HISTOLOGY OF LTI PYROLITE CARBON DENTAL IMPLANT-TISSUE INTERFACE IN PRIMATES

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Low temperature isotropic - silicon alloyed pyrolite carbon dental implants (endosseous blade type) were placed in eight baboons (papio cynocephalus) for a period of 24 months to determine the histologic findings of the implant-tissue interface. Mandibular second and third molars were removed bilaterally and the tooth sockets allowed to heal eight weeks. Conventional surgical techniques were used to place the carbon implants to a shoulder depth at 7 mm placing the polished margin of the implant at the level of the alveolar crest. Tight mucosal closure was obtained with interrupted polyglycolic acid sutures. The animals were maintained on parenteral penicillin twelve postoperative days. Two months after insertion a fixed cast gold prosthesis was placed on the left implants using the natural first molar as a single abutment. Centric vertical occlusion without lateral interference was maintained. All right sided implants were left free standing opposing the natural maxillary dentition. Bimonthly dental prophylaxis and clinical observation of the implant was accomplished. Radiographs were taken at six month intervals.

At 24 months post insertion marginal mandibular resections were performed on six animals (12 implant sites). Two animals have been extended for long term evaluation. Immediately upon resection the implant-tissue interface was forcefully probed with a sharp instrument. The specimens were then placed in 10% formalin. The gingival tissue-bone-implant specimens were divided buccolingually through the center of the implant. (Figure 1) One half of the specimen was prepared in the undecalcified state with the implant in place. The specimen was dehydrated with ethyl alcohol and then infiltrated with methyl methacrylate monomer. The specimen was they polymerized by embedding in a hard plastic block. Bucco lingual sections 250 micra thick were prepared with a diamond saw. These sections were glued to a slide and ground to approximately 100 micra. Staining was accomplished with Paragon 1301. The remaining half of the original specimen was decalcified, the implant removed and tissue embedded in parafin. The sections obtained were routinely stained with hematoxylin and eosin.

Figure 1

Results

Histologic findings on 10 of the 12 specimens showed a complete absence of bone resorption of the alveolar crest and an absence of epithelial migration or fibrous tissue formation at the implant-tissue interface. (Figure 2) Two of the 12 specimens revealed a dense connective tissue capsule with fiber bundles paralleling the implant surface totally surrounding the implant. This capsule was of variable thickness at different areas of the implant. No epithelial migration could be found in either of these implants. In the successful implant no evidence of necrosis or inflammatory processes including foreign body type reactions were observed. At the epithelial junction of the neck of the implant a normal sulcus was observed which closely simulated the normal gingival sulcus. Sulcus depth also appeared normal. There was close adherence of the soft tissue to the implant surface. Normal bony architecture and constructive remodeling occurred throughout the cortical and cancellous bone adjacent to and distant from the implant. (Figure 3) Along the bone-implant interface extending from the neck of the implant to the midbody portion normal dense lamellated bone was seen with occasional marrow

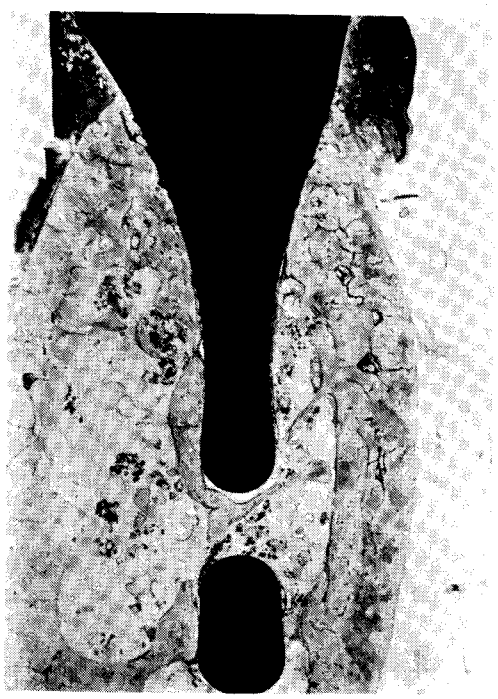

Figure 2

Figure 3

spaces and Haversian canals approximating the implant. Inferiorly, along the body of the implant surface including the vent areas there was a normal increase in fatty marrow and dense bone which radiated from the implant in an apparent buttressing phenomenon secondary to functional stresses. High power views of the interface between dense bone and implant where artefactual separation occurred showed adherence of carbon particles to the bone which could be mentally refit into ne ative corresponding areas on the implant surfa (Figure 4)

Figure 4

Conclusions

The histologic findings of this study correlated exactly with the clinical observations mad with the same animals. Those implants which demonstrated clinical mobility and increased sulcu depth revealed a fibrous encapsulation of varying thickness surrounding the implant. Successful implants demonstrated an interdigitating mechanical bond between bone and the carbon surface. The LTI-silicon alloyed carbon dental implant appears to be extremely well tolerated in the primate experimental animal and provides a surface substrate capable of producing an effective mechanical interlock with surrounding bone.