



# Comparative Microbial Profiling in Dental Prostheses, Natural Teeth, and Implants : An NGS-Based Study

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## Introduction

- ✓ The oral microbiome plays a critical role in maintaining oral and systemic health.
- ✓ Different dental restorative materials influence microbial adhesion and diversity.
- ✓ This study compares microbial composition in supra- and subgingival biofilm of natural teeth, gold crowns, zirconia crowns, and implants using NGS.

## Materials and Methods

- ✓ Study Design: Comparative analysis of microbial communities.
- ✓ Participants: 30 subjects with four types of restorations. (including only individuals with all four prosthetic types)
- ✓ Sample Collection: 120 biofilm samples.
- ✓ DNA Sequencing: 16S rRNA gene sequencing using Sequel platform.
- ✓ Data Analysis: Alpha and beta diversity analysis, biomarker identification.

## Results

- ✓ Gold and zirconia crowns exhibited higher microbial diversity compared to natural teeth and implants.
- ✓ Taxonomic differences:
  - Natural Teeth: *Actinomyces* spp.
  - Gold Crowns: *Prevotella* spp., *Spirochaetes*
  - Zirconia Crowns: *Porphyromonas* spp., *Atopobium* spp.
  - Implants: *Firmicutes*, *Clostridiales*
- ✓ Beta diversity analysis revealed distinct microbial clustering by restoration type.
- ✓ LefSe analysis identified restoration-specific microbial communities, highlighting the influence of material properties on microbiome composition.
- ✓ Gold and zirconia crowns had higher microbial diversity, while implants showed lower diversity, suggesting selective colonization affecting peri-implant health.

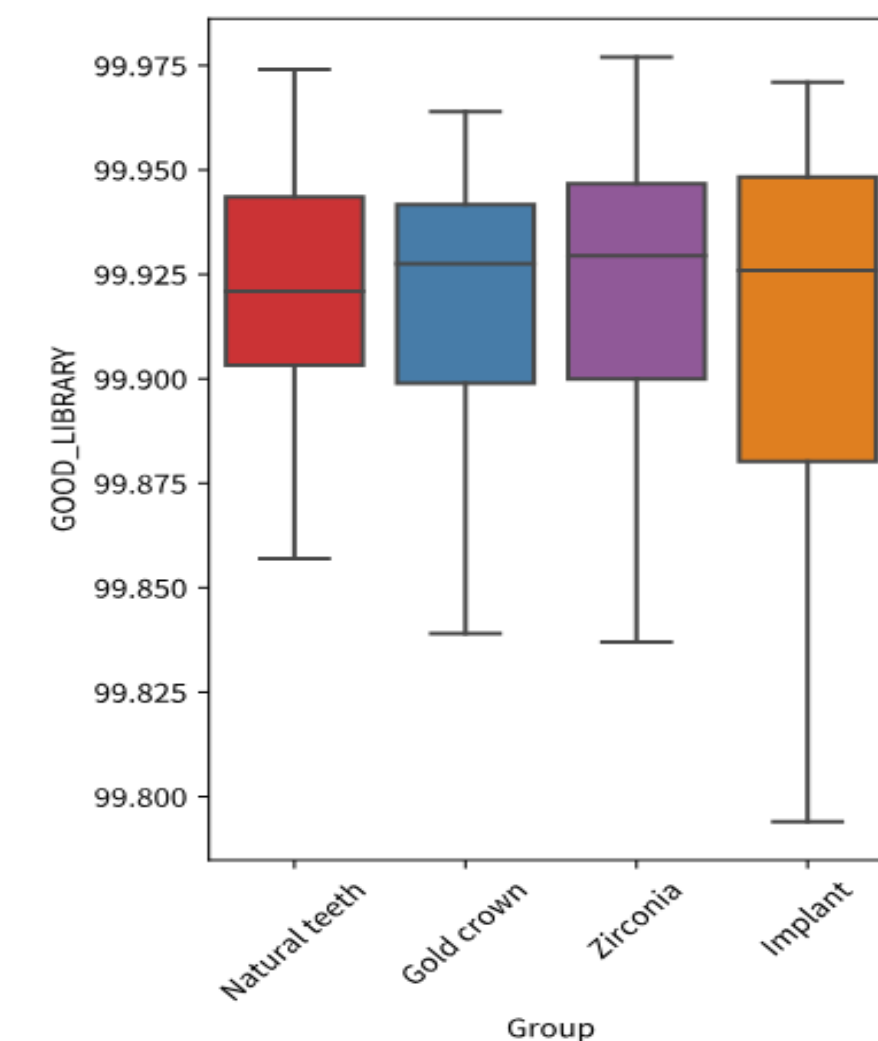


Fig1. Good's coverage estimator (exceeding 99.9% for all samples)

