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Technical Report on the wettability of planar samples

Customer: Titanmed srl

C O N F I D E N T I A L



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Aim

Knowing surface free energy of dental implants, as it occurs for many biomaterials, is an essential element for the evaluation of the interface and of the quality thereof. Through any treatment capable of altering the surface of the material, chemical (polar groups) and / or topographic variables are introduced, which affect the measurement of the surface free energy.

When a drop of liquid is laying on a surface, it forms a contact angle that is a function of the relationship between the surface tension of the liquid and the free energy of the surface. The measurement of this angle characterizes the interaction between the liquid and the contact surface. If the contact angle exceeds 90° , the surface is deemed not to be wet. If, instead, the contact angle is less than 90° , the shape of the drop soaking the surface is not constant. In this case, there is a need to determine the contact angle in a dynamic way in function of time. Along time, a drop of liquid placed on a solid and non absorbent surface reaches an equilibrium condition. The reading of the contact angle provides the value of the angle of static contact. The static contact angle can not be measured, if the drop penetrates underneath the substrate or the liquid reacts with the surface itself. On absorbent materials where the liquid penetrates into the substrate, the contact angle varies in function of time and it is defined as Dynamic Contact Angle.

Materials and methods

To determine the surface free energy of the samples, the DAT Dynamic Contact Angle Tester is commonly used. Such an apparatus is able to determine the contact angle recurring to at least two different reference liquids with known surface tension, polar and dispersed component (usually water and di-iodomethane). On the solid surface, the dispensing system places a drop that is digitally photographed by CCD camera. The SCA20 software automatically determines the contact angle between the liquid and the solid.



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Results

The values of the contact angle θ , as determined for the surface tested and the control, are shown below in tabular form. The clinically used DM surface was compared to the machined titanium in form of planar samples.

	Contact angle θ	
	H ₂ O	CH ₂ I ₂
MAC	34.7±6.8	39.6±1.6
DM	51.4±8.1	43.2±2.3

From the data evaluation following the Wu theoretical method, it is possible to determine the surface free energy of the implant surfaces.

	Surface Free Energy (SE)		
	Total	Dispersive	Polar
MAC	61.6	26.73	34.88
DM	51.05	27.58	23.47

The DM surface investigated is therefore hydrophilic on the basis of the tests run.

Turin, 22nd June 2015.

Faithfully,

Federico Mussano