Titanium and its alloys are widely used in dental and orthopedic fields. Dental implants need a stable system in well bone-implant interactions for long-term fixation. A novel surface modification on implant is to fabricate an osteoinduction, osteoconduction and osteogenic structure. Nanotechnology offers the capability to control cell-surface, cell-cell, and cell-medium interactions on a nanometer scale. The structure of surface could influence cellular behavior. This study is to construct nanostructure on titanium for cells adhesion and properly development.

Materials and Methods

Titanium substrate

Titanium substrate

Titanium substrate

Titanium substrate

Materials analysis

SEM

AFM

TF-XRD

in vitro assay

Cell morphology

Cell proliferation

Results and Discussion

Figure 1. SEM morphology of the ordered texture surface. (a) N0, (b) N50, (c) N65, and (d) N80.

Figure 2. AFM morphology of the ordered texture surface. (a) N0, (b) N50, (c) N65, and (d) N80.

Figure 3. TF-XRD of the ordered texture surface.

Figure 4. After culturing for 1, 7, and 14 days, cell proliferation of the ordered texture surface.

Figure 5. After 1 h of culture, the cell morphologies on ordered texture surface. (a) N0, (b) N50, (c) N65, and (d) N80.

Figure 6. SEM morphologies of cells on N65 after 30 min, 1 h, 3 h, and 12 h of culture.

Conclusion

The anodization is a simple, controllable, and cost-effective process to modify titanium. In this study, the ordered texture surface with nanometric roughness was prepared by anodizing and ultrasonic machine. By TF-XRD analysis, only titanium phase was identified in three kinds of specimens. The average roughness of all specimens is from 4.78 to 20.62 nm, and the contact angle of all specimens is from 44° to 55°. The three kinds of specimens roughness belongs to nanometer level. In vitro test, the ordered texture surface with nanometric roughness was significant influence on cell morphology, and provided a preferential surface for cell proliferation after 14-day culture. The optimal ordered texture surface could improve the biological performance of the coatings.