Preparation and Characterization of RH-PAMAM G2 Nanocomplex-Embedded Temperature-Responsive Hydrogel Platform for Enhanced Inner Ear Gene Therapy

Thi Phuc Le

PhD Candidate, Department of Polymer Science and Engineering, Chungnam National University, Daejeon, South Korea

Abstract:

Gene delivery to the inner ear offers a promising therapeutic strategy for addressing inner ear disorders. However, the intricate anatomy and limited accessibility of the inner ear pose significant challenges to effective gene delivery. This study presents a novel injectable formulation comprised of RH-PAMAM G2/pDNA nanocomplexes embedded in a thermogel based on hexanoyl glycol chitosan (HGC). The RH-PAMAM G2 dendrimer was specifically engineered to enhance transfection efficiency, achieving high transfection rates with minimal toxicity in HEI-OC1 auditory cells. Simultaneously, the HGC thermogel is an injectable carrier to prolong retention time, facilitating sustained absorption of the gene nanocomplex into the inner ear. In vivo results demonstrated that RH-PAMAM G2 complex/HGC thermogel system significantly improved transfection efficiency and gene expression in cochlear tissue, leading to a broader distribution of anti-GFP within the cochlea. Moreover, no significant changes were observed in the middle ear mucosa during the treatment period, indicating the safety of this formulation. Consequently, the RH-PAMAM G2/HGC thermogel system is a promising injectable platform for safe and effective gene delivery to the inner ear, paving the way for enhanced treatment options for inner ear disorders.