The Effect of Oleoresin Capsicum on Respiratory Function in Human Subjects in the Sitting and Prone Maximal Restraint Positions

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Goals and Specific Aims

The goal of this study was to assess the safety of oleoresin capsicum (OC) pepper spray by itself and in combination with the prone maximal (hobble) restraint position.

We sought to determine if OC spray exposure has any detrimental effects on pulmonary function, oxygenation, and ventilation in either the sitting or prone maximal restraint position.

Collaborative Study

This study was a collaborative effort:

University of California at San Diego School of Medicine and Medical Center

- Department of Emergency Medicine,
- Division of Medical Toxicology,
- Division of Pulmonary Medicine

San Diego Regional Public Safety Training Institute
(operated by the San Diego City Police and County Sheriff's Departments)

This study was funded by a grant from the National Institute of Justice, US Department of Justice.

Background - OC Spray

- Tremendous success as a “less than lethal” means of subduing dangerous, violent subjects in the field
- However, there is growing controversy regarding its safety profile focusing on the potential respiratory effects

Background - OC Spray

Sprays consist of 1-10% capsaicin and other capsaicinoids

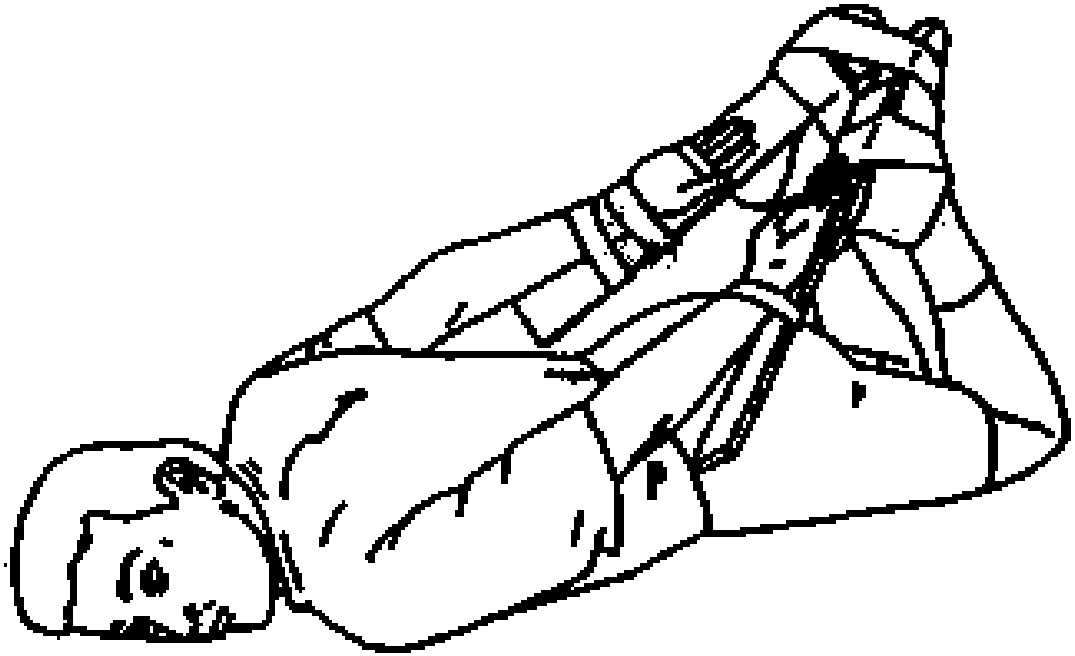
- Oily extract of capsicum pepper plant
- agents stimulate peripheral neuropeptide release, neurogenic inflammation, vasodilation, edema
- Inhalation can result in transient gagging, sob, cough, inability to vocalize

Few studies on OC spray exposure in humans and no studies on OC inhalation and physical restraint

- Capscaicin studied extensively for its ability to induce cough
- Animal and in-vitro tissue studies suggest significant increases in airway resistance, bronchoconstriction

