Microbial Analysis Of The Implant Platform-Abutment Interface: A Pilot Study

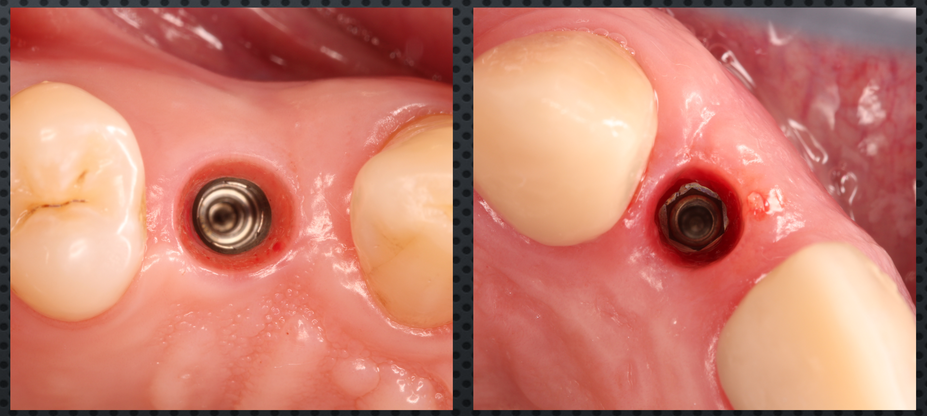
Lillian Nguyen, DMD, MS
Despoina Bompolaki, DDS, MS, FACP; Justin Merritt, PhD; James A. Katancik, DDS, PhD

Background

The progression of peri-implant diseases, specifically peri-implantitis, share common features to periodontitis with a primary focus on the host response to the microbial biofilm. The host immune response to bacterial insult is thought to be the initiator of a cascade of events leading to inflammation and marginal bone loss surrounding an implant. The aim of this pilot study is to gain an understanding of early bacterial colonization at the implant-abutment interface. Comprehension of the nature of bacterial colonization at this location would allow for establishment of an optimal and evidence-based implant-abutment design.

Materials and Methods

Patients of OHSU School of Dentistry with implants placed in the Graduate Periodontics clinic were included in this study. Healing abutments were collected at the initiation of restorative therapy between 4-6 months following implant placement. Clinical parameters such as Implant site, system, height of the gingival collar, subjective assessment of tissue health (in addition to photograph of implant platform), time healing abutment was in place, periodontal diagnosis (current and past), and history of smoking were recorded. Characterization of microbial genera sampled from the healing abutment and implant platform was completed using DNA extraction, PCR amplification of the 16S rRNA genes, Illumina library preparation and sequencing, and bioinformatic analysis.



A B

Fig 1. Photographs of implant platform and surrounding tissues obtained with each sample. (A) Healing abutment sample obtained from a site deemed "healthy". (B) Healing abutment collected from a site that exhibited signs of "mucositis".

RESULTS

Demographics

- 36 Samples, 30 Subjects
- Average Age of Subjects: 59 years-old
  - ✓ Range: 29-79 years-old
- 17 Males, 13 Females
- 2 Current Tobacco Users, 12 Former Smokers, 15 Never Smokers
- 14 Subjects with a History of Periodontitis, 15 Periodontally Healthy Subjects
- Average Time of Healing Abutment Samples: 14.5-weeks
  - ✓ Range: 3.5-32 weeks
- 33 Samples in Platform-switched Design, 3 Samples Platform-matched