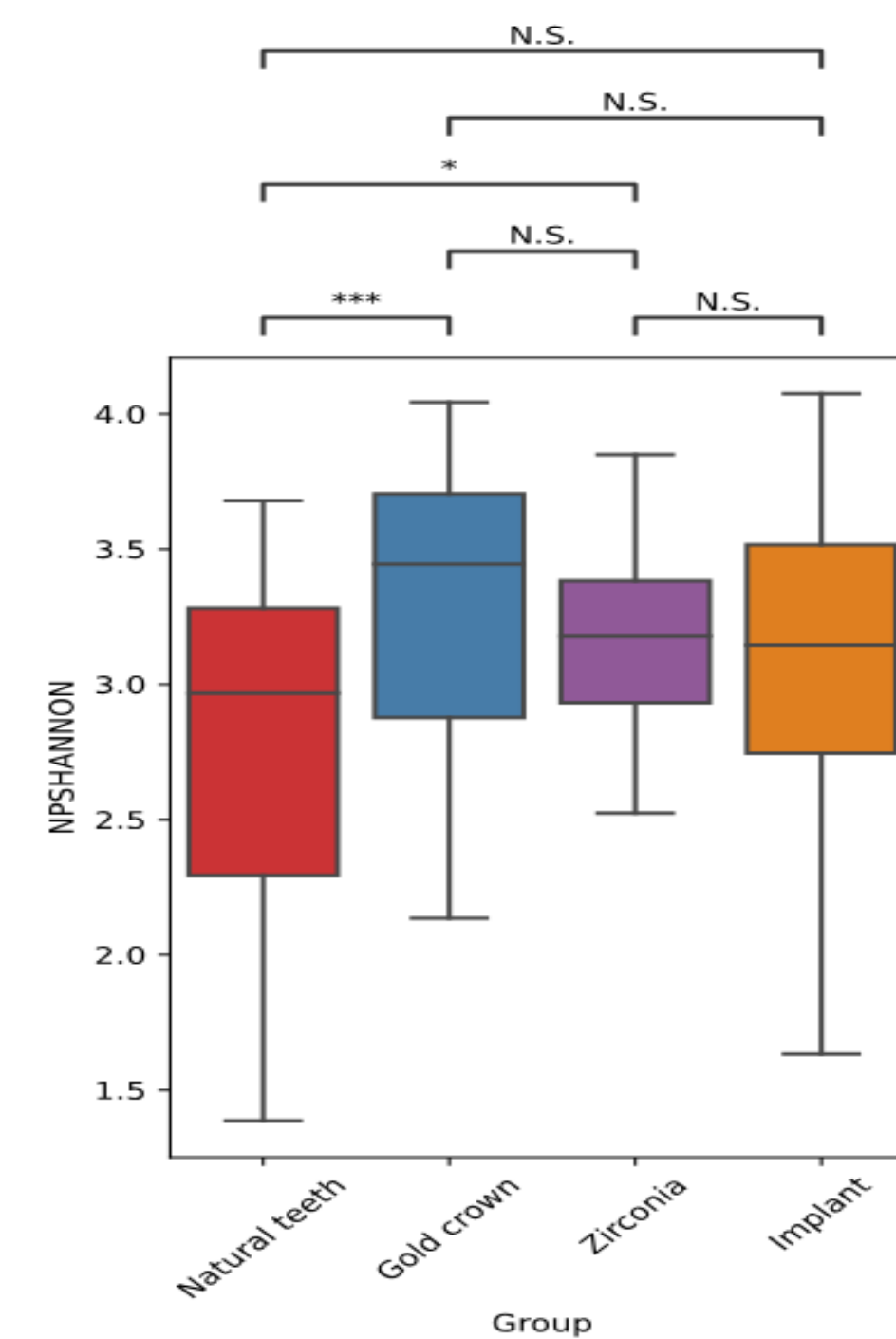


Fig3. Alpha diversity NPSHANNON

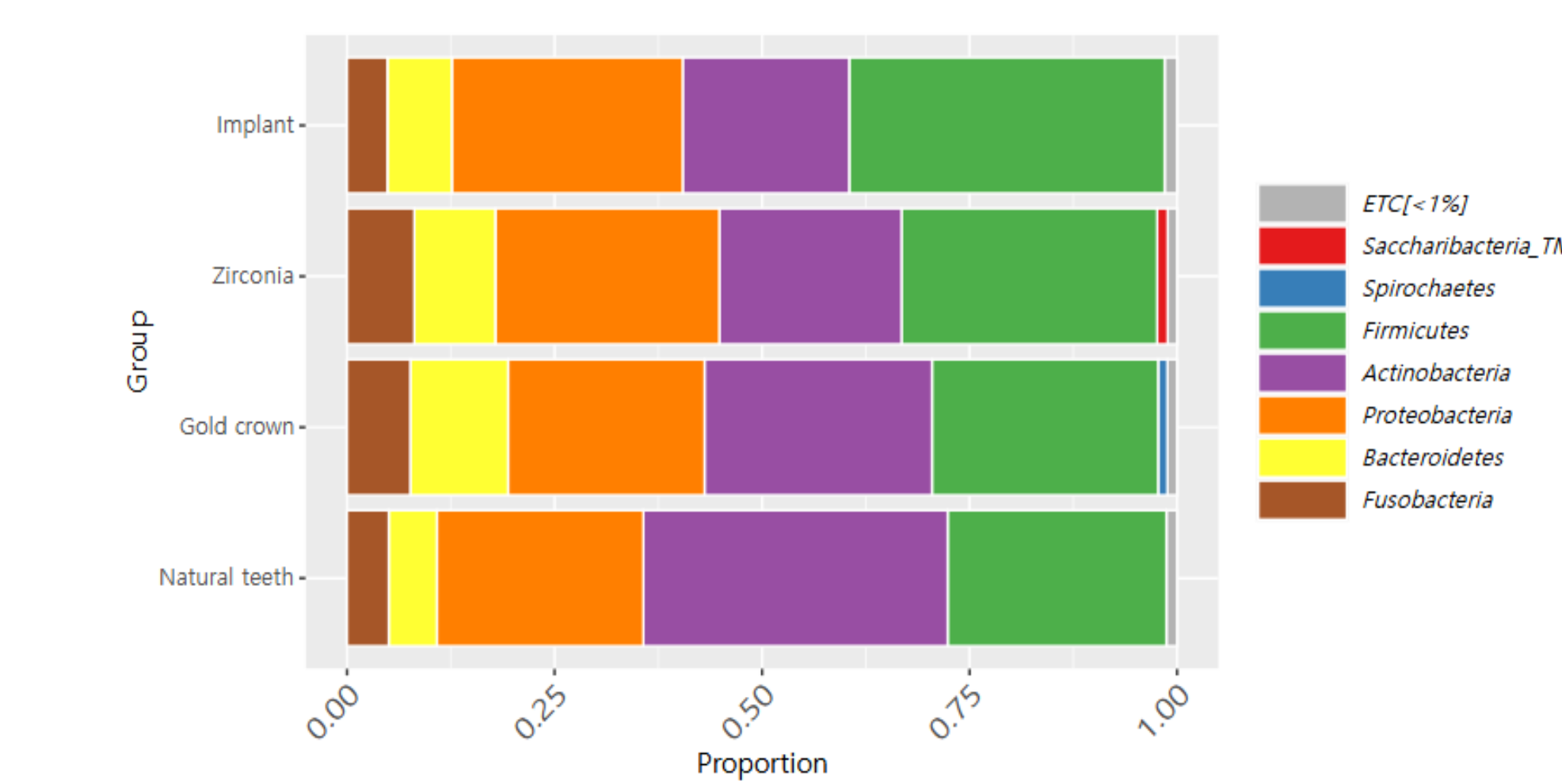


Fig2. The taxonomic composition analysis of microbial communities (Implant, Zirconia crown, Gold crown, Natural teeth ; phylum level)

