



# HYPERBARIC OXYGEN FOR TREATMENT OF STROKE AND TRAUMATIC BRAIN INJURIES

This study was presented as a Poster Session: Improved therapy for Rehabilitation of Stroke. National Stroke Association Ninth Annual Stroke Rehabilitation Conference. Boston, Mass.  
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## ABSTRACT

**TITLE:**  
**HYPERBARIC OXYGEN FOR TREATING STROKE AND TRAUMATIC BRAIN INJURY**

**BACKGROUND:** Hyperbaric oxygen works to improve chronic stroke and TBI patients by regenerating, repairing and generating new blood vessels to the injured parts of the brain. Physical therapy and biofeedback training helps patients maximize use of their existing faculties, as well as stimulates and reinforces gains in functioning.

**OBJECTIVE:** To gauge the clinical impact of HBO, physical therapy and EEG biofeedback benefit patients suffering from the effects of a chronic stroke

**PATIENT POPULATION, TREATMENT METHODS:** 50 patients ( male 21 and female 29) voluntarily enrolled in this study. Patient's ages ranged from 31-89 years with a mean age of 61.8 years. The duration from onset of stroke to entry into our rehabilitation program varied from 1 month to 10 years. The average duration since stroke onset was 28 months. 3 of the patients suffered chronic stroke more than 8 years. Systematic treatments were made using hyperbaric oxygen therapy (HBOT), physical therapy (PT) and Bio-Feedback.

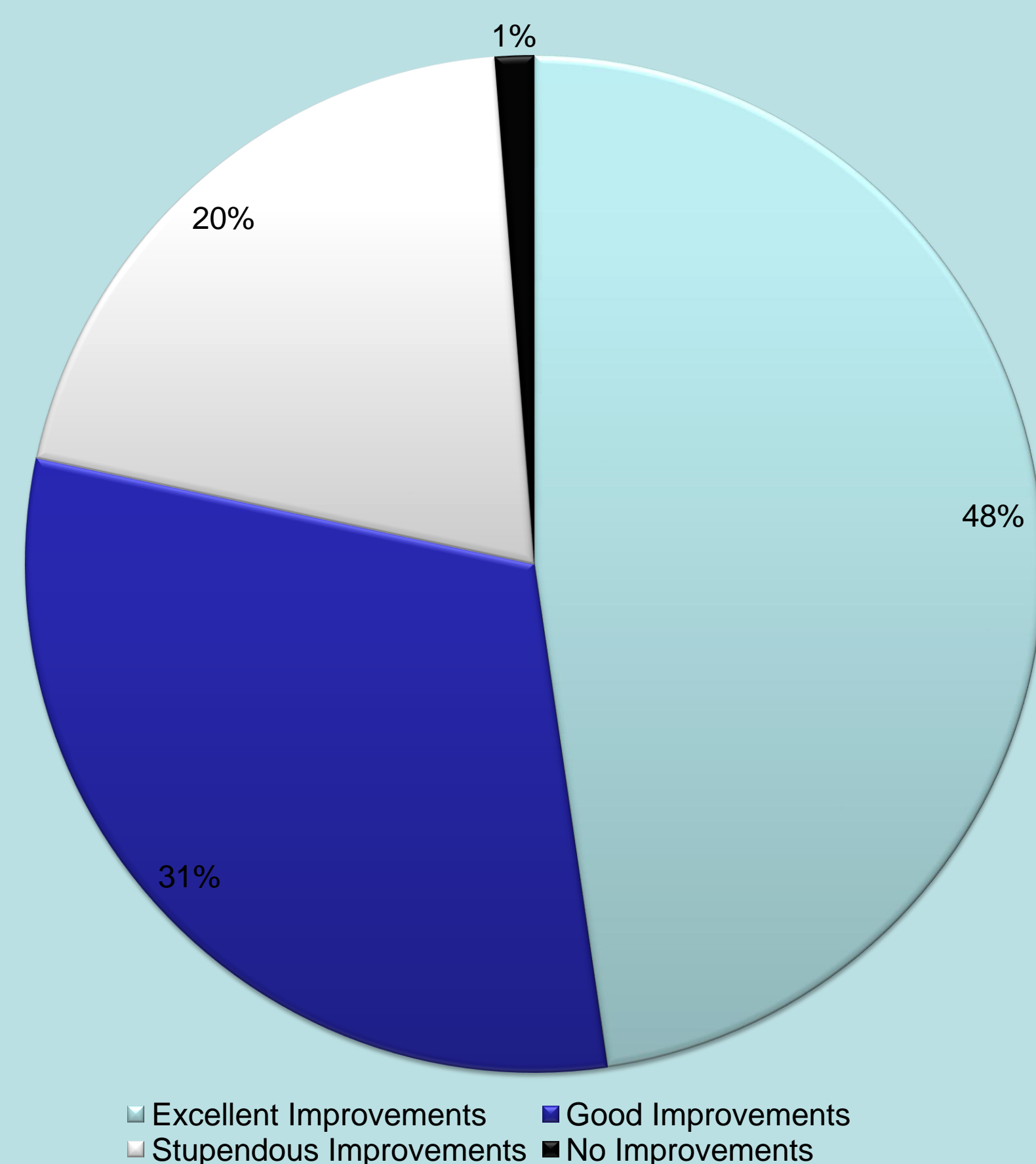
**RESULTS:** 97% of patients and caregivers reported good to "stupendous" results on the combined HBOT-PT-BF. Both patients, caregivers and physical therapists reported clinically significant gains in multiple areas of functions including memory, ability to sit down, motor ability (arm), mental understanding, and much more.

