Soft Bioresorbable Electronic Device for Brain Tumour Therapy

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Abstract

Treatment of the brain tumour, particularly that of its diffused form such as glioblastoma, is extremely challenging because the efficacy of conventional chemotherapy to tumour cells through intravenous delivery is quite limited by the blood-brain barrier (BBB). Implantation of biodegradable polymeric wafers containing anti-cancer drugs on the cavity made by the brain surgery was proposed as an alternative chemotherapy route, since it bypasses the BBB. However, much more dramatic improvement of the therapeutic efficacy is still needed. Therefore we propose a mild-thermic intracranial drug delivery device using the biodegradable wireless electronics integrated with a flexible bioresorbable polymeric drug reservoir. The oxidized-starch-based patch-type bioresorbable electronic implant is used in association with the wireless mild-thermic actuation for extended drug delivery up to tumour cells deeply located in the brain. It significantly enhances the drug penetration depth and the drug release duration while minimizing the unintended drug delivery to the cerebrospinal fluid. The improved survival rate and tumour suppression are confirmed with the mouse human xenograft glioblastoma model in vivo. Successful mild-thermic actuation in a canine glioblastoma model presents the potential for human glioblastoma therapy.