

Balloon with integrated flexible electronics for electrical stimulation and bioelectrical signal detection in pelvic floor dysfunction therapy

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Abstract

In clinical treatment for pelvic floor dysfunction (PFD), electrical stimulation and biofeedback associated treatment are widely used for pelvic floor muscle dysfunctions (PFMDs), which is considered as a main reason for stress urinary incontinence (SUI) in female patients^[1,2]. Utilize electrode design on the medical inflatable balloon is an effective way to realize the biofeedback combined with electrical stimulation therapy for PFD patients. To make electrical stimulate therapy more effective and obtain the human physiological electrical signal at the same time during the treatment and recovery of PFD patients, present work take advantage of flexible electrode and circuit design on the surface of medical inflatable balloon: referring to some reported works^[3,4], the inflating and deflating behavior of the balloon is numerically simulated by finite element method firstly in present study. According to the simulation results, deformation at latitudinal direction is larger than that at longitudinal direction, so the longitudinal direction layout of serpentine interconnects is considered to improve the stretchable ability of balloon electrode system. In order to make the deformation of electrode match the deformation of balloon when the balloon interacts with body, avoid the separation and relative displacement of electrode from the balloon, and consider the feasibility of device fabrication, a reasonable paper-cut design is chosen for electrode. The mechanical feasibility of the paper-cut designed electrode is verified by FEM simulations and experiments.

References

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