Investigating the Efficacy of Combined Photodynamic Inactivation and Antimicrobial Therapy against *Streptococcus pneumoniae*

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Streptococcus pneumoniae is a major etiological agent of pneumonia and is implicated in numerous global fatalities annually. The difficulty in treating this respiratory condition, exacerbated by increasing antimicrobial resistance, necessitates the exploration of novel and supplementary therapeutic strategies. This study investigates the efficacy of integrating photodynamic inactivation (PDI) with traditional antimicrobial therapy against *S. pneumoniae*. The goal is to develop an enhanced therapeutic protocol that effectively combines these treatments. A series of experiments were conducted where the microrganism was exposed to the antimicrobials amoxicillin (AMO), erythromycin (ERI), and ceftriaxone (CEF). Bacterial survival was monitored over time at three-hour intervals. Following antimicrobial exposure, the bacteria were treated with PDI, using curcumin as the photosensitizing agent in two different concentrations. The results demonstrated that antimicrobial treatment alone achieved a consistent reduction of approximately 1.5 log units every three hours, with the potential for complete bacterial eradication within nine hours when using CEF. The combination of antimicrobials with PDI led to a significantly greater reduction in bacterial counts, highlighting the potential for enhanced therapeutic efficacy. The integration of PDI with antimicrobial therapy shows promise in significantly reducing *S. pneumoniae* populations. This study provides a foundation for further evaluation of the optimal combinations of PDI and antimicrobials, considering different time frames to maximize the reduction of bacterial load and improve the efficacy of combined treatment strategies. The results pave the way for the development of an optimized protocol for treating pneumonia caused by *S. pneumoniae*.