Supplementary materials

Experimental section

Synthesis of gold nanorods (GNRs)

First, 5mL CTAB solution (0.2M) was mixed with 2.5mL deionized water and 2.5mL $HAuCl_4$ (0.001M) under constantly stirring. Then, 0.6mL of ice-cold sodium borohydride (0.01M) was added dropwise with continuous stirring until forming a brownish yellow solution. After stirring the solution for 2 minutes at 28℃, the seed solution was prepared. The seed solution had to be used in between 2 and 5 hours. Furthermore, 50mL of CTAB solution (0.2M) was blended with 50mL $HAuCl_4$ solution (0.001M), then added 1mL silver nitrate (0.01 M), and 0.8 mL of 0.1 M ascorbic acid were added dropwise after gentle mixing until the growth solution color changing from dark yellow to colorless. Finally, 200μL of seed solution was added. The growth medium was kept constantly stirring at 28°C overnight in the dark place. The prepared GNRs were collected via centrifugation (11,000 rpm) for 30 minutes. Then, adequate deionized water was used to wash GNRs twice by centrifugating (11,000 rpm). The bare GNRs were dissolved in 25 mL deionized water after purification.

Synthesis of gold nanorods@ palladium (GNRs@Pd)

A typical procedure for the growth of Pd shells is as follows: the as-prepared GNRs solutions (4 mL) was mixed with 2 mL of 0.1 M cetyltrimethylammomium bromide (CTAB) aqueous solution containing 20 μL of 0.1 M ascorbic acid (AA). 425 μL of 2 mM $PdCl_4^{2-}$ (0.035 g of PdCl2 was dissolved in 2 mL of 0.2 M aqueous HCl solution and then diluted into 100 mL with deionized water) was added, respectively. The mixtures were then shaken vigorously and placed in a 30 °C water bath. Within several hours, the color of the solution changed from brown to dark gray, suggesting the formation of Pd shell. After 14 h, the reaction was stopped by centrifuging (12 000 rpm 10 min) the solution twice.

Eye patch preparation

Add 3g gelatin to 10ml GNRs@Pd and form a solution in 50℃ water bath. And then add geniping(20ul, 0.1M). Absorb the appropriate amount of solution in the model, get the shape of the eye patch, after 5min, drop about 3-4 drops of $FeCl_3$ solution.

Cell experiments

All cell lines including human renal epithelial 293 cells, retinal precursor 293 cells were purchased from the Chinese Academy of Sciences Cell Bank of Type Culture Collection (CBTCCCAS, Shanghai, China) and cultured according to the relevant specifications. The cells were cultured in DMEM or 1640 medium (Hyclone, Logan, UT) supplemented with 4.5 g/l glucose,10% fetal bovine serum (FBS) and 1% glutamine. Cultures were maintained at 37°C in a humidified atmosphere containing 5% CO2. The in vitro cell cytotoxicity was performed using cell counting kit-8 (CCK-8) (Solarbio, Beijing, China).

Animal experiments

Sprague-Dawley rats were perfused with 0.9% saline solution and then perfused with 4% PFA in PBS. The skin of the back skin and the eyelids were separated and cryoprotected in a 30% sucrose solution and cut into 5 μm sections and HE stained. All procedures were approved by the Animal Care and Use Committees of Nanchang University Medical School and the ARVO statement for the Use of Animals in Ophthalmic and Vision Research.

Human tests

To further confirm the effectiveness of this eye patch in practice, several volunteers watched the same video on the computer for 3 hours with one eye patch on each face. We tested the first tear break-up time (BUT), the

average tear break-up time (BUT), the tear meniscus height (TMH) and the red eye analysis (B Grading) of these subjects w hith a Keratograph 5M non-invasive ocular surface analyzer. All tests follow the specifications of Affiliated Eye Hospital of Nanchang University.