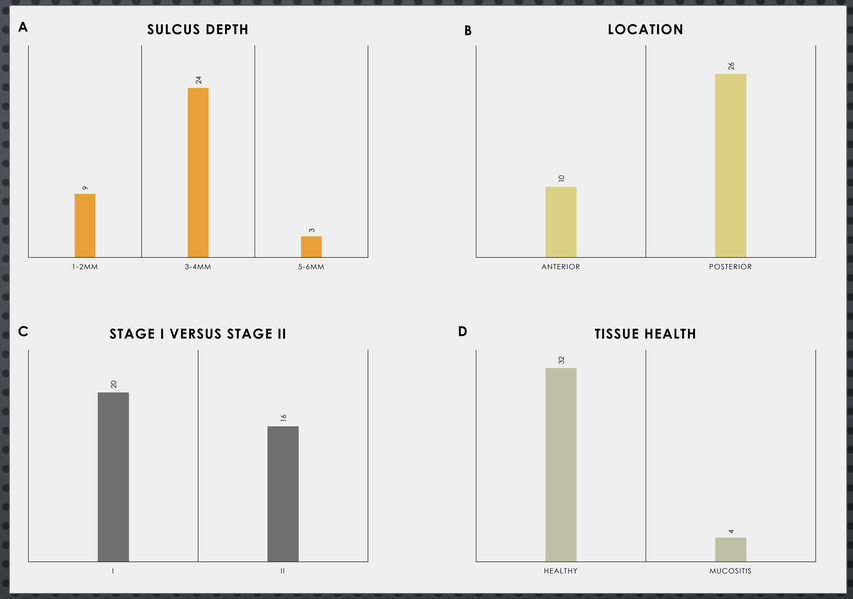


Fig 2. Distribution of samples based on clinical parameters. (A) Gingival collar height as measured from the level of the platform to the gingival margin at the most coronal aspect. The average sulcus depth was 3-4 mm. (B) Healing abutment samples based on the location in the mouth, classified as either "anterior" or "posterior". (C) Distribution of samples based on surgical placement technique; 20/36 samples placed as single stage and 16/36 placed in two-stage technique. (D) Subjective assessment of the surrounding tissues of the implant platform; 32 samples deemed clinically healthy with 4 samples exhibiting mucositis.

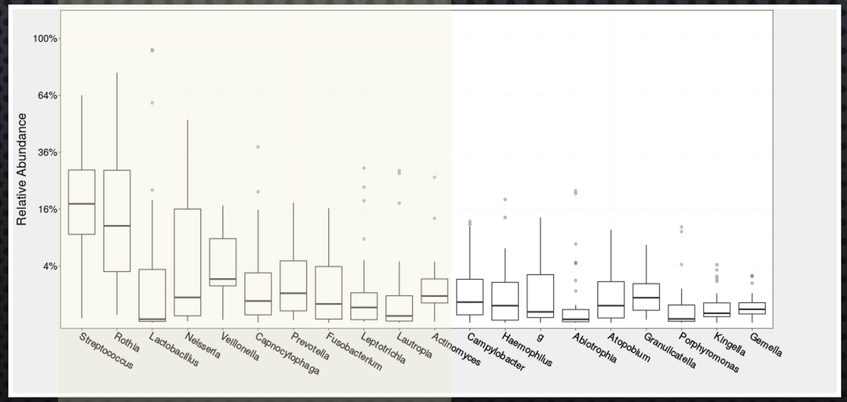


Fig 3. Relative Abundance of the Top 20 microbial genera collected from samples. Top 11 genera (highlighted in yellow) are *Streptoccus, Rothia, Lactobacillius, Neisseria, Veillonella, Capnocytophaga, Prevotella, Fusobacterium, Leptotrichia, Lautropia, Actinomyces*

RESULTS

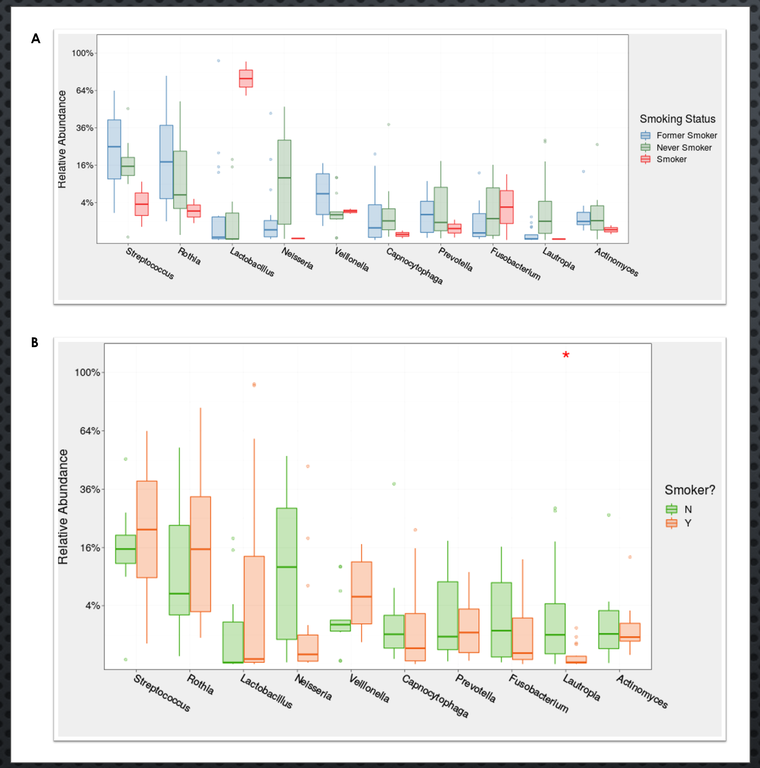


Fig 4. Box plot of relative abundance of microbial genera based on subjects' smoking status. (A) Subjects classified as "never smokers", "former smokers", and "smokers". No statistical difference found. (B) Former smokers combined with current smokers compared to never smokers. Statistical significance in the relative abundance of *Lautropia* found.