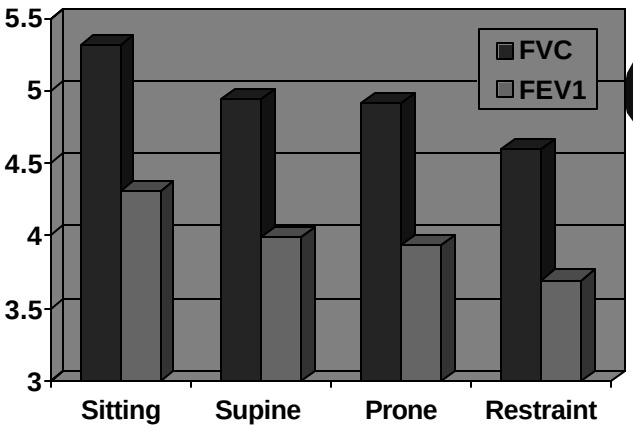
Background - Hobble Restraint

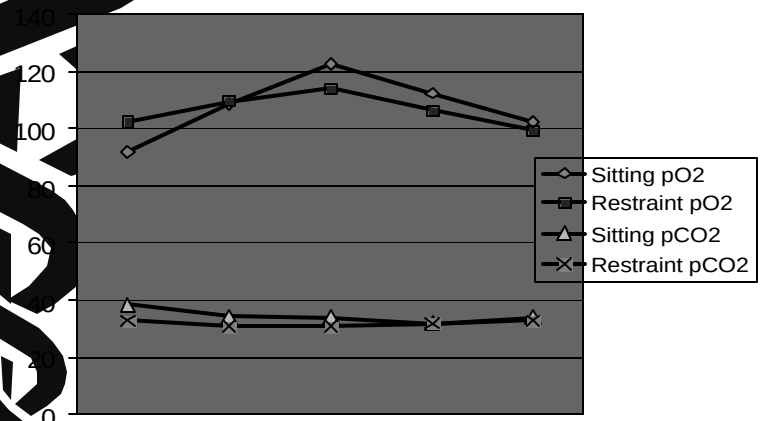
Hobble restraint position previously thought to result in adverse respiratory mechanics and potential for positional or restraint asphyxiation



Background - Hobble Restraint

Recent, more comprehensive work now has refuted the theory of positional asphyxia as it applies to the hobble restraint. Our study showed that there was a small restriction on pulmonary function, but no evidence of hypoxia or hypoventilation





Chan, Vilke, Neuman, Clausen - Restraint Position and Positional Asphyxia. Annals of Emergency Medicine, November 1997.

Background - Hobble Restraint

As a result of this study, a number of legal actions against law enforcement agencies throughout the country have been dismissed

There have been no studies on the respiratory effects of OC spray and physical restraint

Study Protocol

Study of the respiratory effects of OC spray by itself and in combination with hobble restraint position

Randomized, cross-over controlled trial

35 volunteer participants

4 trials conducted over 2 laboratory days

Study Protocol

Each subject underwent 4 trials

a. Placebo spray followed by sitting position

b. Placebo spray followed by restraint position

c. OC spray followed by sitting position

d. OC spray followed by restraint position

Study Protocol

1. Exposure to OC or placebo spray
   - 1” second spray inside isolation hood
   - breathing pattern monitored by impedance
   - 5” exposure, after which hood is removed
   - subjects must inhale at least one time during exposure (by impedance monitoring)
   - eyes are protected

Study Protocol

2. After exposure, subject placed in sitting or restraint position for 10 minutes
   - continuous pulse oximetry monitoring
   - continuous expired gas monitoring
   - pulmonary function testing at 1.5’ and 10’
   - arterial blood gas sampling at 8 minutes
   - continuous ECG monitoring
   - serial blood pressure monitoring

Pulmonary

Study Protocol

3. After 10’ period, subject rests 1 hour before next trial

- 2 trials each laboratory day
- only single OC spray exposure each day

Results

35 subjects completed the study to this date

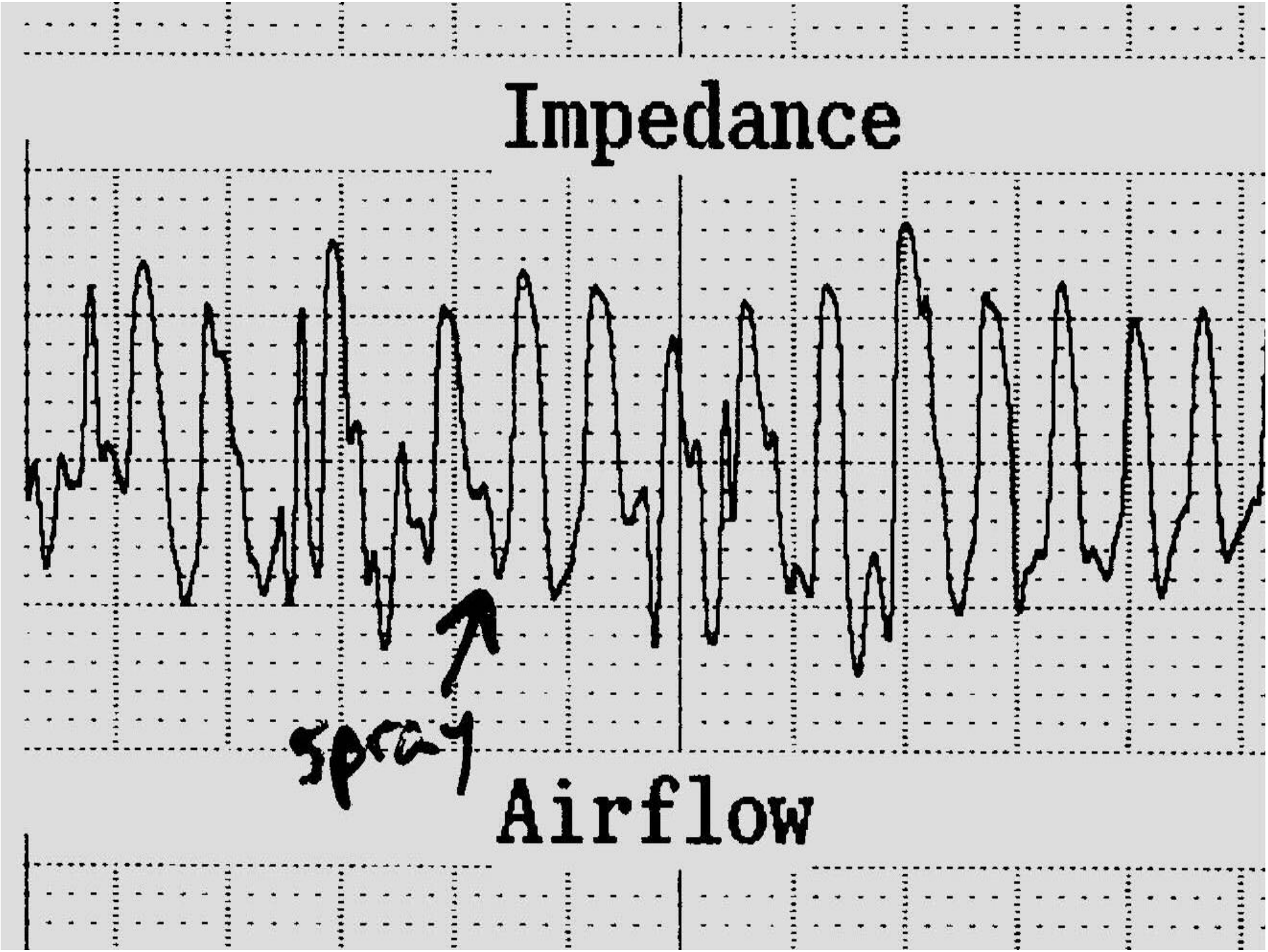
1 adverse reaction – vasovagal syncopal episode during blood draw (placebo/sitting trial); subject had not been exposed to OC or placed in the restraint position at any time