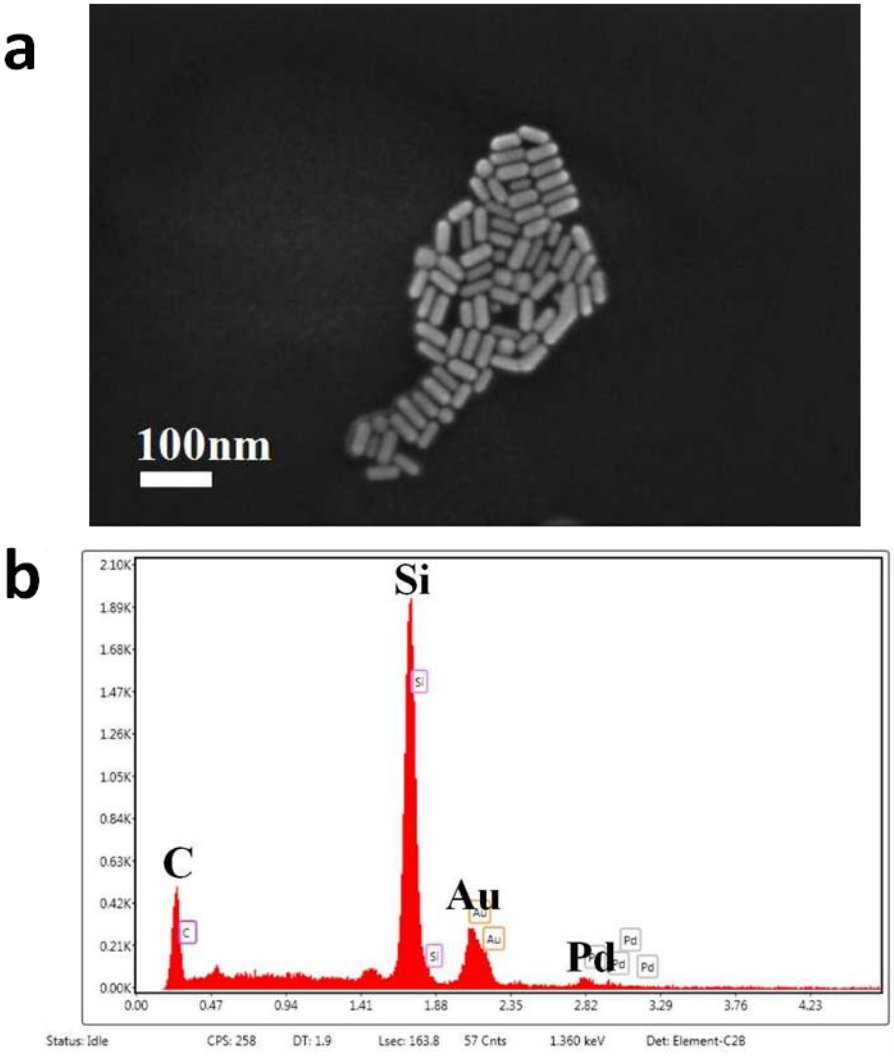

Figure S1. (a)Scanning electron micrograph of Au. (b) The energy spectrum of GNRs@Pd

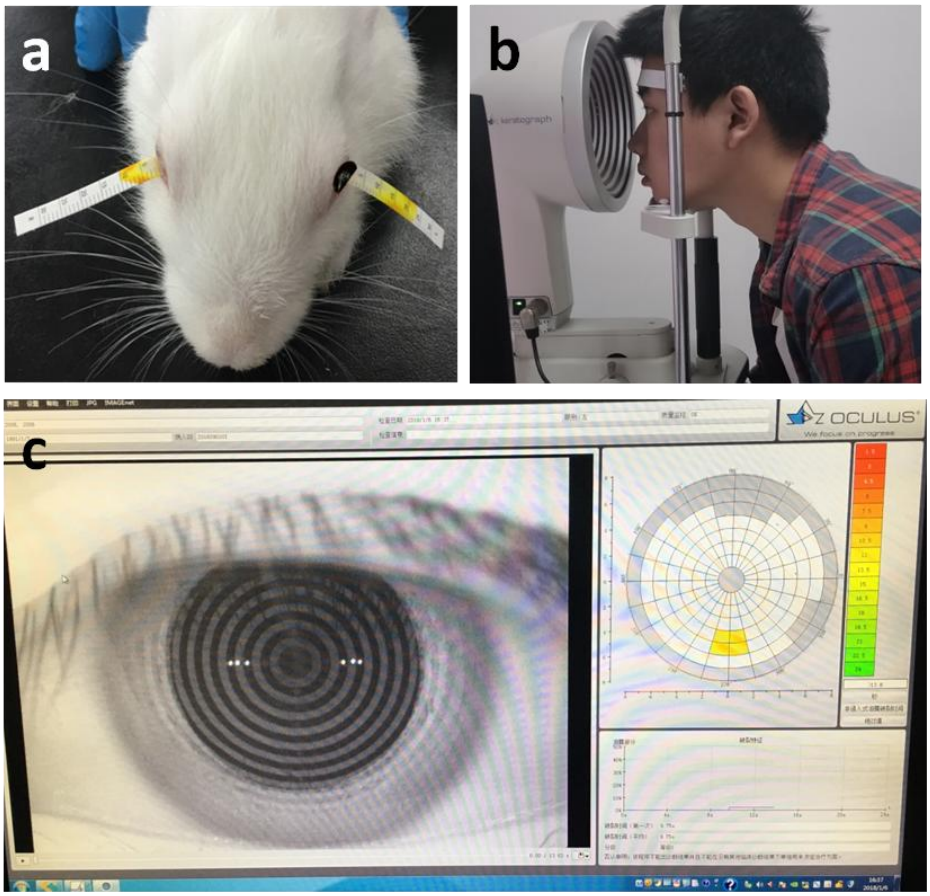

Figure S2. (a) The photographs of rabbit tear secretion test. (b)(c) The photograph of subjects used Keratograph 5M non-invasive ocular surface analyzer

