

Effect of Localized Heat Therapy on Blood Oxygenation and Perfusion

Case Study 81006

August 19, 2006

Introduction

Heat therapy is a common and clinically proven treatment for musculoskeletal pain relief.¹ The application of controlled low level heat to the skin is known to relax muscles, stimulate natural pain inhibitors, increase blood flow² and oxygen content. However, the actual increase of oxygen itself relative to temperature has not been clinically established. Therefore the purpose of this test is to determine if controlled localized heat therapy can measurably increase blood oxygenation.

Test Method

A HTP-1500 heat therapy pump with medium pad was preheated to 107°F. A reusable transreflectance sensor was taped to the volunteer's wrist. A skin temperature probe was also adhered to the wrist. Base line vital readings were recorded 5 minutes prior to the application of heat therapy. At 5 minutes the heat therapy pad was wrapped around the volunteer's right forearm and hand. Additionally, a probe was inserted in-between layers of the heat therapy pad to record its temperature. Blood oxygenation (SpO2) and perfusion (PI) data were captured by a Masimo RAD5 Pulse Oximeter unit and exported to a spreadsheet for analysis and presentation. Skin temperature, pad temperature and room temperature were recorded manually. Test duration was 35 minutes with 30 minutes of heat therapy. Infrared images of the volunteer's arm were taken.

Equipment

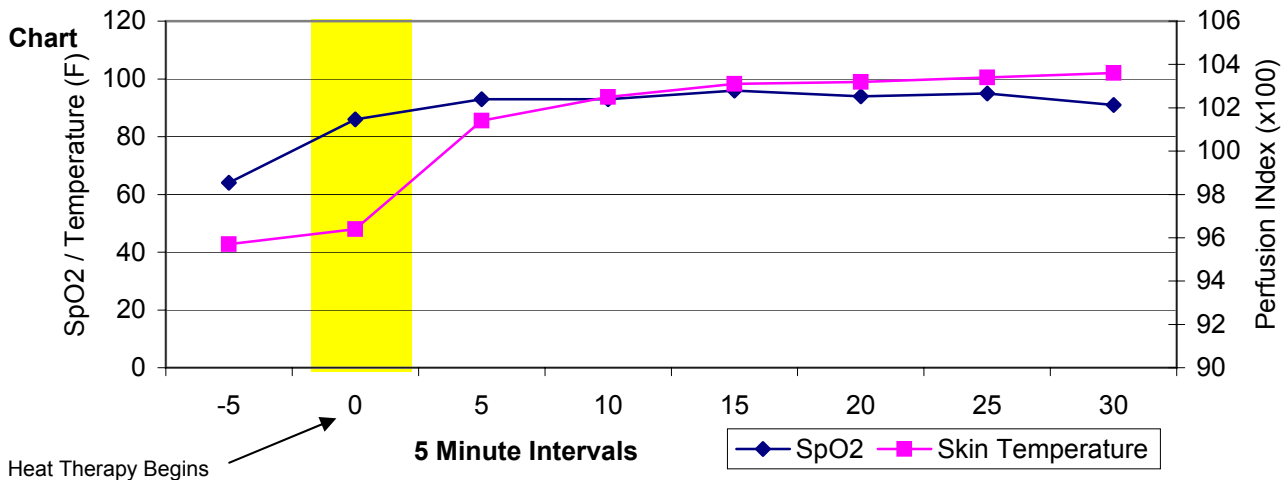
- | | |
|--|--|
| 1 Masimo RAD5 Pulse Oximeter, SN 523506 | 1 Thermistor Thermometer, Model 8402-20 |
| 1 Reusable Transreflectance Sensor, Model TF-I | 2 Disposable Skin Sensor Probes, Lot 6760334 |
| 1 HTP-1500 Heat Therapy Pump SN 1120406 | 1 Computer Laptop |
| 1 ST-020 Medium Heat Therapy Pad, Lot G1002603 | 1 Micron Infrared Camera |

Volunteer

Female, age 53. In good health, not known to be diabetic. Volunteer was tired and sleepy throughout test.

