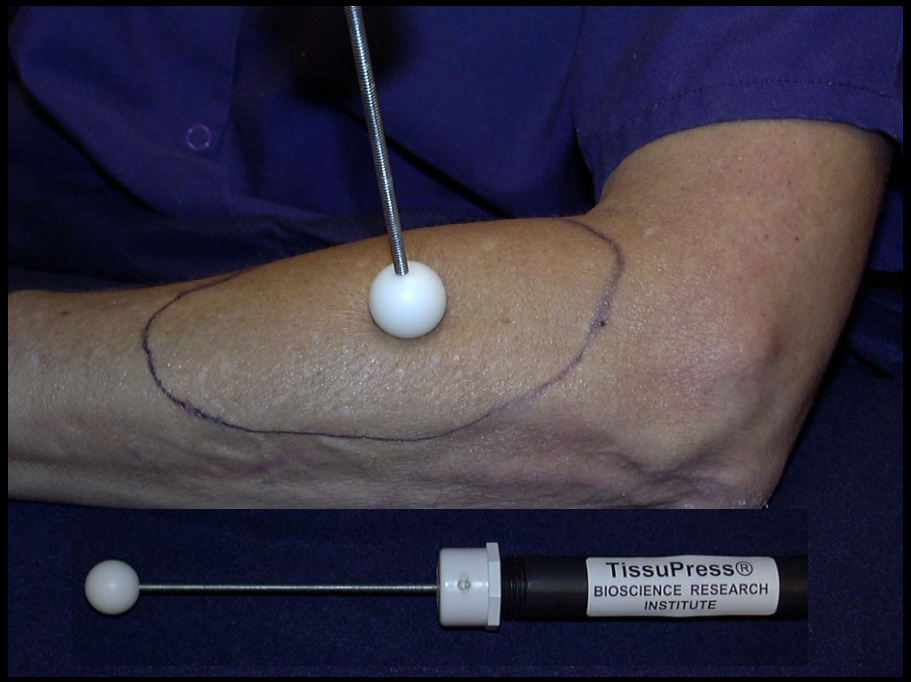
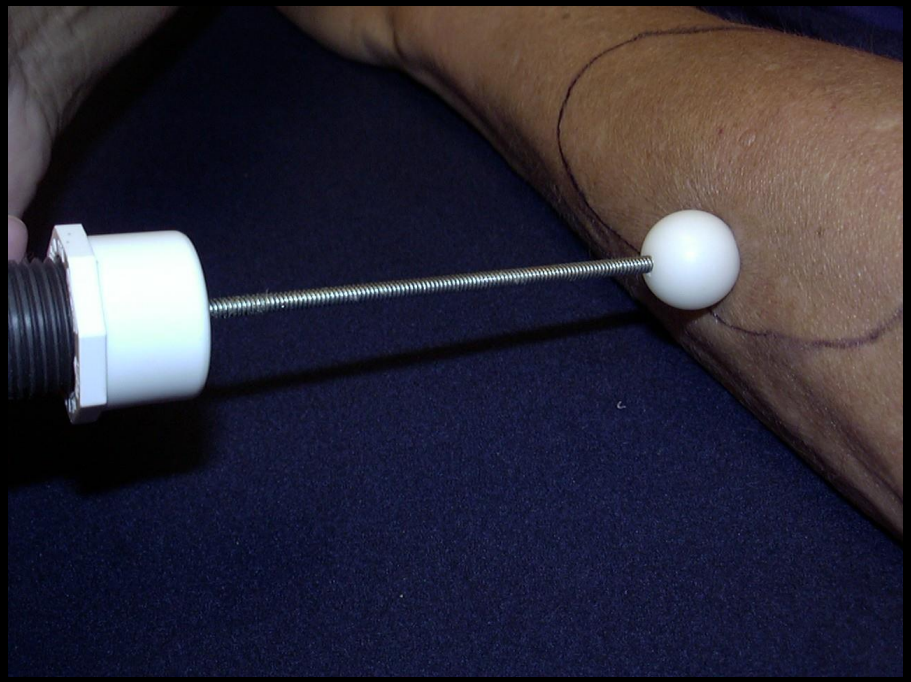
Methods Overview

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





***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		
	Limb Length	If both limbs are affected (bilateral) then limbs are designated as right and left	Segment Length (cm)	Total # Segments
	42		4	
From data there are	10	full segments plus one partial segment of length =	2	11