**CONCLUSIONS:** The results from this study demonstrated that combined of HBO, physical therapy and EEG biofeedback confers clinically significant benefits in a broad number of mental & physical functions in patients suffering from the effects of a chronic stroke.

## SUMMARY

Fifty stable, chronic stroke and traumatic brain injury (TBI) patients (mean age 62, mean duration post stroke 29 months) were treated with a combination of hyperbaric oxygen, physical therapy and EEG biofeedback for two months. Surveys given to patients or their family members showed that 96.7% of the patients improved one or more of their lost or diminished functions. Pre- and post-treatment, physical therapy evaluations indicated that 100% of the patients experienced improvements in one or more functions. These results suggest hyperbaric oxygen therapy along with other modalities provide safe and efficient treatment of stroke or TBI related disabilities.

50 PATIENT HBOT STUDY



## OBJECTIVE

To gauge the clinical impact of HBO, physical therapy and EEG biofeedback benefit patients suffering from the effects of a chronic stroke

## PATIENT POPULATION, TREATMENT METHODS

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**Diagnosis:** 9 brain hemorrhage, 4 embolic infarction, 3 stroke after brain surgery, 1 a car accident, 33 ischemic infarction (thrombosis)

**HBO Treatment:** Patients received hyperbaric oxygen therapy (HBO) at a pressure of 1.5 to 2.0 atmospheres absolute (ATA) in a sealed single person chamber. Oxygen (100% medical grade) was inhaled through a plastic face mask. The therapy was carried out for 90 minutes per day and 6 times per week in most patients. A few patients received HBO treatment twice a day. The average number of HBO treatments completed was 55.

**Physical Therapy Treatment:** Physical therapy procedures included various physical activities and modalities as needed. The modalities used were electrical stimulation, hot or cold packs, ultrasound, short wave diathermy and paraffin bath therapy. Each patient's condition was evaluated to determine the appropriate modality, dosage, placement and methods of application.

**Bio-Feedback Treatment:** Patients came to biofeedback therapy 5 times per week and received a minimum of 21 (mean 35) one-half hour daily sessions of EEG biofeedback. Sessions consisted of inhibiting and rewarding various selected EEG frequencies through audio and visual displays to encourage flexibility in brain activity. Each session's threshold level was automatically calibrated by the instrument (American Biotech Capscan 80) and a frequency spectral display summarized EEG amplitudes over 0 to 32 Hertz.

