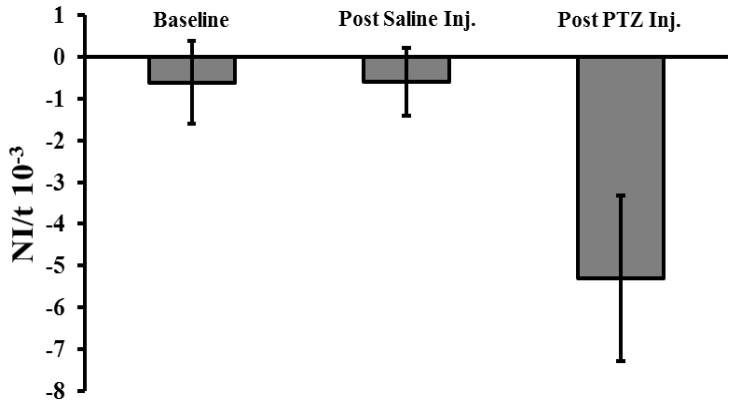

Fig. 4. Plot of the three average slopes: Baseline, Post saline injection, and Post PTZ injection. The average slopes were calculated from four seizure experimental data sets. The interval bars were calculated with a 90% confidence interval using the t-distribution. NI: Normalized Intensity, t: time (min), Inj.: Injection.

Table 1. ANOVA for the average slopes of the three experimental steps

	df	Sum of Square	Mean of Square	F-value	*P*-value
Treatment	2	5.98×10^{-5}	2.99×10^{-5}	22.34	1×10^{-4}
Error	9	$1.2. \times 10^{-5}$	1.34×10^{-5}		

df: degrees of freedom

To explore the differences found with the ANOVA F-test, we performed a Tukey multiple comparisons test to compare the baseline, post saline, and post PTZ slopes. As mentioned previously in Section 3.2, the baseline and post saline slopes were not significantly different. This procedure also compared the post PTZ injection slopes to the baseline and post saline injection slopes. The resulting *P*-values were $P < 0.001$ for both comparisons: post PTZ injection slope to the baseline slope and post PTZ injection slope to the post saline injection slope. This demonstrates that the change in backscattered intensity as a seizure progresses can be quantified and when compared with pre-seizure states, signifies that there is a significant decrease in intensity, detectable with OCT.

4. Conclusion

In conclusion, we conducted seizure experiments *in vivo* to establish, as a proof of principle, that a decrease in intensity during seizure progression can be detected through OCT imaging. We created a threshold interval model for the temporal identification of changes in the backscattered intensity. Our results indicated that crossing below the definable optical detection threshold occurred prior to either FMJs or generalized (tonic-clonic) manifestations of seizure activity. In the future, we plan on further developing this into an optical trigger to help identify the occurrence of seizures prospectively even before physical manifestations are present. These results could lead not only to optical seizure detection but also prediction with appropriate algorithmic real-time analysis of the OCT signal. Furthermore, previous research has used OCT to spatially resolve changes in cortical tissue during electrical stimulation [14,15] and by utilizing the high spatial and temporal resolution of OCT, it will be possible to map changes in intensity during seizure progression and propagation through the intact brain.

Acknowledgments

The authors acknowledge financial support from the following US National Institutes of Health grants: R00EB007241, and K08NS059674.