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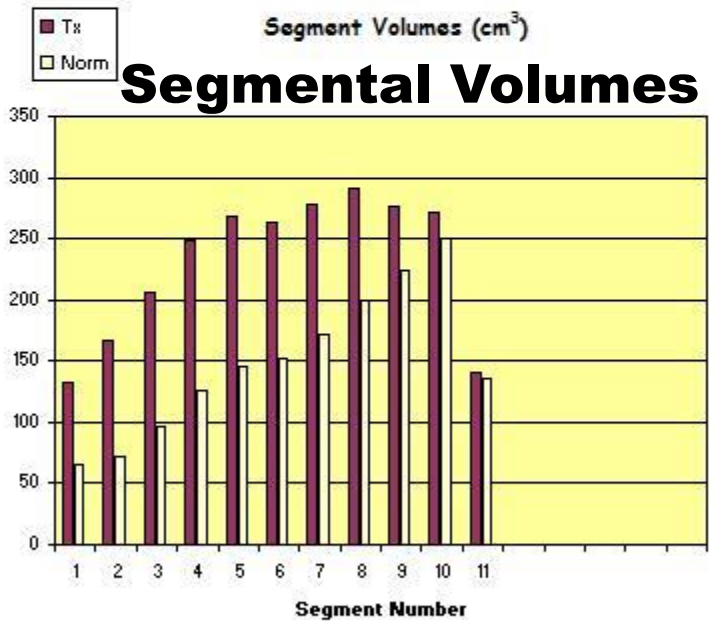
Enter Circumferences in yellow cells below (columns C and D)

Note that the first circumference pair to be entered for "0" cm corresponds to either the wrist or ankle

cm from wrist/ ankle	Circumferences (cm) Tx	Norm	segment number	Volume (ml) Tx	Norm
0	19	14.6			
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		
	Limb Length	If both limbs are affected (bilateral) then	Segment Length (cm)	Total # Segments
	42	limbs are designated as right and left	4	
From data there are	10	full segments plus one partial segment of length =	2	11

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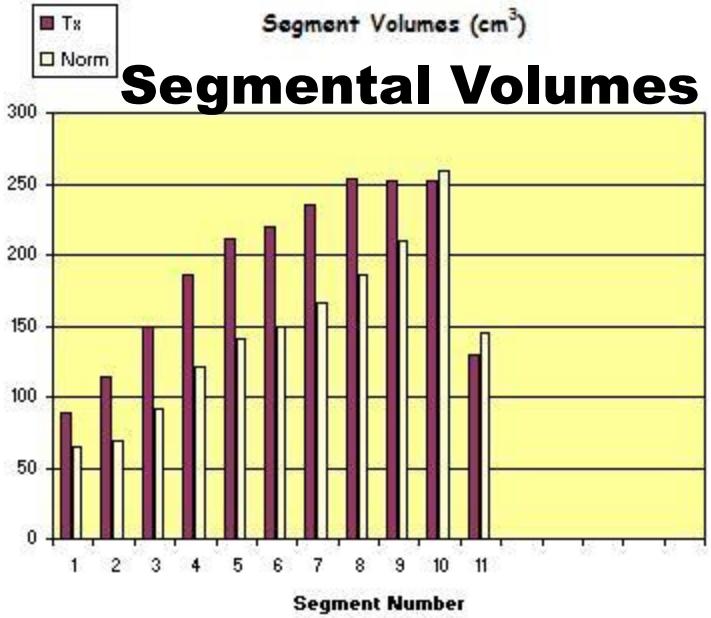
Enter Circumferences in yellow cells below (columns C and D)

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

cm from wrist/ ankle	Circumferences (cm) Tx	Circumferences (cm) Norm	segment number	Volume (ml) Tx	Volume (ml) Norm
0	16	14.5			
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

Note that the first circumference pair to be entered for "0" cm corresponds to either the wrist or the ankle



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	859	785.7	713.5	629	598	569	554	531	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		