25 men, 10 women

BMI range 24 – 33 kg/m2

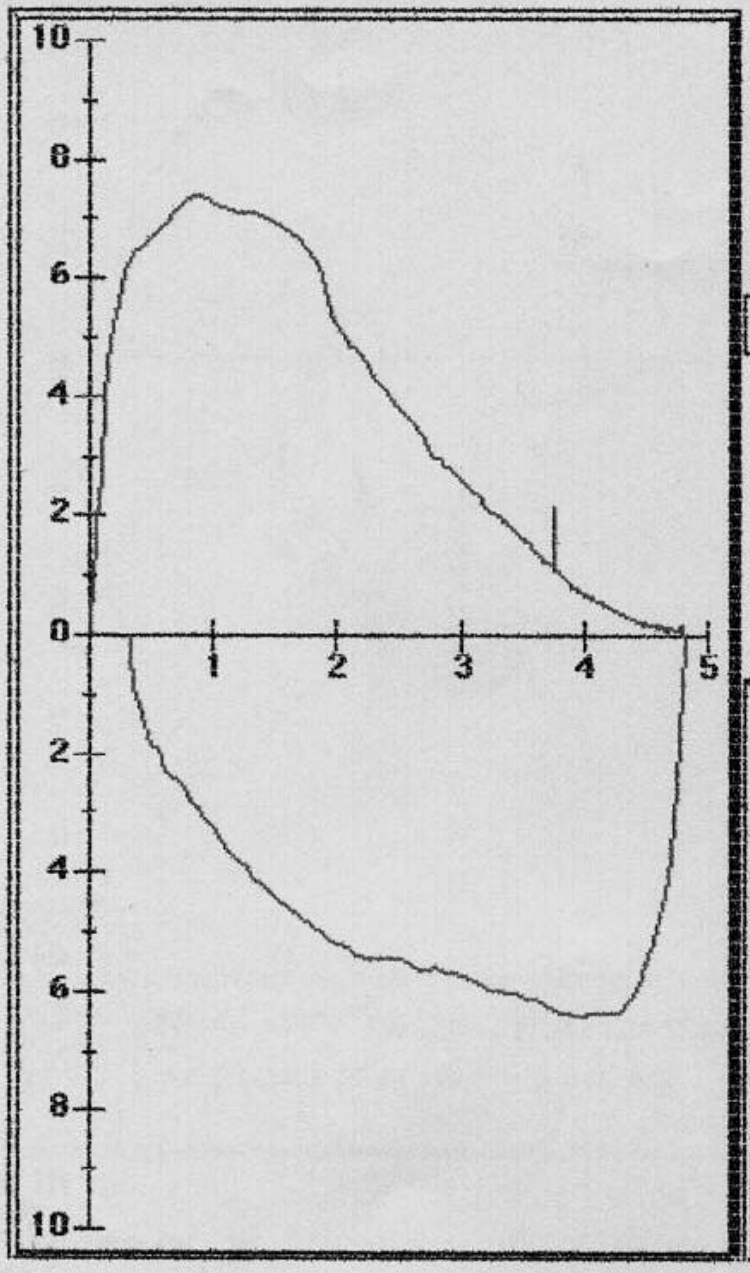
Age range 22 – 40 years

No exclusions based on baseline pulmonary function, pulmonary disease or obesity


Impedance
spray
Airflow

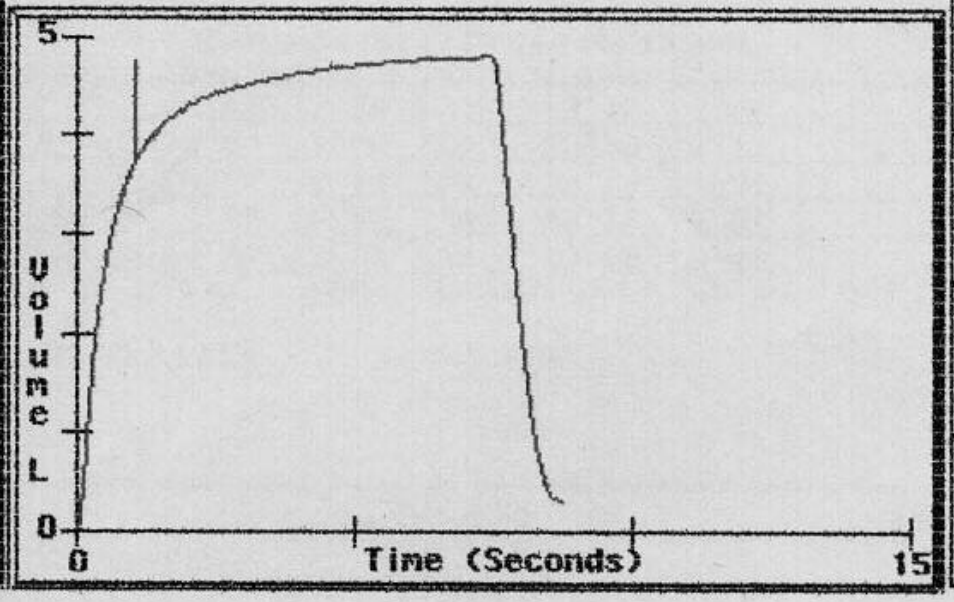
FVC Effort Selection -- Challenge

