Electronic Supplementary Information

Nanostructural control of transparent hydroxyapatite nanoparticle films using a citric acid coordination technique

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Fig. S1  TEM images of the surface layers between top and internal surfaces of (a) 0Cit/HA, (b) 1Cit/HA, (c) 2Cit/HA and (d) 3Cit/HA where the average surface layer thicknesses were 0, 1.7, 2.2 and 4.1 nm, respectively. (e) Illustration of the possible surface layer structures of the Cit/HA nanoparticles.
**Figure S2**

**Fig. S2** Particle size distribution of 1Cil/HA dispersed in PBS.
**Figure S3**

(a) Transmittance and haze value changes of the cal-Cit/HA-F films with the coordinated amount of Cit, and the photographs of (b) cal-0Cit/HA-F and (c) cal-3Cit/HA-F.
Fig. S4  GD-OES elemental depth profiles of (a) 0Cit/HA-F, (b) 1Cit/HA-F, (c) 2Cit/HA-F and (d) 3Cit/HA-F.
**Figure S5**

Fig. S5 Microscopic photographs of (a, e) cal-0Cit/HA-F, (b, f) cal-1Cit/HA-F, (c, g) cal-2Cit/HA-F and (d, h) cal-3Cit/HA-F before and after the tape peeling test and (i) their reduction rate of the film areas.
**Figure S6**

Optical microscope images of the cell adhesion on 0Cit/HA-F at the culture time of 3 h ((a) lower and (b) higher magnification).
Scheme S1  Illustration of the possible nanospace formation in the Cit/HA-F films based on the results in the N$_2$ adsorption and desorption isotherms.
**Scheme S2.** Illustration of the changes in (a–d) arrangement states and (a′–d′) interaction forces between the nanoparticles during the dry process of 3Cit/HA-F. Here, only the nanoparticles in the bottom layer are discussed for easily understanding.
**Fig. S7.** SEM and AFM surface topographic images of (a, b) cal-0Cit/HA-F and (c, d) cal-3Cit/HA-F, and the RMS values of cal-0Cit/HA-F and cal-3Cit/HA-F were 7.69 nm and 4.59 nm, respectively. (e) Nanoparticle size distribution in the cal-3Cit/HA-F.