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# Hydrogen Bonds Autonomously Powered Gelatin Methacrylate Hydrogels with Super-elasticity, Self-heal and Underwater Self-adhesion for Sutureless Skin and Stomach Surgery and E-Skin

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## Abstract

Interface-interaction induced self-healing and self-adhesive are a gem–like attribute inspired by our Mother Nature. Biocompatible gelatin methacrylate (GelMA) hydrogels exhibit tunable mechanical properties which are favorable in biomedical applications. However, it is difficult to integrate high stiffness, super-elasticity, large deformability and self-healing property together. Here, we report a GelMA-based double-network (DN) hydrogel with above properties by utilizing tannic acid (TA) as a multi-functional H-bond provider. We first investigated the morphological and mechanical properties' changes of GelMA over different TA's concentrations and treating times. In comparison to pristine GelMA hydrogel (10% w/v), the GelMA-TA hydrogels presented significant increase in ultimate stress (4.3-fold), compressive modulus (2.5-fold), and especially in elongation (6-fold). Adhesion properties of GelMA-TA can be tuned by TA and have been proven to be water-resistant. To test gels' feasibility *in vivo*, we applied GelMA-TA gels to close skin wound and gastric incision without suture. The results indicated the gels had the capabilities of promoting wound healing with superior tissue restoration and minimal tissue adhesion. Furthermore, integrated with carbon nanotubes, the GelMA-TA-carbon nanotube gel was an alternative self-healing electric skin with strain-sensitive conductivity. This work demonstrated a strategy to yield