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Histological Analysis for forty one retrieved dental implants

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ABSTRACT

Objectives: To analyze the anatomy and osseous integration status of the hard tissue interfaces for retrieved implants, and to interpret the clinical status of this specific implant patient population through correlating bone integration status and demographical data.

Methods: Eighty dental implants removed for clinical reasons were retrieved from patients over a 3 year period. Forty one explants were selected for histological analysis because they had adequate bone for longitudinal section analyses. Specimens were processed, embedded in plastic, and thin (20-30 micrometer) ground sections were made along the long axis of the implants. Specimens were stained with Sandersons' Bone Stain. Blinded histomorphometric analysis was performed to measure the percentage of bone area between the plateaus and the bone/implant contact (BIC). Patient records (gender, date of birth, smoking status, time in vivo, type of implant surface, presence of augmentation, and position of the implants in the jaw) were collected and incorporated into the histomorphometric data; and statistical analysis was performed.

Results: There were no strong associations between any of the clinical, patient and implant variables and the bone area percentage and (BIC). In a multiple regression analysis adjusting for the available data, the anterior position was marginally significantly associated with higher percentage of bone and (BIC) (p=0.067). Performing a simple pair wise correlation, females had higher percentage of bone than males (p=0.0898).

Conclusions: The findings support that the success and failure can be caused by a combination of factors not associated with bone integration status. Revision procedures represent a small percentage of dental implants treatment and this study demonstrates that larger numbers of specimens will be required for statistical significance amongst the variables considered.

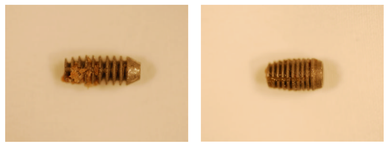
INTRODUCTION

The histological evaluation of dental implants retrieved from human is important to establish the causal determinants of implant failure. The aim of this study was to examine some available human dental implants and the surrounding tissues; establish correlation between histomorphometric and osseous integration data, and available implant and patient information. Several limitations associated with the retrospective approaches are recognized because of inadequate information which sometimes confounds answering many questions. However, these studies can provide more information about the function of such devices and their materials of construction in the human body. Improved understanding permits prospective changes to be made in implant composition, design, fabrication, and clinical techniques to improve outcomes for future recipients.

MATERIALS AND METHODS

Eighty dental implants removed for clinical reasons were retrieved from patients over a 3 year period. Forty one explants were selected for histological analysis because they had adequate bone for longitudinal sections (Figure 1).

Figure1. Images of dental implants as received. Left implant with bone to be analyzed and the right implant with little bone to be excluded.



Specimens were processed, embedded in methyl methaacrylate (MMA), polymerized and processed with an Exakt system to give 20-30 micrometer ground sections along the long axis of the implants. Specimens were stained with Sandersons' Bone Stain. Figure 2 (A-D).

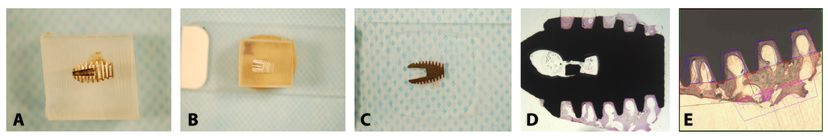
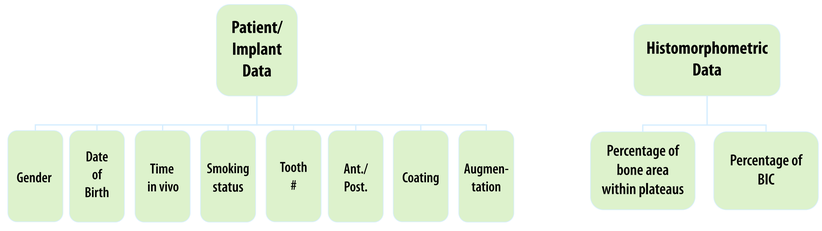


Figure 2. Image showing embedded specimen (A), block trimmed and attached to back up slide (B), then ground section made (C). The longitudinal ground section is shown stained with Sanderson Bone Stain (D). Image (E) shows the tracing of the measured bone area between the threads and the bone contact area from ®Bioquant Image Analysis.

Histomorphometric analysis was performed to measure the percentage of bone area between the plateaus and the percentage of Bone –Implant-Contact (BIC) as shown in Figure 2 (E). Patient records were collected as described in Diagram A and correlated with the histomorphometric data, Diagram B. Statistical analyses were performed.

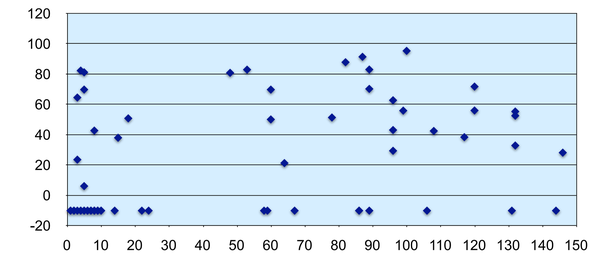


Diagrams A and B. Schematic for clinical, patient and implant information that was provided from the coordinator is shown in A and the measures of osseous integration are shown in B.

RESULTS

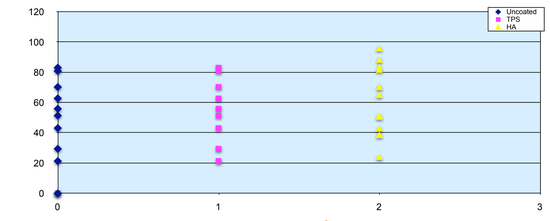
The results did not show strong associations between any of the clinical, patient and implant variables, the percentage of bone area between the plateau and Bone Implant Contact (BIC).
•In a multiple regression analysis adjusting for the available data, the anterior position was marginally associated with higher percentage of bone and BIC (p=0.067).
•Performing a simple pair wise correlation, females had higher percentage of bone than male (p=0.0898).
The percentage of bone osseous integration among the analyzed specimens ranged between 5-95% with time in vivo which varied from 3 to 146 months. Seventeen specimens were in vivo for more than 82 months as presented in Graph 1.

Graph 1. The time periods in vivo ranged from 1 to 146 months, the 39 specimens not analyzed are shown below zero bone integration and 11 specimens with unknown times in vivo are not shown.



The relationship between the percentage of bone integration and type of implant surface is shown in Graph 2.

Graph 2. No strong association between the implant surfaces (HA, TPS and uncoated) and the percentage of bone length was found.



CONCLUSIONS

The findings show that the outcomes for plateau design root form dental implants may be due to a combination of factors not associated with bone integration status. Dental implant revision procedures represent a small percentage of treatments and this study of explants demonstrates that larger numbers of specimens will be required for statistical significance amongst the clinical variables considered. However many significant and constructive observations can be made from retrospective studies.

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ACKNOWLEDGEMENTS

Partial funding from Bicon LLC, the University of Alabama at Birmingham and NIDCR grant T32-DE14300 is acknowledged**.** No royalties, consulting fees or honoraria were received by any of the UAB investigators.
Center for Metabolic Bone Disease--Histomorphometry and Molecular analysis core laboratory, NIH Grant # P30-AR46031.