BioZap: Iontophoresis-Assisted Transdermal Delivery of Epigallocatechin-Gallate Within a Skin-Simulating Membrane Towards Adjunctive Breast Cancer Treatment

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Breast cancer, the most common cancer in women, is treated with chemotherapy drugs, a systemic treatment prone to multidrug and chemoresistance. An improved adjunctive treatment that increases the efficacy of chemotherapy would be extremely beneficial within breast cancer oncology-related healthcare. Epigallocatechin-Gallate (EGCG), a bioactive compound derived from green tea, has been previously studied as a chemotherapy sensitizer, but has extremely poor bioavailability, needing to be delivered through optimal methods. Through a transdermal drug delivery system, EGCG can be locally delivered to regional cancerous cells, improving delivery through increased concentration and penetration depth. Incorporating iontophoresis enhances delivery of EGCG by improving concentrations and penetration of tissue. Penetration depth and concentration trends were assessed through ImageJ analysis using the measure feature and an RGB color intensity calibration system. The agar gel samples received their treatments, an EGCG hydrogel with or without electrical enhancement. The electrically-enhanced diffusion device was prototyped through iterative phases, mainly focused on the development of electrode geometry and improvement of the relationship between voltage, current, and resistance. The device contains a conductive dough layer through which the current is delivered, stimulating an EGCG-soaked hydrogel. Previous tests were performed on a small sample size of an agar gel membrane and delivery of EGCG was discovered to have improved with electrical assistance in both penetration depth and concentration. The next experimental phase increased the sample size of agar gel and introduced mathematical modeling as a way to validate the diffusion study.

Awards Won:

Zydus Pharmaceuticals USA Inc.: Third Place Translational Medical Science