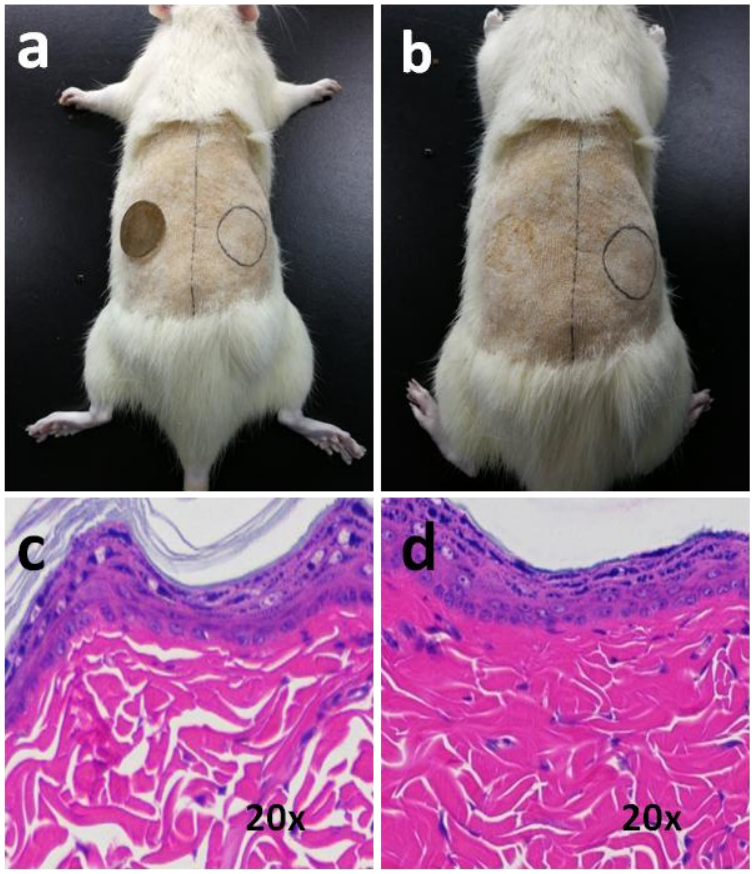

Figure S3. (a) (b) Toxicity test of eye stick on the back skin of rats. (c) (d) HE staining of rat's back skin

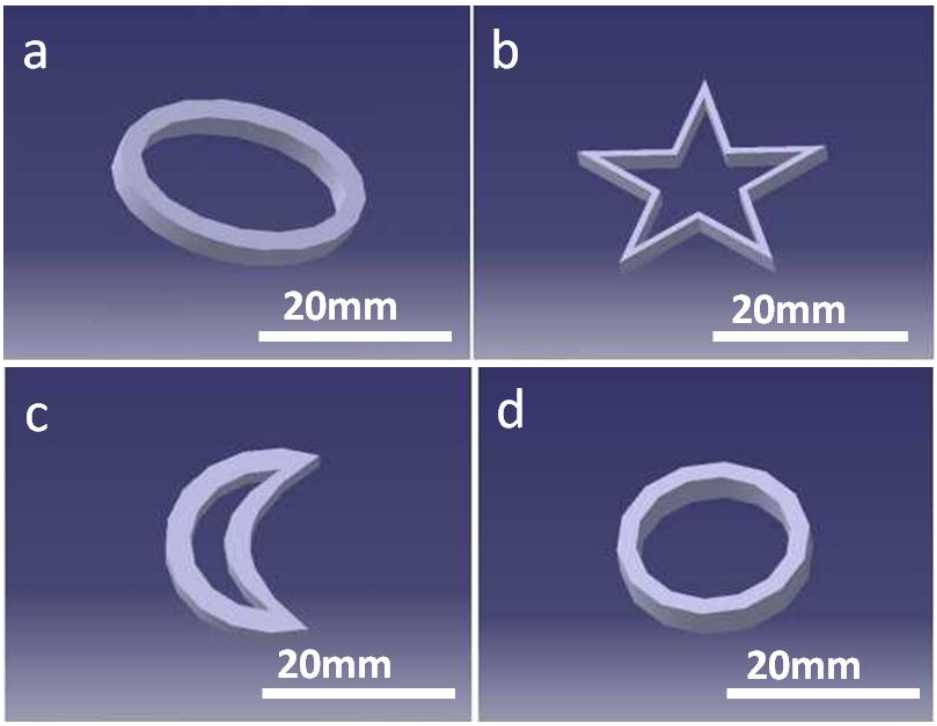

Figure S4. customized elliptical, pentagonal, crescent and circular 3D models.