Copy Summary

View

Full Screen

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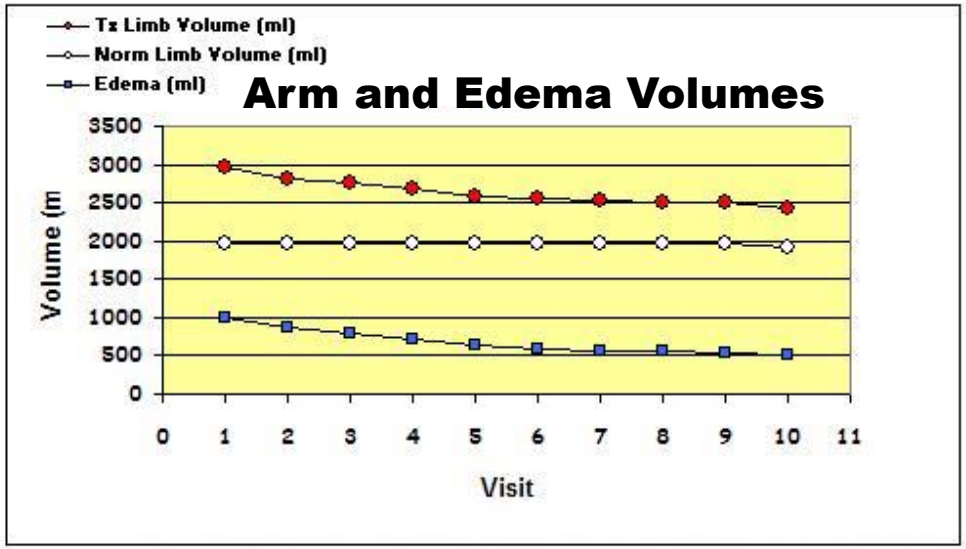
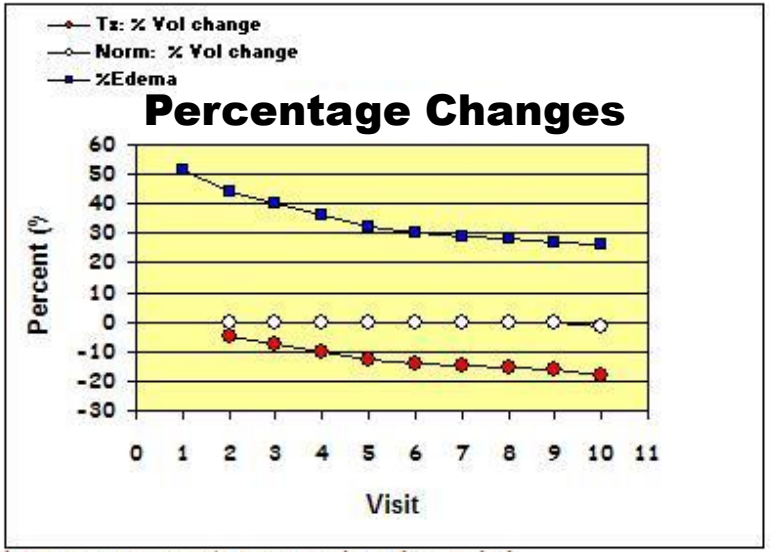




Note: In the above graphics, Visit refers to patient visits during which limb volume measurements were made and recorded

