

Manufacturing processes for titanium implants and their influence on surface chemistry.

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Neoss Research Report

Abstract: Manufacturing, storage and sterilisation processes can create changes in the surface chemistry which may impair osseointegration of dental implants. This investigation analyses the chemical composition of titanium implants following surface treatment techniques.

Introduction

The surface energy of titanium dental implants is a consequence of material, production method, cleaning technique and storage and packaging conditions. A number of researchers have reported the decrease in hydrophilicity and wetting observed when implants are packaged in plastic. It has been suggested that this may impair the integrity of the blood clot-implant interface during the early events of bone healing. Surface carbon levels vary considerably on different implants and it has been suggested that blasting media and plastic packaging may be a major source of contamination. The effects of blast treatment with an ultraclean particle, etching and glass storage on surface chemistry were investigated

Materials and Methods

Grade 4, commercially pure titanium implants were manufactured. They were immediately blasted with an inert media, acid etched,

cleaned using a proprietary cleaning technique and immediately stored in hermetically sealed glass transport packaging. Six implants were analysed using a PHI 660 Scanning Auger Microprobe (SAM). The electron beam was defocused to cover a larger area of the implant surface thereby lowering radiation damage and attaining a more true average surface composition.

Results

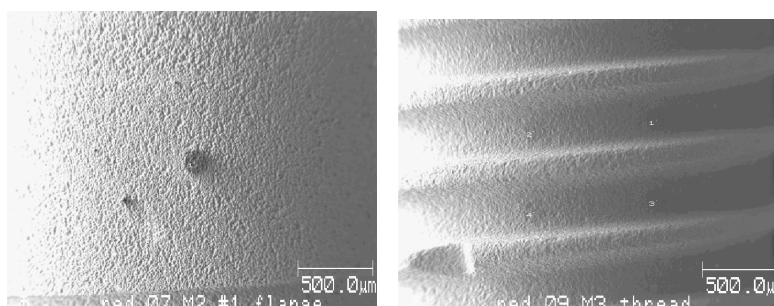
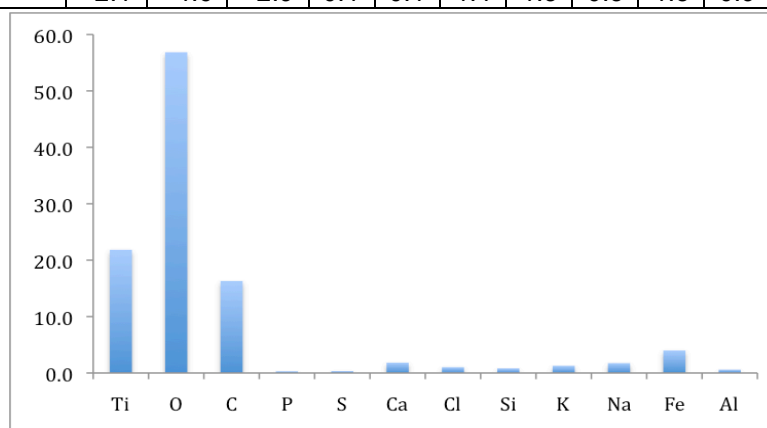
Quantitative AES analysis results by sample in atomic % are presented in Table 1 and graphically in Figure 1.

Conclusions

- Implant surfaces exhibited low levels of carbon and trace elements post manufacturing and storage.
- This indicated optimal conditions for wetting and blood clot formation in line with other dental implant systems

Table 1.

	<i>Ti</i>	<i>O</i>	<i>C</i>	<i>P</i>	<i>S</i>	<i>Ca</i>	<i>Cl</i>	<i>Si</i>	<i>K</i>	<i>Na</i>	<i>Fe</i>	<i>Al</i>
Mean	21.8	56.8	16.3	0.3	0.3	1.8	1.0	0.8	1.3	1.8	4.0	0.6
Std. Dev	2.1	4.6	2.9	0.1	0.1	1.4	1.3	0.3	1.5	0.9	3.8	0.3



SEMS showing AES analysis positions for the flange and threaded portion of one of the test implants M4.

