VAMPIRE: Vital Anti-Aging MiRNAs To Promote Induced Regeneration

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Cardiovascular diseases (CVDs) are the leading cause of death worldwide, killing about 17.9 million people annually. Most CVDs are age-related, driven by gradual damage to blood vessels, also known as endothelial cell senescence. Current treatments like antiplatelets and anticoagulants simply manage the symptoms, and no existing products target the root cause - endothelial cell senescence. VAMPIRE (Vital Anti-aging MiRNAs to Promote Induced REgeneration) introduces the delivery of therapeutic miRNAs to reduce endothelial cell senescence and ultimately treat CVDs, employing microneedle patches as a minimally invasive method. The goal was to evaluate the differentiation of the expression of a specific miRNA, miR26a-5p, between young exosomes (Y-XO) and old exosomes (O-XO) and its therapeutic effect. The results showed that Y-XOs carry more miRNAs than O-XOs, including miR-26a-5p, which is upregulated in Y-XOs and decreases with age. Doxorubicin was used to induce senescence in human coronary artery endothelial cells and Y-XO-treated cells had a reduced expression of 53BP1 (DNA damage marker) and SA-ß-Gal (senescence marker). Y-XOs had a lower expression of NF?B (inflammation indicator) due to containing inhibitory miRNAs like miR26a-5p, reducing apoptosis and senescence. Lastly, Agomir26 (stable miR-26a-5p mimic) was loaded into the microneedles to test its therapeutic effect, revealing an increase in Ki67 (cell proliferation indicator) expression, thus promoting vascular repair. A release profile test verified the sustained release of Agomir26 delivered by microneedle patches that demonstrated structural integrity through a rheometer test. Overall, VAMPIRE demonstrates promise in treating and preventing the progression of CVDs, potentially benefiting millions of people.

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