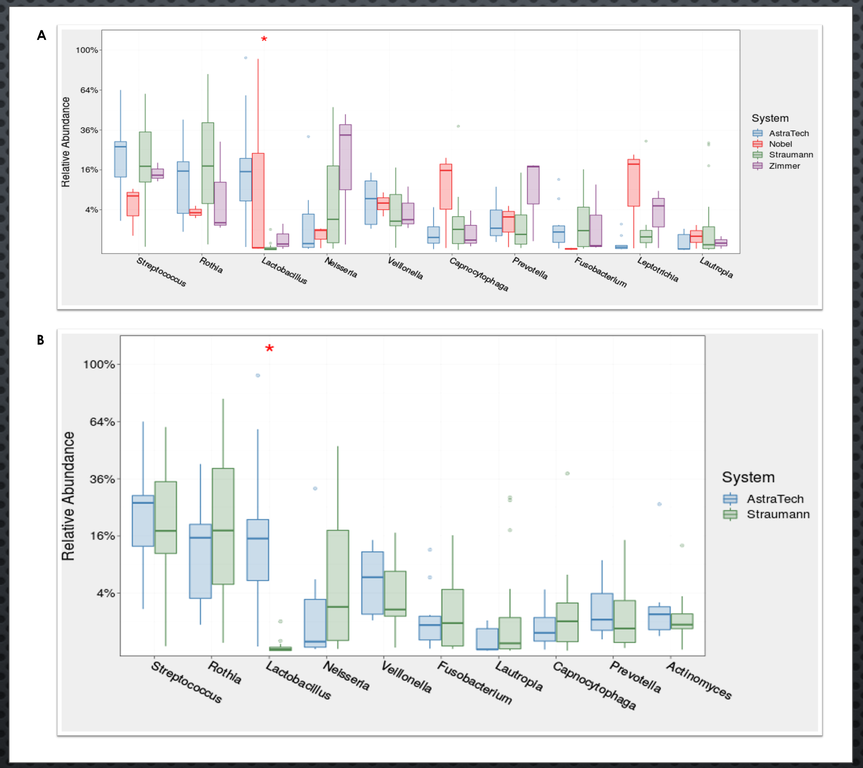


Fig 5. Box plot of relative abundance of microbial genera based on implant system healing abutment was collected from. (A) Statistical significance noted between groups for *Lactobacillus*. (B) Isolation of two most common sampled groups, AstraTech and Straumann showed statistical significance associated with AstraTech implants in relative abundance of *Lactobacillus*.

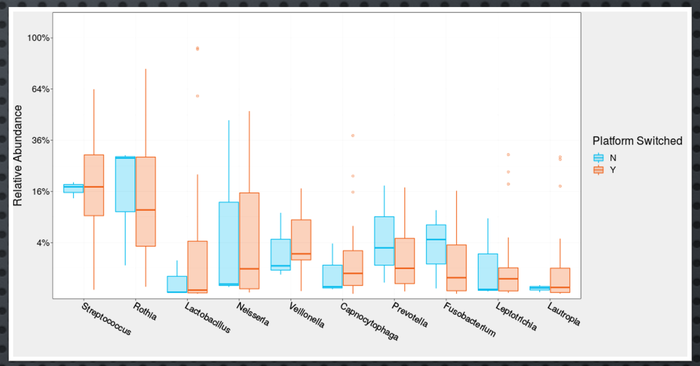


Fig 6. Box plot of relative abundance of microbial genera based on platform-abutment design. No significant differences noted between platform-switched and platform-matched implants

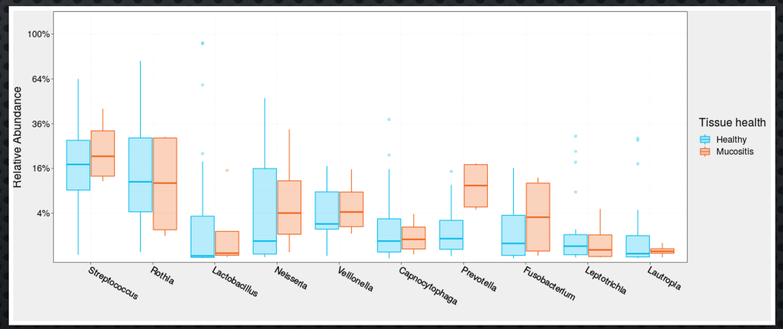


Fig 7. Box plot of relative abundance of microbial genera based on assessment of soft tissue health. No statistical differences noted between health and mucositis; slight elevation in *Prevotella* and *Fusobacterium*.

Conclusion

From the samples obtained in this study, there is a wide range of microbial genera present among all participants and among sampled sites. Samples collected from sites that exhibited signs of mucositis showed a slight increase in microbes associated with inflammation such as *Prevotella* and *Fusobacterium*. Patients that were either previous smokers or current smokers demonstrated an increased prevalence of periodontal pathogens around implants as opposed to increase in relative abundance. At this time, no differences can be discerned from this study between platform switched and platform matched implants. However, alterations of the physio-chemical properties of the healing abutment represented by different implant systems suggest that these modifications may result in altered microbial composition.

This study was funded by a grant from the American Academy of Implant Dentistry Foundation