

## **Photodynamic Therapy as an Alternative to Tonsillectomy Procedures**

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A tonsillectomy is one of the most common surgical procedures in the United States, with more than 530,000 performed annually as of 2011. In this procedure tonsils are removed due to recurrent inflammation, sleep disorders, or complications from being enlarged. The procedure can be performed by different modes of excision such as cold knife surgery and electrocautery; however, complications of all tonsillectomies include primary and secondary hemorrhages, infections, and a long recovery. The goal of this project was to validate an alternative procedure for tonsil removal using photodynamic therapy (PDT). The envisioned procedure involves topical application of a photosensitizing drug (PS) to the tonsil followed by a wait interval allowing the drug to localize. After this, the tonsil is to be irradiated with a low-powered diode laser causing the excitation of the PS, generation of cytotoxic species, and cell death. If the PS can localize in and destroy germinal centers of the tonsil, the tonsils should postoperatively shrink away after several weeks without cutting and the associated bleeding of standard excision.

The specific aims of the work conducted for this project were to 1) characterize the penetration of liposomal benzoporphyrin derivative (L-BPD), an FDA approved PS, into excised tonsil tissue after topical application in solution, and 2) characterize the ability of irradiation following L-BPD application to cause cell death in excised tonsil tissue. To this end, both penetration and cell death studies were performed. For the drug penetration studies, fluorescence microscopy was used to measure penetration after application of L-BPD in varying concentrations and with varying wait intervals. The greatest penetration was observed with 70  $\mu\text{M}$  L-BPD and a 30-minute incubation. For cell death studies, tonsil portions were treated with L-BPD, irradiation, both, or neither. While evidence of necrosis was visible in all groups, it was qualitatively most pronounced in the groups that had both the drug and laser applied. These results suggest that L-BPD is capable of penetrating excised tonsil tissue and, in combination with irradiation, induces cell death. This project is a promising preliminary step toward validating PDT for tonsil removal; however, further work needs to be done to validate the procedure.