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Supplementary Information

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Loading Approach vs. Burst Release

To date, the objectives to immobilize the growth factor onto the surface of implants is to reduce burst release and increase residence time at the implantation site. It has been verified the burst release has close relationship with the loading approach for proteins. Fig.S1 compared the burst release of BSA molecules from Ti-disks with different loading approaches including physical absorption, dropping, BSA-chitosan immersion, ESD, and plasma-ESD. The original concentration for BSA loading in all cases was maintained as 20 mg/ml. As can be seen, the disks with BSA absorption, dropping, and ESD exhibited high burst release, i.e. more than 50% BSA were quickly released at the initial stage. However, for the plasma-ESD samples, the burst release was greatly reduced to around 20%. Thus, the plasma-ESD technique provided the possibility to slow down the protein release and prolong residence time.

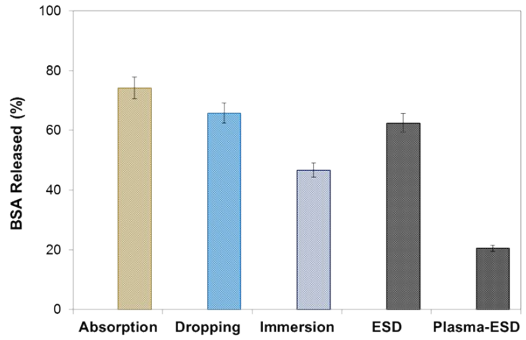

Fig.S1: Burst release of BSA from Ti disks in PBS with different loading approaches including physical absorption, dropping, BSA-chitosan immersion, ESD, and plasma-ESD.

Degradation Behavior of Chitosan w/wo Crosslinking

The degradation behavior of the coating materials directly affects the release characteristics of entrapped proteins, and then has great impact on the osteoblast response. Fig.S2 showed the SEM images for ES-P-SLA disks coated with chitosan layer w/wo crosslinking immersed in SBF solution for 10 and 20 days, respectively. As can be seen, the chitosan layer without crosslinking was completely degraded after 10 days in SBF solution and only small amount of residue was kept on the disk surface, indicating the rhBMP-2 released in the medium. However, the chitosan layer with crosslinking maintained its structure without degradation for three weeks. In this case, the biological behaviours of osteoblasts might be stimulated by the signals from the entrapped rhBMP-2.

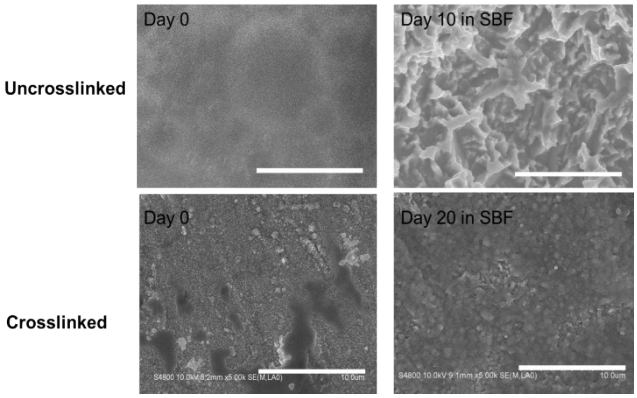

Fig.S2: SEM images for ES-P-SLA disks coated with chitosan layer w/wo crosslinking. The scale bar: 10 μm.

Comparison Release of BSA and rhBMP-2

BSA is a hydrophilic macromolecule with a molecular weight of 66KD. In a contrast, rhBMP-2 is a hydrophobic molecule with a molecular weight of 13KD. It has been reported that the release rate of rhBMP-2 in the cell culture medium was slower than that of BSA molecules because of the hydrophobic nature. However, as shown in Fig. S3, rhBMP-2 still showed slightly higher release rate than BSA because of the molecular size. This comparison offers the reasonable evidence for BSA molecule as a model protein to evaluate the release characteristics of rhBMP-2.

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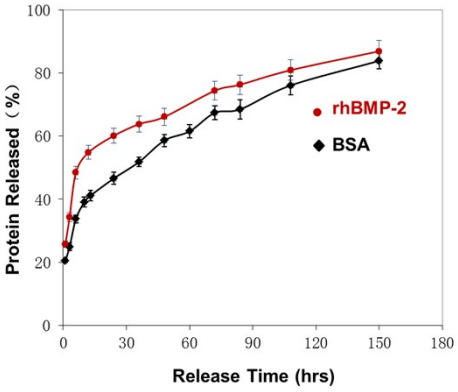

Fig.S3: Cumulative release of BSA and rhBMP-2 from ES-P-SLA disks in PBS. The spraying time is 10 minutes.

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