Name: VELA, MICHELLE M U1791243 ID: 38267522 Date: May 8, 1999

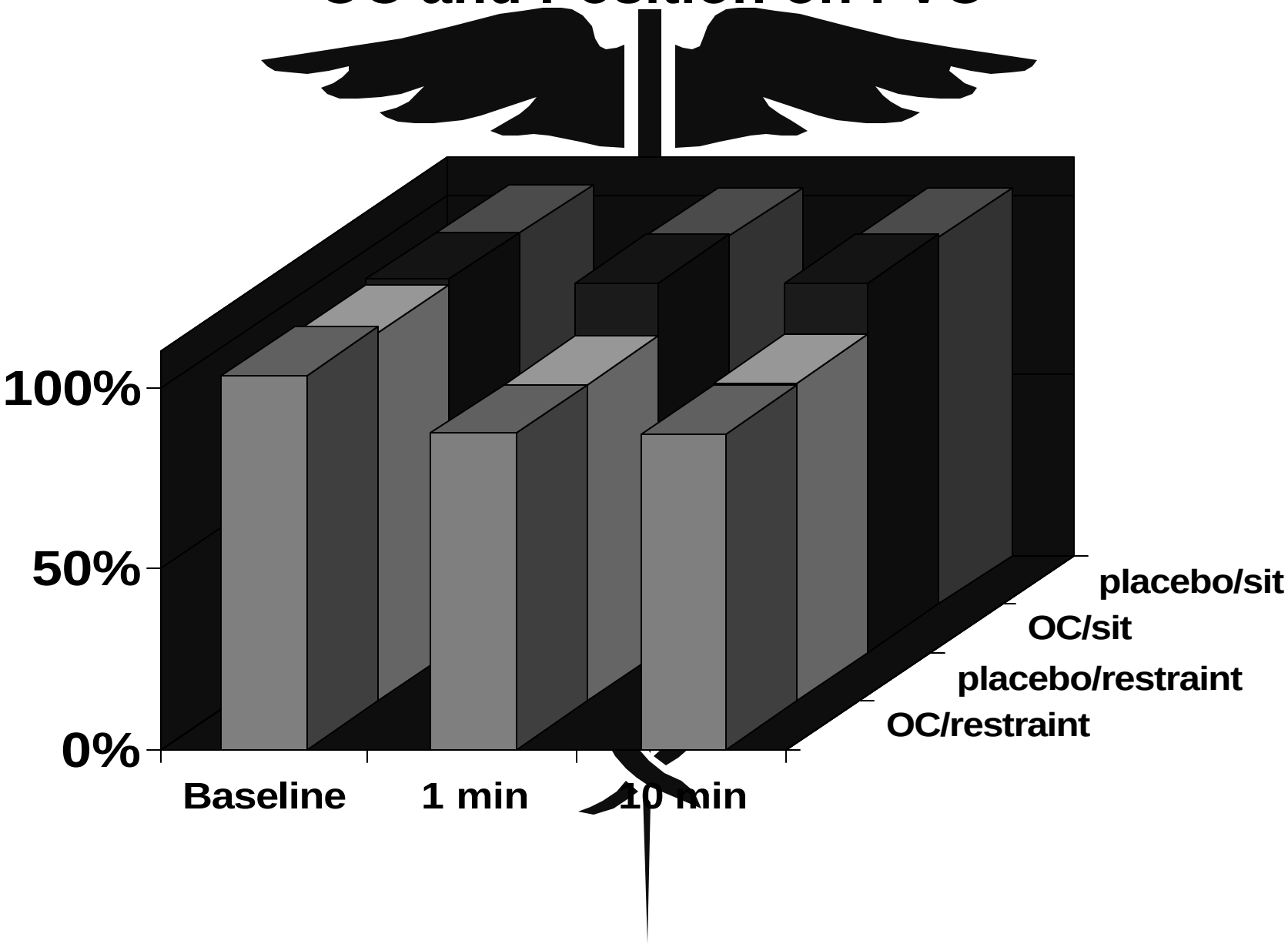


#	D	S	FVC	FEV1	FEV1%	25-75	PEFR	Code
Pre-BD			4.75	3.77	79	3.76	8.42	
HTS		●	4.81	3.75	78	3.32	8.04	
2	✓	○	4.81	3.75	78	3.32	7.36	
3	✓	○	4.68	3.65	78	3.15	8.04	
4	✓	○	4.61	3.57	77	3.11	7.79	
1		○	4.75	3.34	70	2.59	5.27	B

