A net structure bariatric surgery device with silicone materials

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Introduction: Silicone rubber has excellent biocompatibility and good mechanical properties, which makes it a valuable candidate for implantable medical device. Bariatric surgery is considered as the most effective treatment option for morbid obesity. This paper tests the feasibility of designing net-shaped device to control the stomach capacity.

Methods: The net-shaped bariatric device is custom made for each patient by 3D printing using silicone based on a physician's assessment of height, weight, and energy consumption of obese patients. The device is placed on the outer wall of the patient's stomach by laparoscopic surgery. Due to its good elasticity and toughness of the silicone rubber, a patient's stomach is getting constrained gradually by the device during the feeding process, until the constrain reaches a threshold to achieve the purpose of weight control. The function of net-shaped device was tested by a simulation experiments using a balloon as the model for stomach. The pressure pump inflates to simulate feeding process. Our experiment uses a control group with balloons only, and a testing group with basket over the balloons. For both groups, the balloon was injected with air at a constant pressure stream. When pressure reached a certain level, the volume of the balloon w/o the device was recorded. The relationship between the volume and pressure for different hardness, thickness and braid density of the device was measured.

Results: In the control group, the balloon tripled in size when the pressure pump stopped filling; while the volume of the balloon in the control group increased by 0.5 times. The hardness, thickness and braid density have a lot effect on the expanding volume, and the silicone with 25D (shore hardness), 0.2 mm in thickness and 35 PPI seems to be optimal in performance.

Discussion: A net-shaped bariatric surgical device made of silicone were designed and prepared. The preliminary function of the device was tested using a simulation system, and the design parameters of the device was optimized.

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