R-3. Effects of a Nanostructured Calcium Titanate Coating on the Osseointegration of Blasted Endosseous Implants in Rabbit Tibiae

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Background

The predictability and long-term success rates of dental endosseous implants have been well documented, however, high implant failure rates have been reported in areas of poor quality bone such as in the posterior maxilla. One of the strategies used to improve osseointegration is to make the bioinert surfaces of metallic implants bioactive, thereby favoring bone-tissue reactions at the interface.

Titanium (Ti) is generally considered to be bioinert and not likely to form direct bonds with bone, so various kinds of bioactive material have been coated onto the surfaces of Ti implants in order to provide optimal surface reactivity.

The purpose of this study was to investigate the effects of a nanostructured calcium coating on the surfaces of blasted Ti implants on periimplant bone formation in the rabbit tibiae.

Material and methods

Threaded implants (3.75 mmin diameter, 6.0 mm in length) were roughened by hydroxyapatite (HA) blasting (control; blasted implants). The implants were then hydrothermallytreated in a Ca-containing solution for 24 h to prepare Ca-incorporated Ti surfaces (experimental; blasted/Ca implants). Surface characterizations were performed by scanning electron microscopy and stylusprofilometry before and after Ca coating. Forty-two implants (21 control and 21 experimental) were placed in the proximal tibiae of seven New Zealand White rabbits. Each rabbit received six implants. To evaluate the effects of the nanostructured Ca coating on the periimplant bone healing response, removal torque tests and histomorphometric analyses were performed six weeks after surgery.

Results & Conclusion

The Ca coating did not significantly change the surface properties produced by blasting at micron level. Histologically, active bone apposition was observed in the blasted/Ca implants in the marrow space.

Compared to the blasted implants, the blasted/Ca implants showed significantly increased bone-to-implant contact over the total implant length ($p < 0.01$) and greater mean removal torque values ($p < 0.05$).

The nanostructured, Ca-incorporated surface significantly enhanced the periim-plant bone healing response of HA-blasted Ti implants.

It may be concluded that the use of nanostructured, Ca-coated surfaces may have synergic effects in enhancing osseointegration of blasted Ti implants due to their micron-scaled surface properties and biologically active surface chemistry.