## RESULTS

### Patient Questionnaires

Consider this program poor	0%
No improvement (received 22 HBO treatments only)	03.3%
Consider this program good	30.0%
Consider this program excellent	46.7%
Consider this program "stupendous"	20.0%

### Improvement level as evaluated by patients/caretakers

Function	% No	%Slight	%Mild	%Mod	%Significant	%Total Improvement
Arm's motor ability	34.29	0.00	34.29	14.29	17.14	65.72
Arm's Sensitivities	43.48	26.09	4.35	13.04	13.04	56.52
Finger's movement	32.26	32.26	0.00	16.13	19.35	67.74
Leg's motor ability	13.16	13.16	34.21	21.05	18.42	86.84
Walking manner	13.51	0.00	24.32	35.14	27.03	86.49
Sit down ability	30.00	0.00	13.33	33.33	23.33	70.00
Stand up	33.33	0.00	10.00	40.00	16.67	66.67
Foot	53.57	21.43	0.00	14.29	10.71	46.43
Speech	26.09	4.35	30.43	21.74	17.39	73.91
Memory	20.83	0.00	29.17	25.00	25.00	79.17
Thinking	16.67	0.00	20.83	37.50	25.00	83.33
Understanding	13.64	0.00	27.27	31.82	27.27	86.36
Urine control	31.35	0.00	21.05	21.05	26.32	68.42
Bowel Control	17.65	17.65	11.76	11.76	41.18	82.35
Vision	47.37	0.00	15.79	10.53	26.32	52.63
Hearing	46.67	0.00	13.33	6.67	33.33	53.33

Physical therapist's evaluations were performed prior to and at the end of the program. 33 different functions including the range of motion, strength and balance function were analyzed. From the paired evaluations, all the patients showed one or more improvements among the 33 functions. The general findings from the physical therapist's evaluations are this table:

Patient %	Functional Improvement Levels
10 %	Minimal Gains
08 %	Mild Gains
48 %	Moderate Gains
34 %	Excellent Gains
100%	Showed Improvement

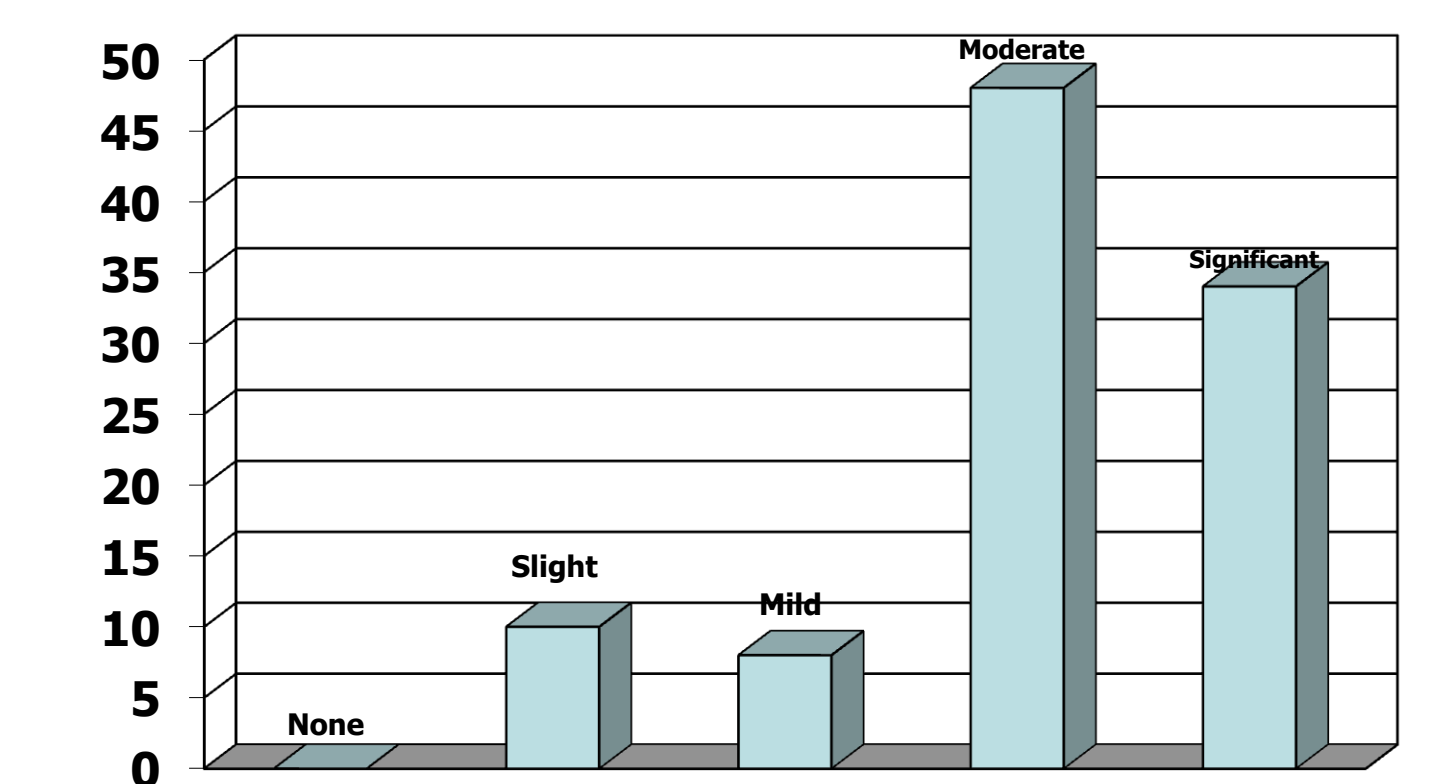
### Physical Therapist's Evaluation of Extremities