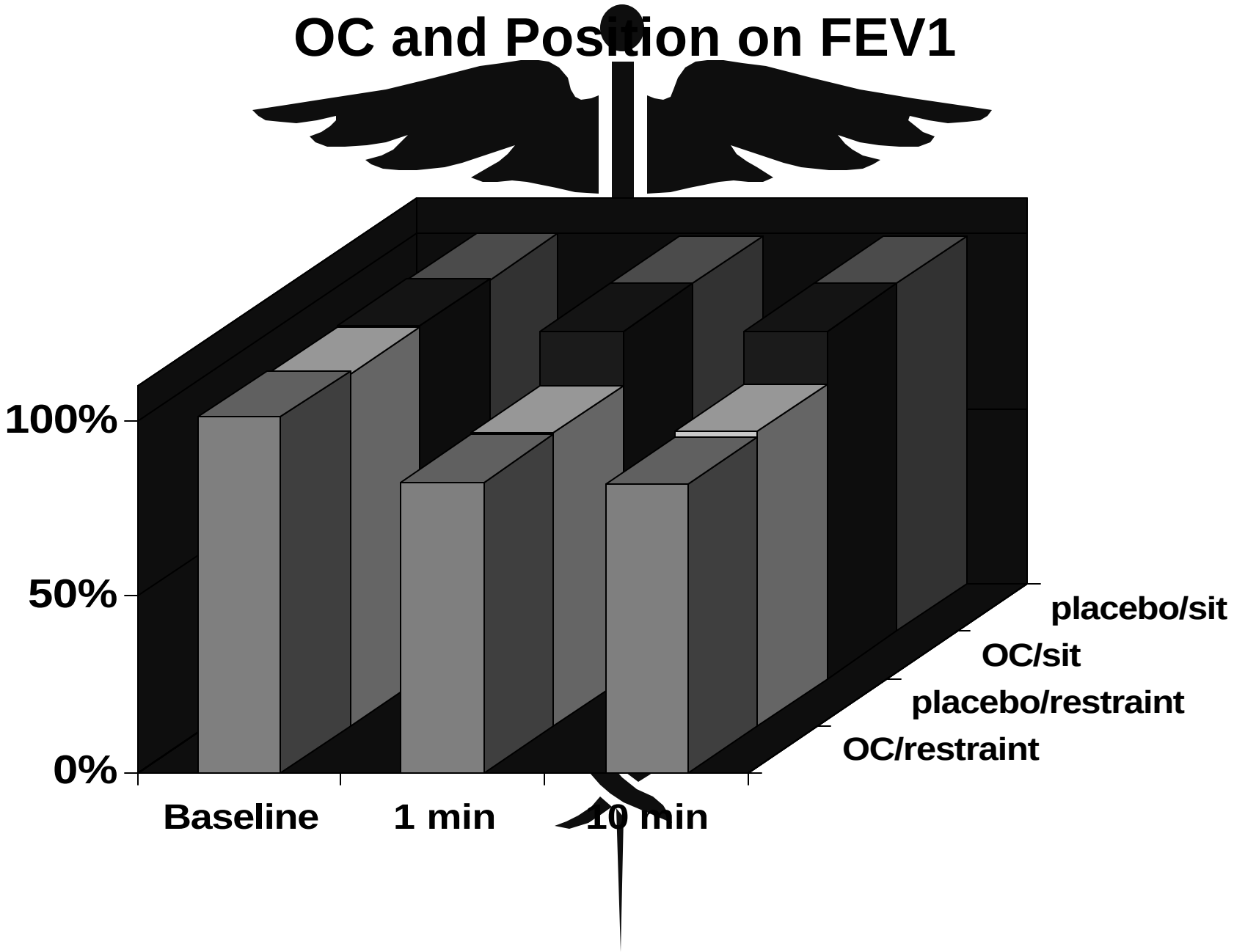
Reproducibility Criteria Met



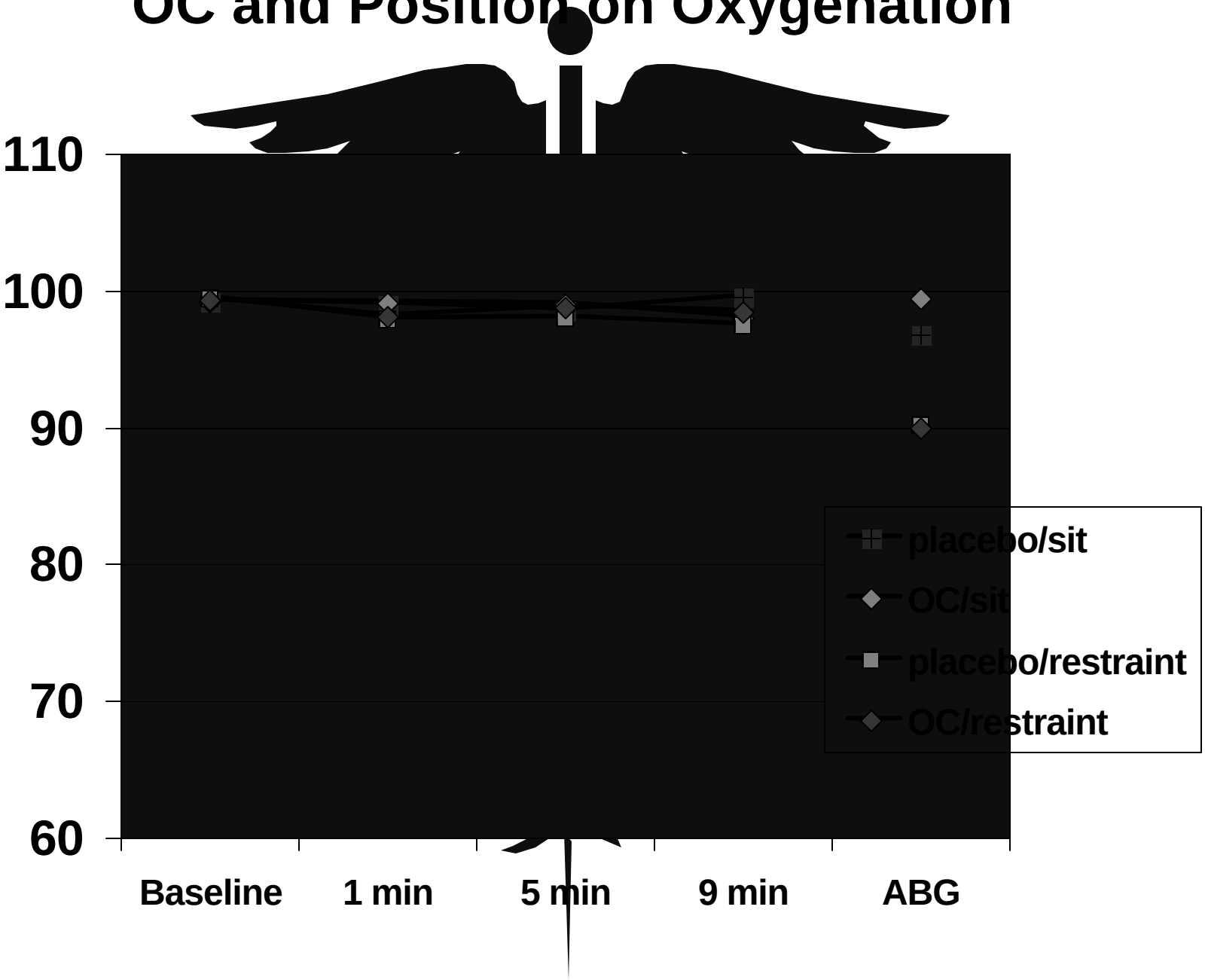
OC and Position on FVC



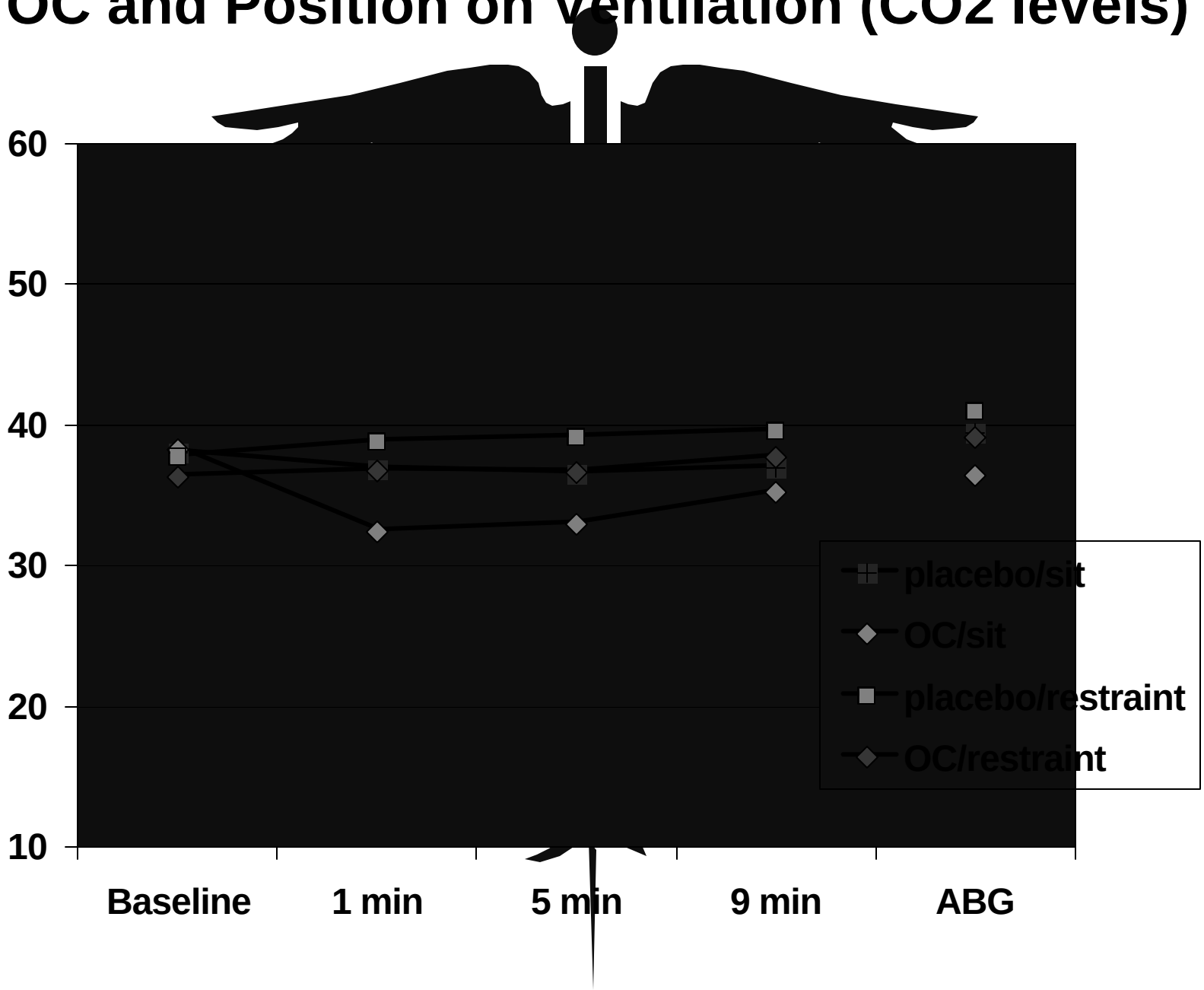
OC and Position on FEV1



