

Abstract

In order to investigate the friction properties of medical alloys (316L, CoCr, NiTi, TiMoSn), a ball-on-disc friction test of those kinds of alloys using poly (vinyl alcohol) hydrogel (PVA-H), which has the mechanical properties similar to those of soft tissue, as a counter part was carried out. The conditions of normal load and sliding velocity included those in clinical operation such as endovascular intervention. Distilled water was employed as lubricant. In addition, for investigating the friction properties in more detail, the wettability of those alloys was measured with the Owens-Wendt method.

The characteristic phenomenon, elastic friction, was observed at lower velocity region in the Stribeck curve. This governed by the adhesion of hydrogel polymer by the surface of alloys. The friction coefficients of 316L and CoCr in the elastic friction are higher than those of NiTi and TiMoSn. Concerning the polar components of surface free energy of NiTi and TiMoSn are higher than those of 316L and CoCr, there seems to be the following correlativity between friction coefficient and wettability of metallic alloys: i.e., when the polar component of alloy is high, hydrophilic lubricant like water can easily intrude into the gap between hydrogel and metallic alloy. Then, hydrogel polymer chain cannot adsorb on the surface of the alloy with ease because of the presence of water, which can reduce the friction coefficient.

This assumption can affect the development and design of various medical metallic devices. In conclusion, the surface characteristics of metallic alloy can affect the friction behavior of medical devices.