## Supporting Information



**Fig. S1** Low magnification images of enamel-like hydroxyapatite layer grown on acid etched enamel. a) enamel after acid etching; b) surface morphology of the acid etched enamel after the E125 treatment and re-mineralization in SOF for 12 h. c) surface morphology of the acid etched enamel after the Glu treatment and re-mineralization in SOF for 12 h.



**Fig. S2** SEM images and EDS data of enamel surface. a) original enamel; b) enamel after acid etching; c) acid etched enamel after soaking in 1% E125 solution for 24 hours. (d), (e) and (f) are the EDS analysis data of (a), (b) and (c) respectively.



**Fig. S3** EDS mapping results of the cross section of the re-mineralized enamel infiltrated with dental resin. a): SEM image of the microstructure of cross section of the re-mineralized enamel infiltrated with dental resin; b) C element mapping (blue color); c) Ca element mapping (purple color) ; d) O element mapping (red color); e) P element mapping (yellow color); f) The overlay image of all element mappings. The blue area represents C element mapping, indicating the distribution of dental resin. The orange color in (F) represents the overlay image of Ca, P, and O element mappings indicating the calcium phosphate mineral region. It is clear to see that the blue color penetrates into the orange area, which indicates the well infiltration of dental resin in the re-mineralized enamel structure.



**Fig. S4** The Ca<sup>2+</sup> concentrations of original enamel and re-mineralized and resin infiltrated enamel after soaking in phosphoric acid.



**Fig.S5** SEM images of the samples to resist acid erosion. a) the original enamel; b) the original enamel after phosphoric acid etching for 1 min; c) the re-mineralized enamel; d) the re-mineralized enamel infiltrated with dental resin; e) the re-mineralized enamel infiltrated with dental resin; e) the re-mineralized enamel infiltrated with dental resin; and then phosphoric acid etched for 1 min.