Data	Time	SpO2	Pulse Rate	Perfusion Index	Pad Temp. (F)	Skin Temp.	Room Temp.
	2:57:21	64	75	0.27	-	95.7	78
	3:01:05	86	75	0.44	-	96.4	79
	3:06:01	93	78	0.69	106.7	101.4	79
	3:11:01	93	78	0.45	106.3	102.5	79
	3:16:05	96	78	0.71	106.3	103.1	79
	3:21:01	94	79	1.12	106.5	103.2	79
	3:26:01	95	79	1.18	106.5	103.4	80
	3:31:01	91	80	1.28	106.7	103.6	80

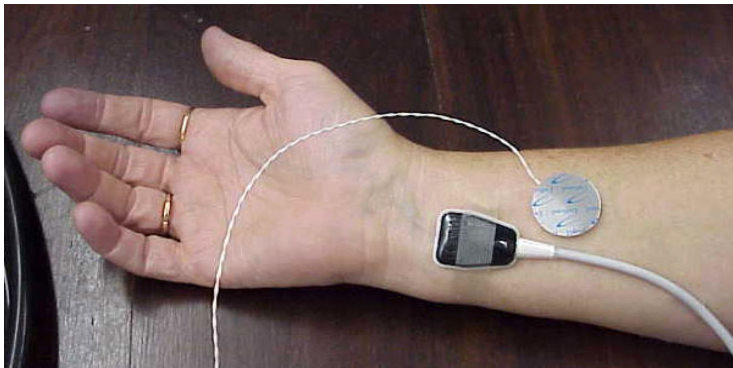
Heat Therapy Begins



Conclusion

The volunteer's oxygen saturation (SpO2) and perfusion index (PI) increased steadily and significantly after the initiation of localized heat therapy. The increase in SpO2 was an average of 8.2% with a peak of 10.5%. The perfusion index (a relative measurement of pulse strength) also increased an average of 205% with a peak increase of 290% at 30 minutes of heat therapy. This test indicates that there is a measurable correlation between controlled localized heat therapy and increased oxygen content. Further testing is needed to determine if the effects are linear and consistent with certain temperature values. Longer tests are needed to examine peak oxygen saturation and perfusion values and residual effects post heat therapy.

Test Photos



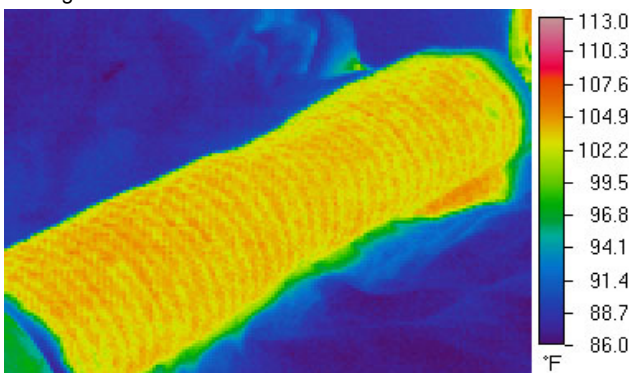
Before test



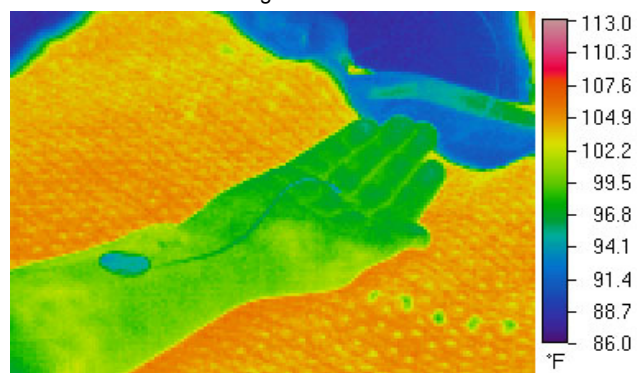
Masimo RAD5 during test



During Test



Infrared image of wrap during test



Infrared image of wrist and hand after test

1. A New Look at Heat Treatment for Pain Disorders, Part 1
Bill McCarberg, MD FABPM, and Annie O'Connor, PT OCS.
American Pain Society, November/December 2004, 14(6)
2. The effect of topical heat treatment on the trapezius muscle blood flow.
Erasala GR, et al. Physical Therapy 81(5) A5 2001.
3. Perfusion Index Whitepaper, Masimo Corp. www.masimo.com, Accessed Aug 2006

Test conducted and prepared by
 Scott Gammons & Jenny Hagler
 Adroit Medical Systems, Inc.
 1146 Carding Machine Road
 Loudon, TN 37774
 adroitmedical.com
 865-458-8600