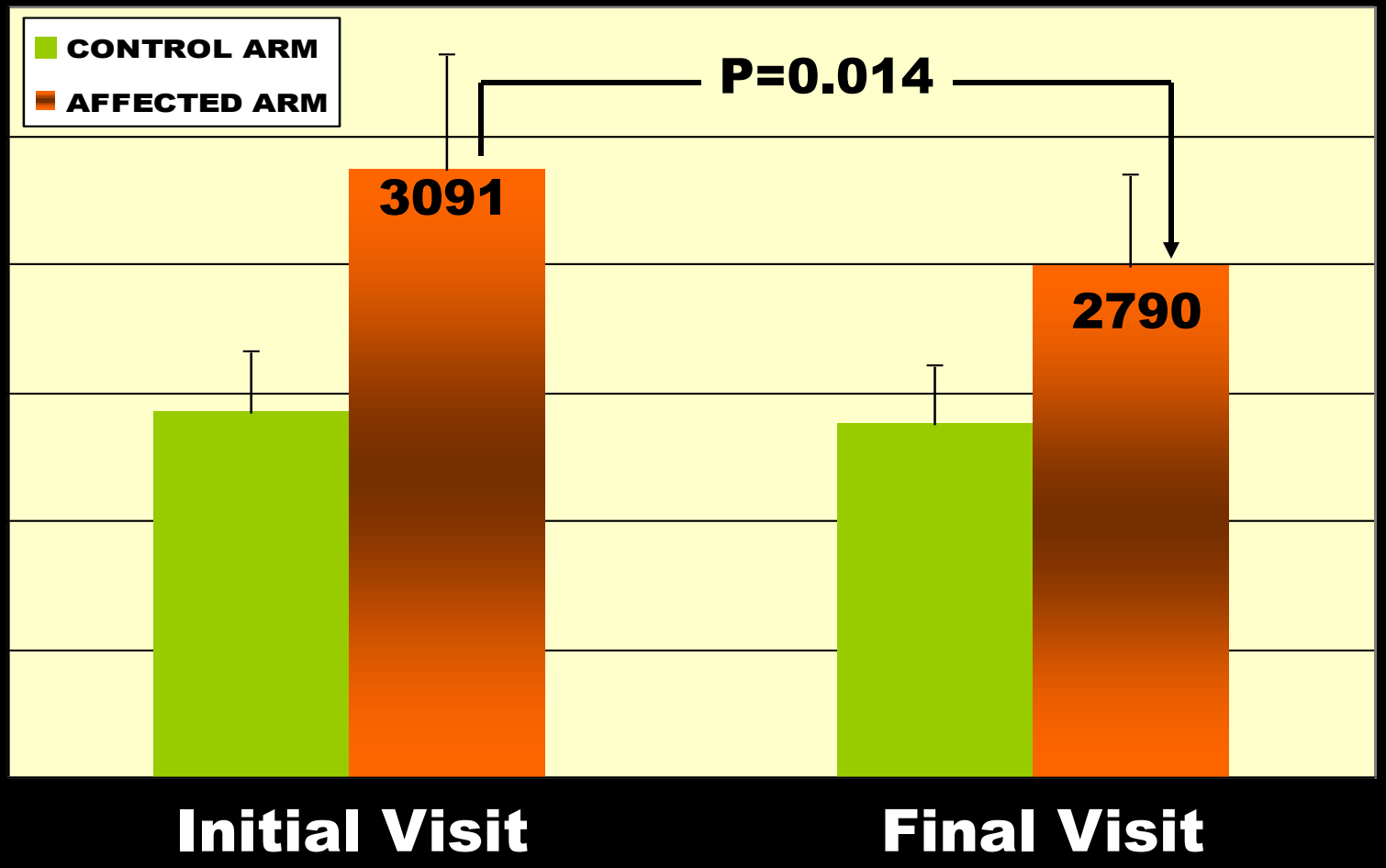
Comments

This patient is part of the Lymphedma 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.

RESULTS

Arm Volume Reduced!



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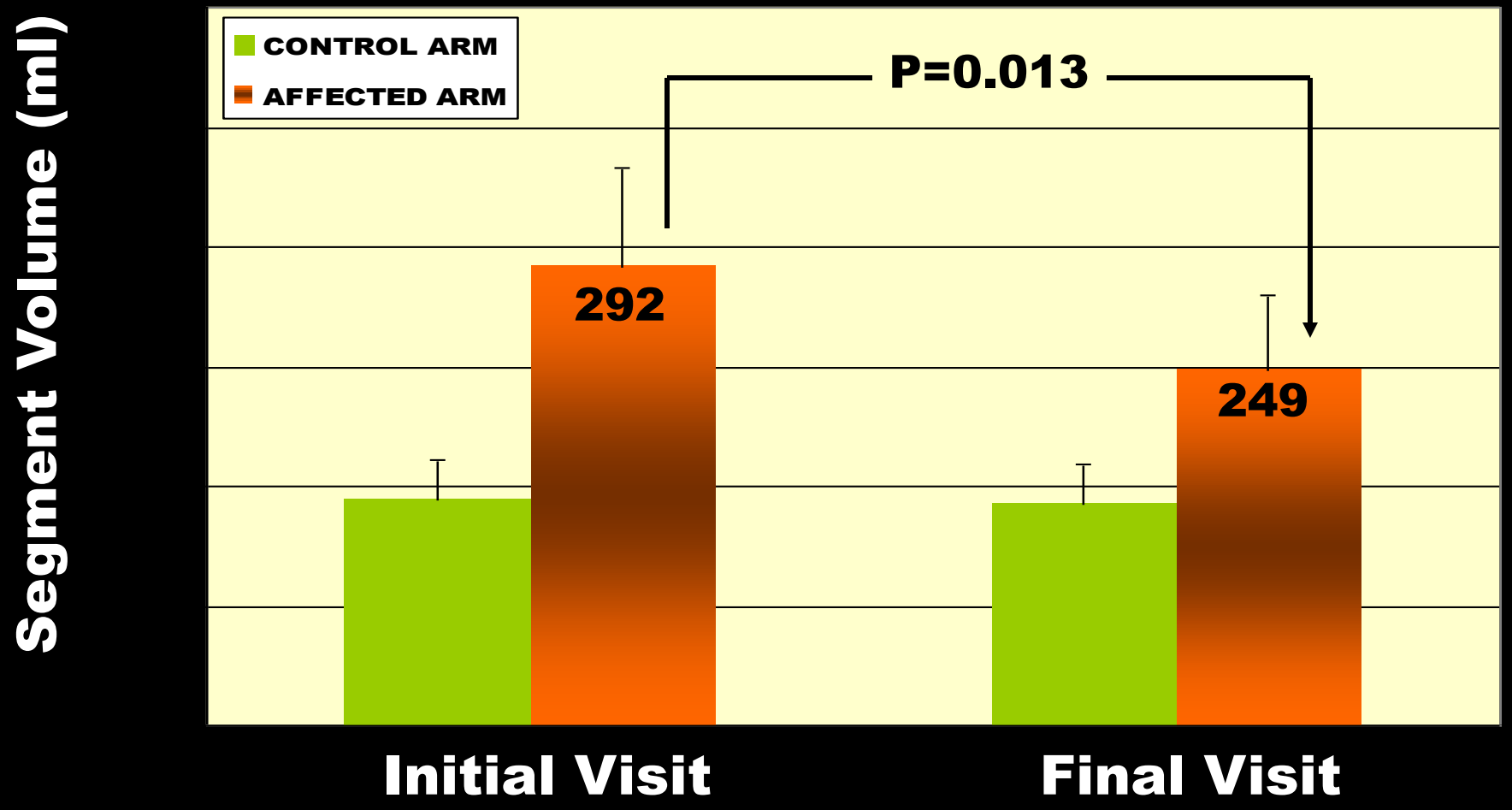
Fibrosis Segment Volume Reduced!