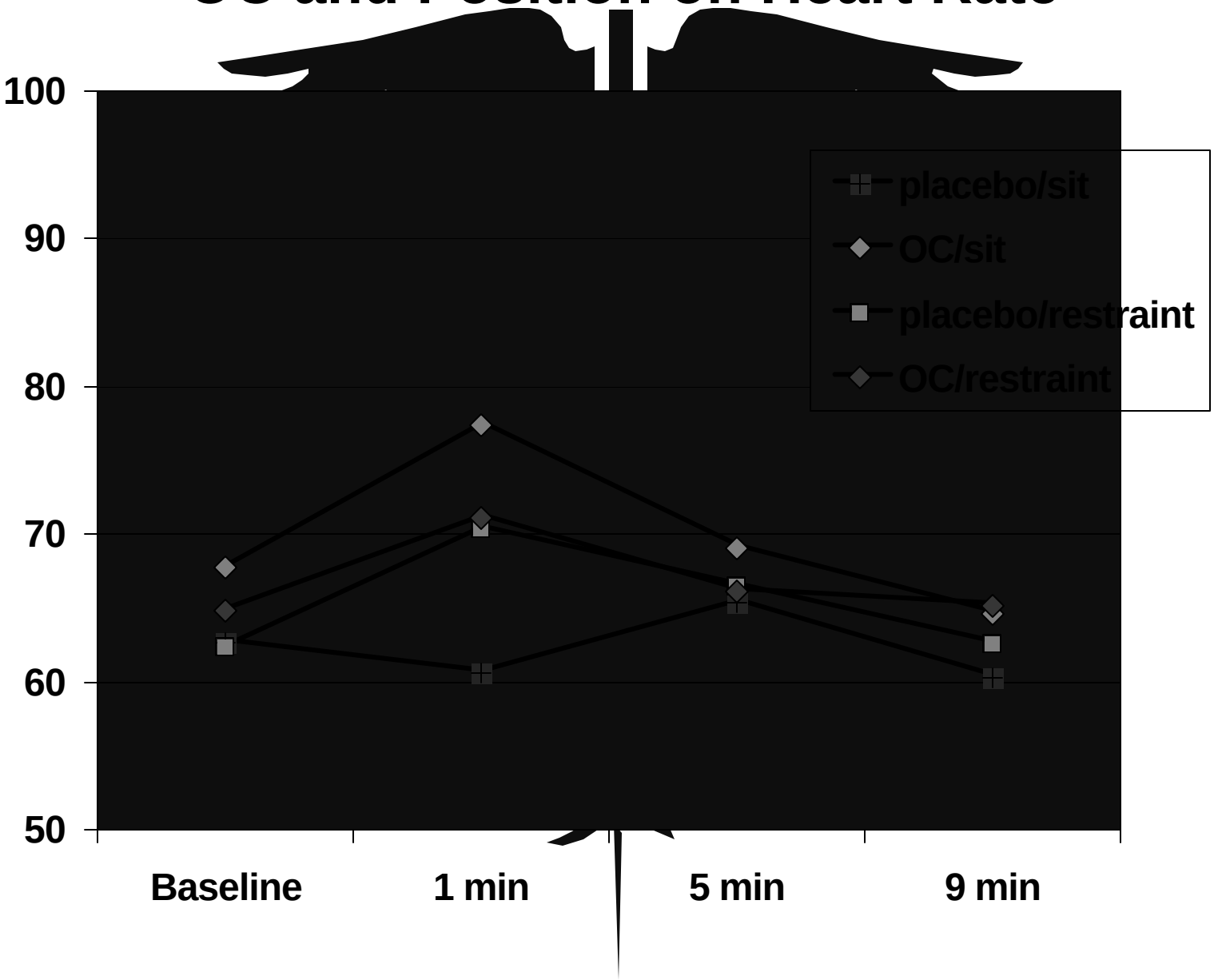
OC and Position on Oxygenation



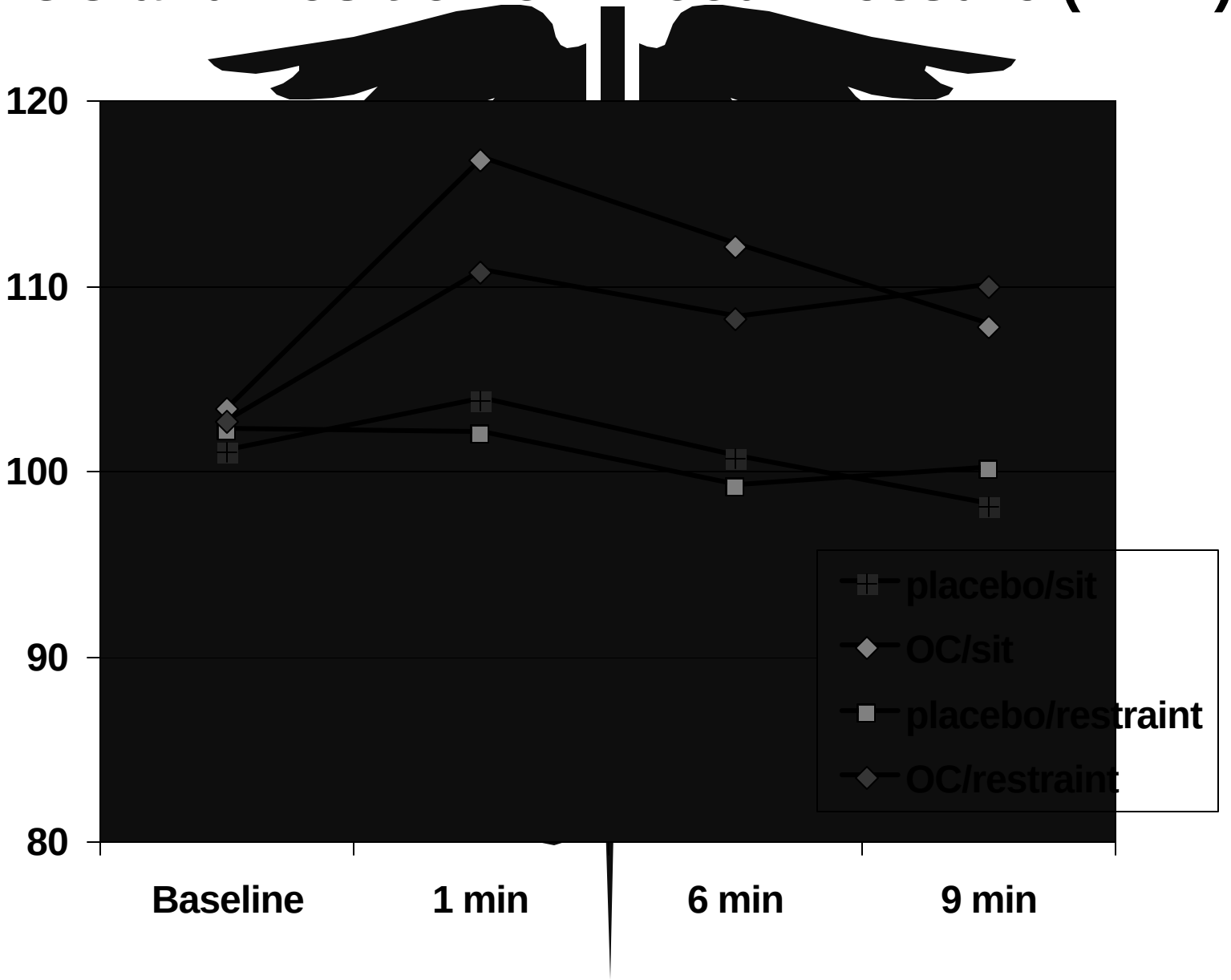
OC and Position on Ventilation (CO2 levels)



OC and Position on Heart Rate



OC and Position on Blood Pressure (MAP)



Conclusions

- OC did not result in any further change in pulmonary function (FVC, FEV1) in either sitting or restraint positions as seen in the original UCSD restraint study
- OC exposure did not result in any evidence of hypoxia, hypoventilation, or respiratory compromise
- OC did exposure did result in an elevation of blood pressure in both the sitting and restraint positions