

Hassan et al. Titanium biomaterials with complex surfaces induced aberrant peripheral circadian rhythms in bone marrow mesenchymal stromal cells

S1 Fig. Surface characterization of Ti substrates by SEM. **A.** Commercially pure Ti discs were produced by a rotary machine, which left the isotropic grooves. **B.** The machined surface was treated with double acid etching (DAE), which generated submicron levels of anisotropic rough surface. **C.** The discrete crystalline deposition (DCD) surface modification to the DAE surface created the less than 50% surface coverage of hydroxyapatite nanoparticles (2~10 nanometer). **D.** To eliminate the effect of surface topography and to evaluate the role of Ti chemistry, the machined Ti disc was polished until 600-grade. **E.** Prior to DAE-DCD surface treatment, Ti disc was treated with sand blasting (B), which gave rise to greater surface roughness at the submicron to micron levels. **F.** The B-DAE-DCD surface modification remained to contain hydroxyapatite nanoparticles up to 50% surface area. The machined surface Ti implant is used as dental implant. Clinically used dental implants are also available with DAE, DAE-DCD and B-DAE-DCD surfaces (Zimmer Biomet, Palm Beach Garden, FL).