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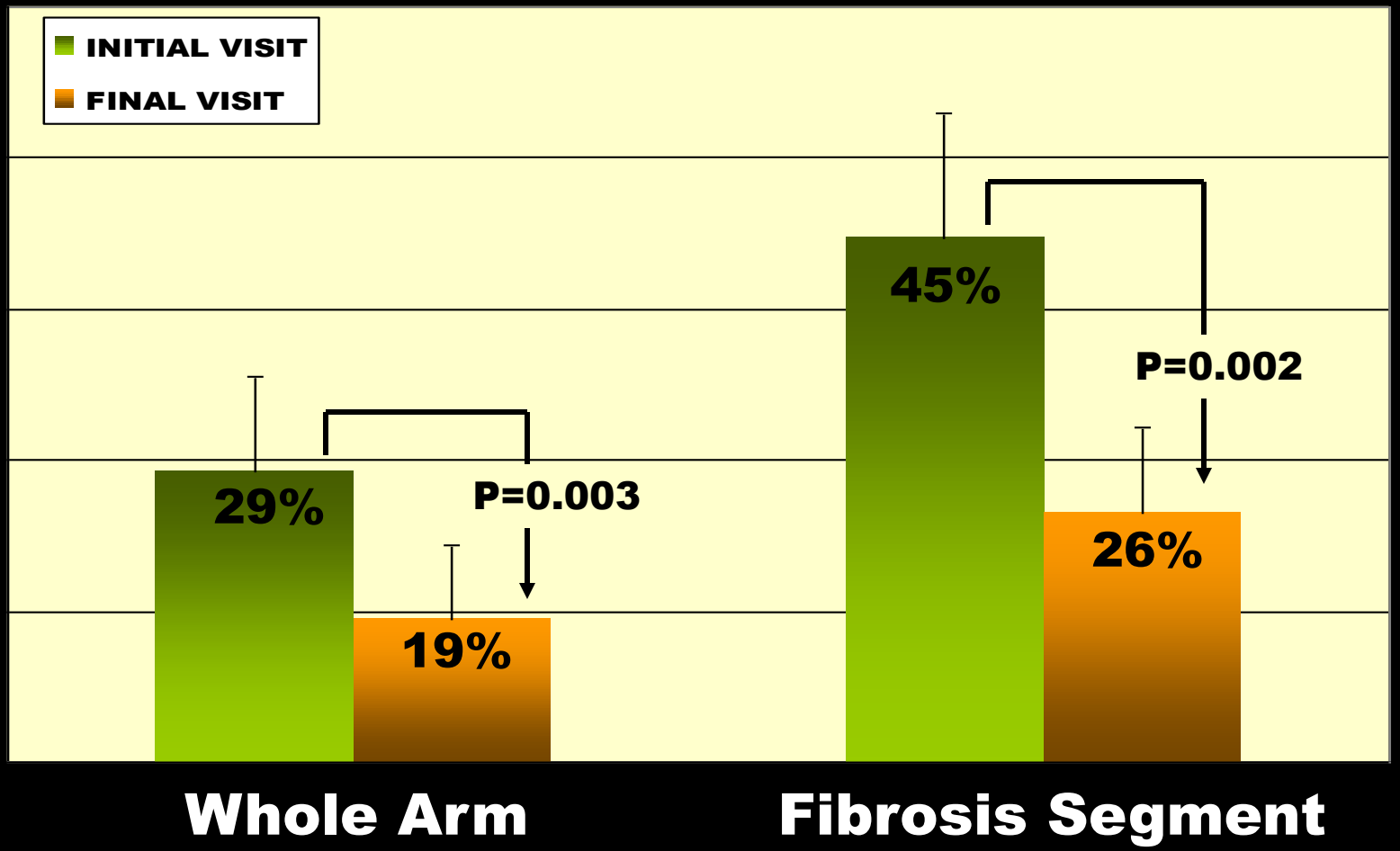
Percentage Edema Reduced!