Muscle Group	Improvement in Range of Motion		Improvement in Strength	
	NO	YES	NO	YES
<b>Shoulder</b>				
Extension	00.00	100.00	34.48	65.52
Flexion	00.00	100.00	48.15	51.85
Abduction	18.75	81.25	48.15	51.85
Adduction	00.00	100.00	48.15	51.85
Intern.Rotat	50.00	50.00	50.00	50.00
Extern.Rotat	42.86	57.14	50.00	50.00
<b>Elbows</b>				
Flexion	0.00	100.00	50.00	50.00
Extension	50.00	50.00	29.63	70.37
<b>Forearm/Wrist</b>				
Supination	33.33	66.67	55.56	44.44
Pronation	N/A	N/A	51.85	48.15
Flexion	N/A	N/A	40.74	59.26
Extension	28.57	71.43	51.85	48.15
<b>Hip</b>				
Flexion	N/A	N/A	41.38	58.62
Extension	N/A	N/A	42.86	57.14
Abduction	N/A	N/A	46.63	53.57
Adduction	N/A	N/A	29.63	70.37
Internal Rot	N/A	N/A	50.00	50.00
External Rot	50.00	50.00	53.57	46.43
<b>Knee</b>				
Flexion	100.00	0.00	62.96	37.04
Extension	0.00	100.00	35.71	64.29
<b>Foot</b>				
Plantar Flexion	83.33	16.67	100.00	42.31
Dorsiflexion	100.00	0.00	55.56	44.44
Inversion	N/A	N/A	73.08	26.92
Eversion	N/A	N/A	68.00	32.00

### Physical Therapist's Evaluation

Activity	% No Improvement	% Improvement
<b>Bed Mobility</b>		
Rolling right	20.00	80.00
Rolling left	44.44	55.56
<b>Transfer</b>		
Supine to Sit	0.00	100.00
Sit to Stand	7.14	92.86
Bed to Chair	7.14	92.86
<b>Balance</b>		
Sitting	42.86	57.14
Standing	21.05	78.95
Ambulatory	30.43	69.57

### Physical Therapist's Evaluations



### HYPERBARIC CHAMBERS AT DR. STEENBLOCK'S CLINIC



## CONCLUSIONS

The results from this study on this new procedure demonstrated that combined of HBO, physical therapy and EEG biofeedback benefit patients suffering from the effects of a chronic stroke. The improvements were similar among patients suffering from cerebral hemorrhage, and cerebral ischemia/thrombosis / embolism. Improvement also occurred in the in the 3 patients who had suffered from a stroke more than 8 years before beginning our combined therapy program.

Other improvements were also reported by the patients. For example, patients reported that their affected arm and leg felt chronically cold but changed to warm at some point during the therapy. Fingernails, which had stopped growing for several years, began to grow normally again. The chronic fatigue experienced by the patients prior to their therapy was generally relieved by the program.

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