Background
N2O is a commonly used anesthetic agent that has significant amnestic and analgesic properties. Studies in volunteers breathing up to 70% N2O have shown no change in Bispectral Index™ (BIS™) from normal awake values (95-100), despite loss of responsiveness to commands and apparent sedation. Furthermore, in a previous study we have shown that addition of N2O to a stable sevoflurane anesthetic did not change BIS™ despite near doubling of MAC. Patient State Index (PSI) is a new index of unconsciousness using a different EEG derived algorithm than BIS™. The purpose of this study was to compare the BIS™ and PSI responses to N2O during a sevoflurane anesthetic.

Methods
General anesthesia was induced and titrated to maintain normal blood pressure and pulse during laparoscopic surgical procedures. Laparoscopic operations were selected due to a relatively stable level of surgical stimulation. After 10 min with no change of more than ±10% in heart rate, mean blood pressure, end-tidal anesthetic concentration, and BIS™ or PSI, baseline data were recorded. N2O was then added to the inspired gas mixture to achieve an end tidal concentration of >65%. When end-tidal N2O was >65% and after 10 min of blood pressure and pulse stability, data were again collected. N2O was discontinued, and after end-tidal N2O was <5% and following 10 min of physiologic stability, data were re-collected. Sample size (n=20) was designed to detect a 10 unit change in BIS™ or PSI with alpha = .05 and statistical power = .80. Data are summarized as mean ± SD and were compared with an analysis of variance for repeated measures.

Results
There were no differences in variables reflecting cardiovascular function throughout the study in either the PSI or BIS™ groups. Supplementing sevoflurane with >65% N2O increased MAC from 1.3±0.05 to 2.2±0.10, but did not alter BIS™ or PSI (p-value for differential MAC is <0.001). (Figure 1)

Conclusion
Supplementing sevoflurane with >65% N2O affected neither BIS™ nor PSI despite nearly doubling MAC. Since N2O often is used in combination with volatile anesthetics to increase depth of anesthesia, it is important to know that N2O has variable effects on these derived measures of “unconsciousness” while deepening the patients’ level of hypnosis. This evidence suggests that neither BIS™ nor PSI are useful measures of depth of anesthesia when using N2O in addition to sevoflurane anesthesia.
Figure 1

Differential Measures of Unconsciousness

Level of Unconsciousness

Awake, Sevoflurane, Sevoflurane & N2O, Sevoflurane