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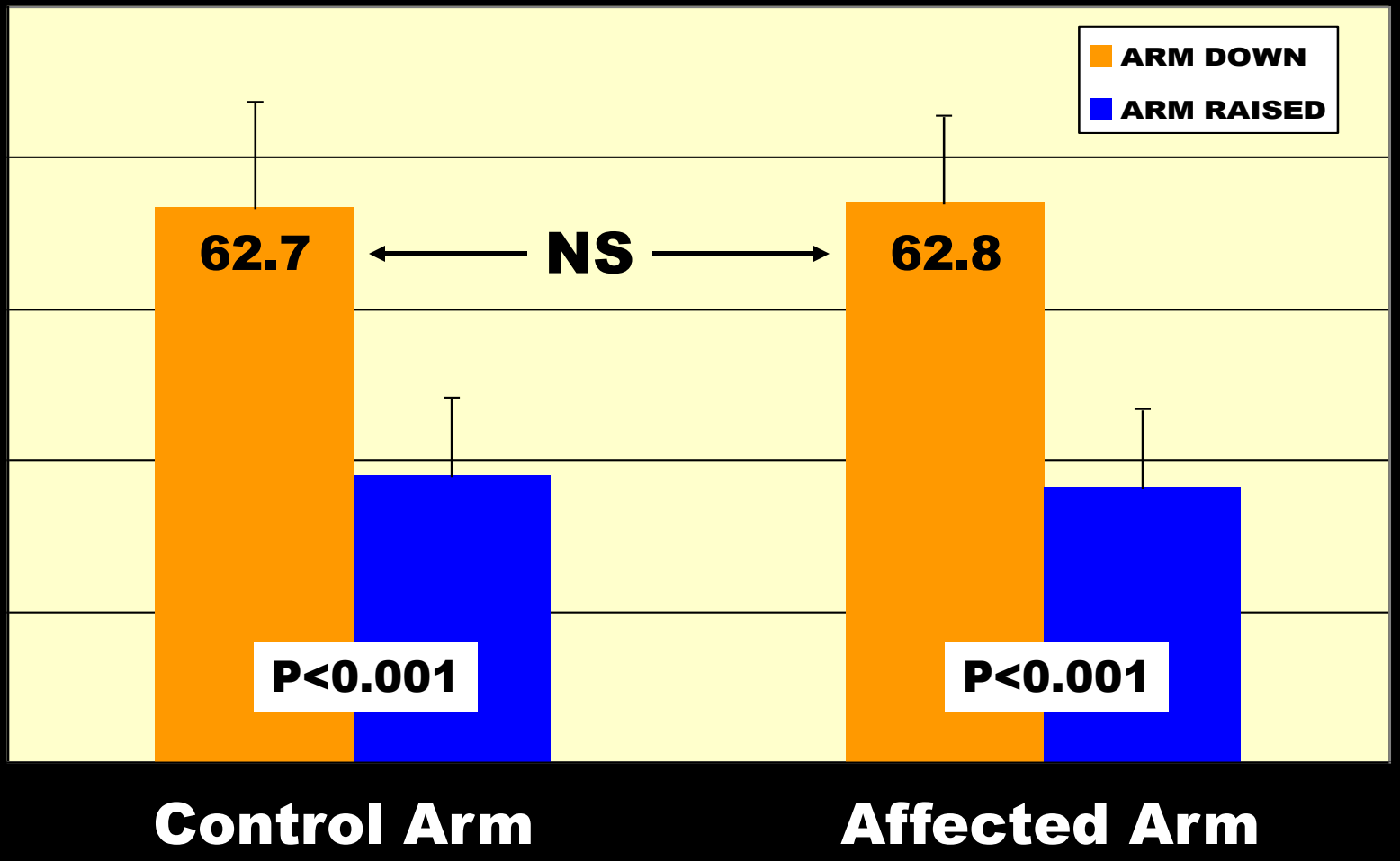
Initial Visit Oxygen
No Difference!