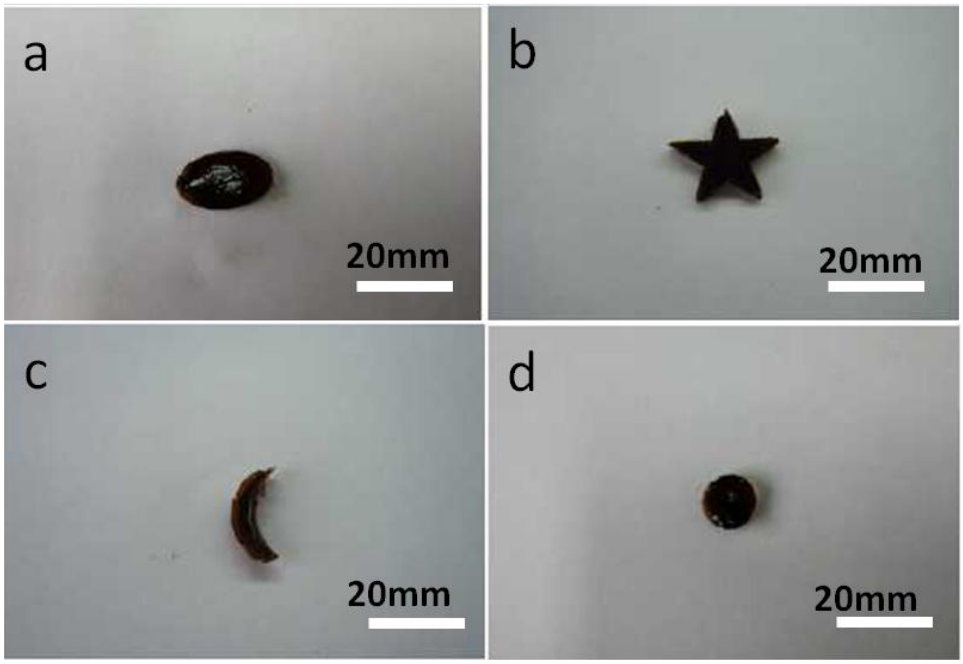

Figure S5. Photographs of eye patches corresponding to different 3D molds.

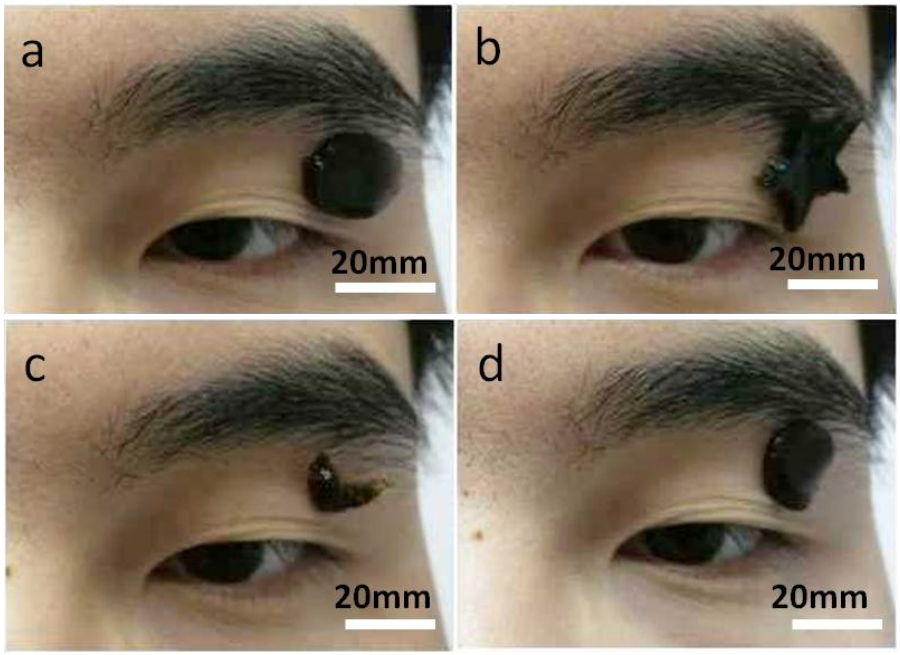

Figure S6. Photoes of the human eye with different eye patch.