$TcPO_2$ (mmHg)

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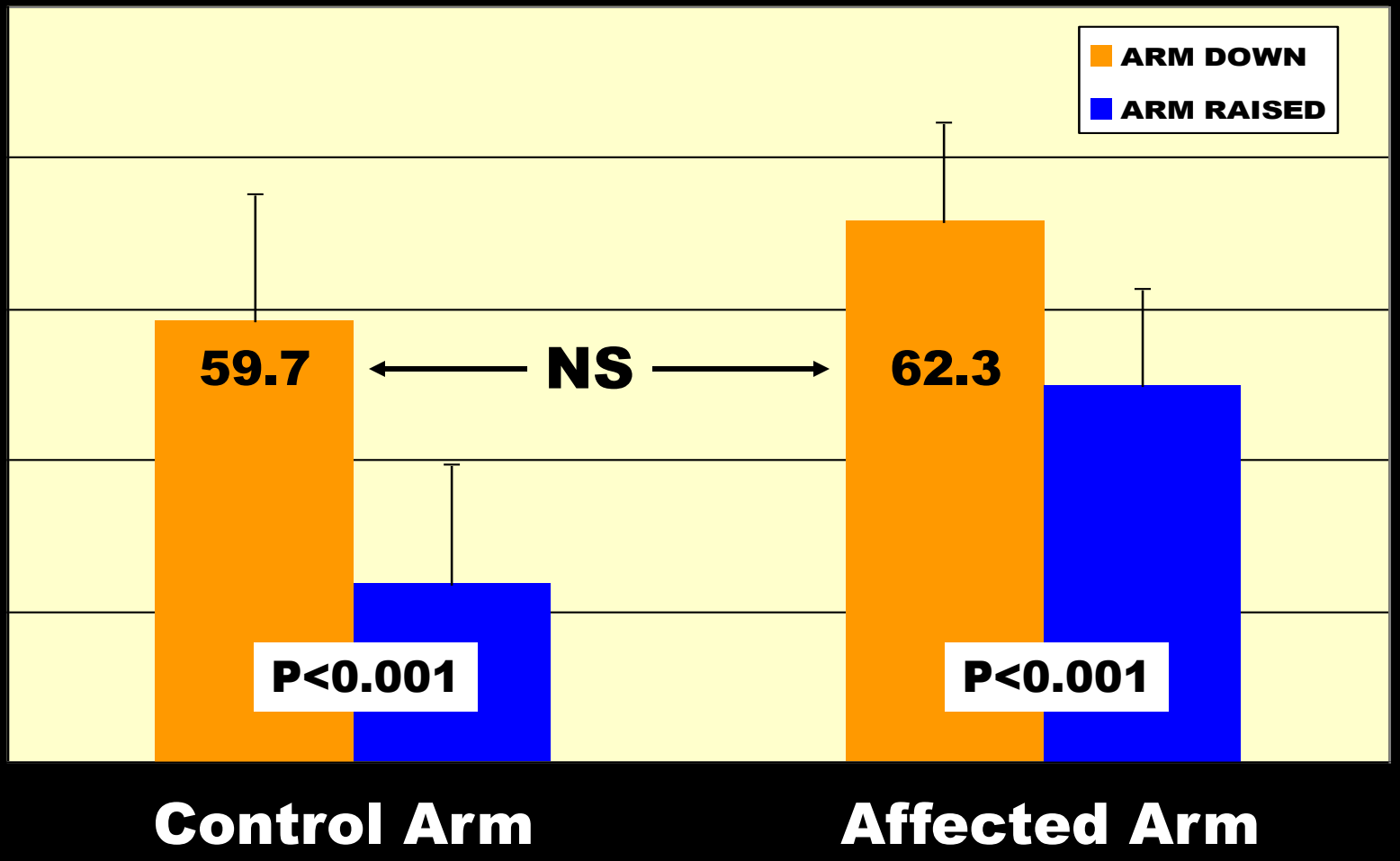
Final Visit Oxygen
No Difference!



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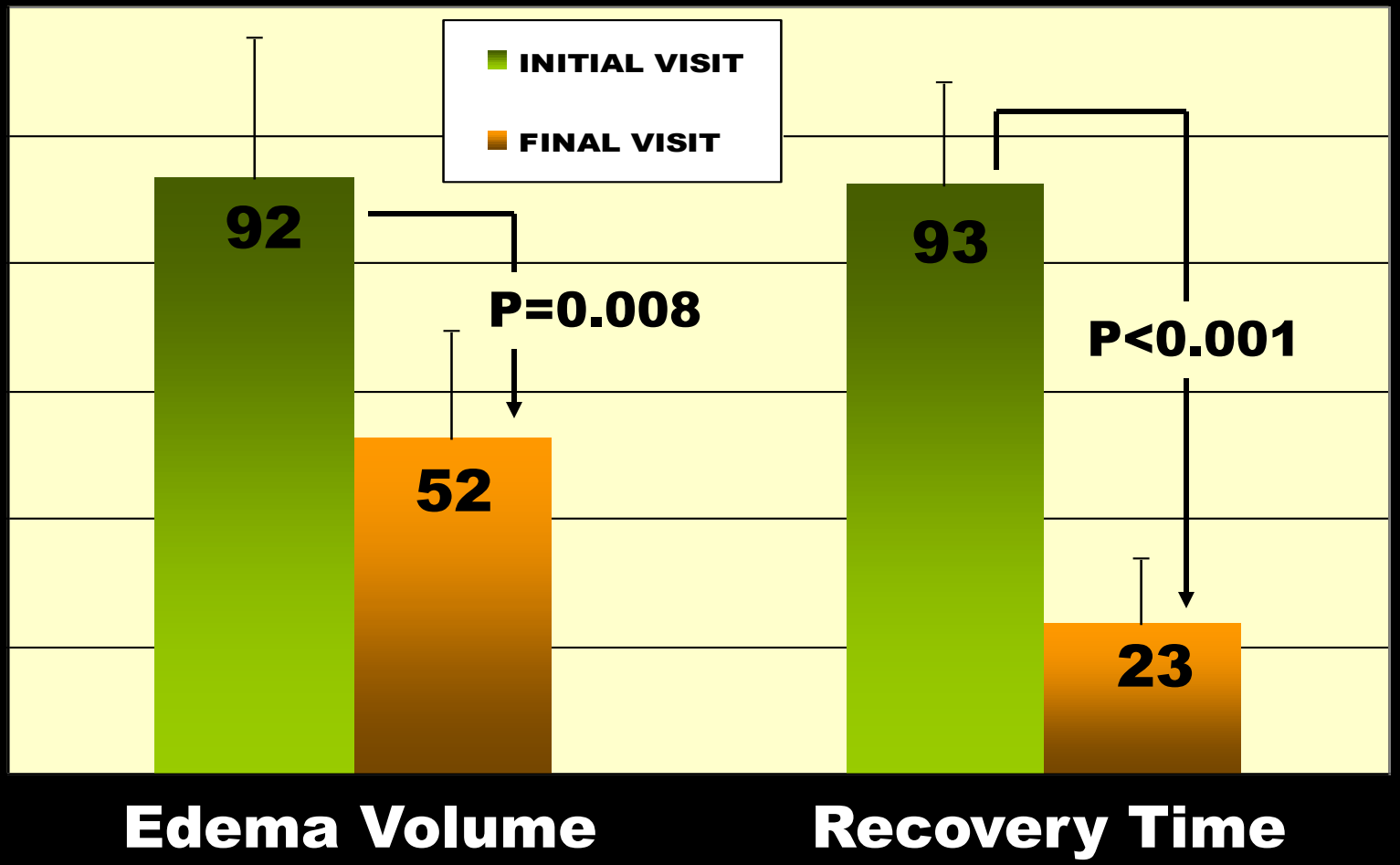
Fibrosis Segment Features Reduced Recovery Time!



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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.

The Team

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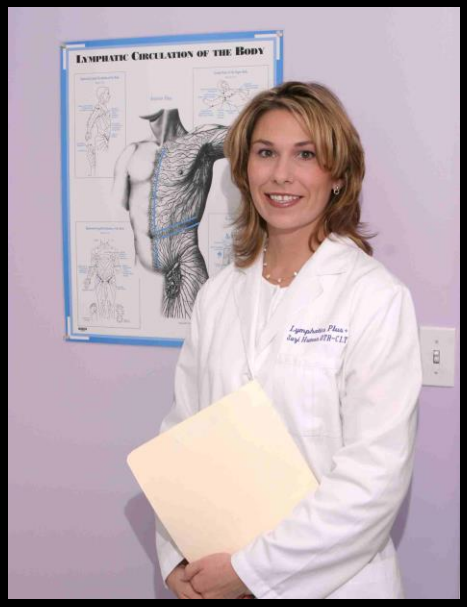

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