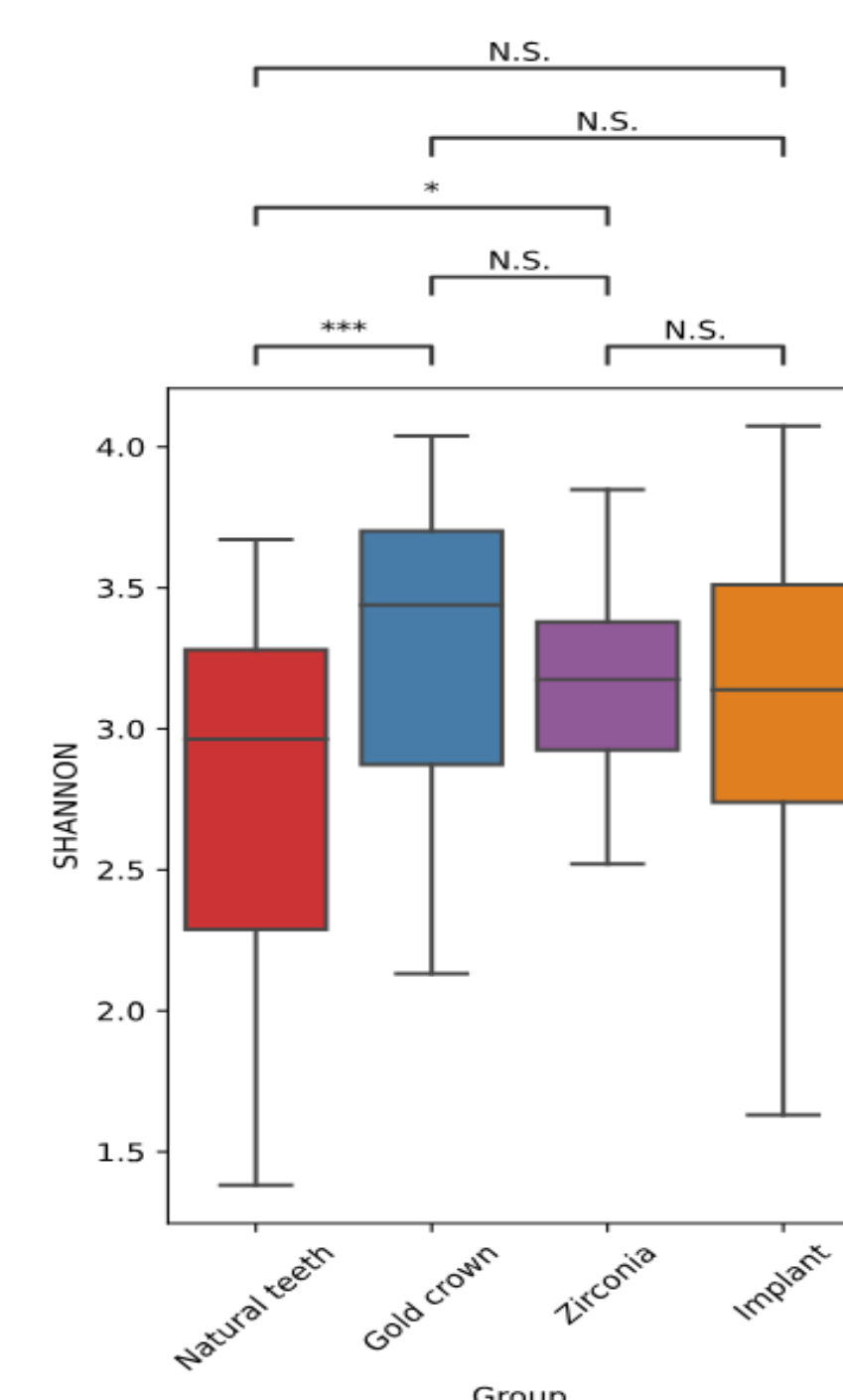


Fig 4. Alpha diversity SHANNON

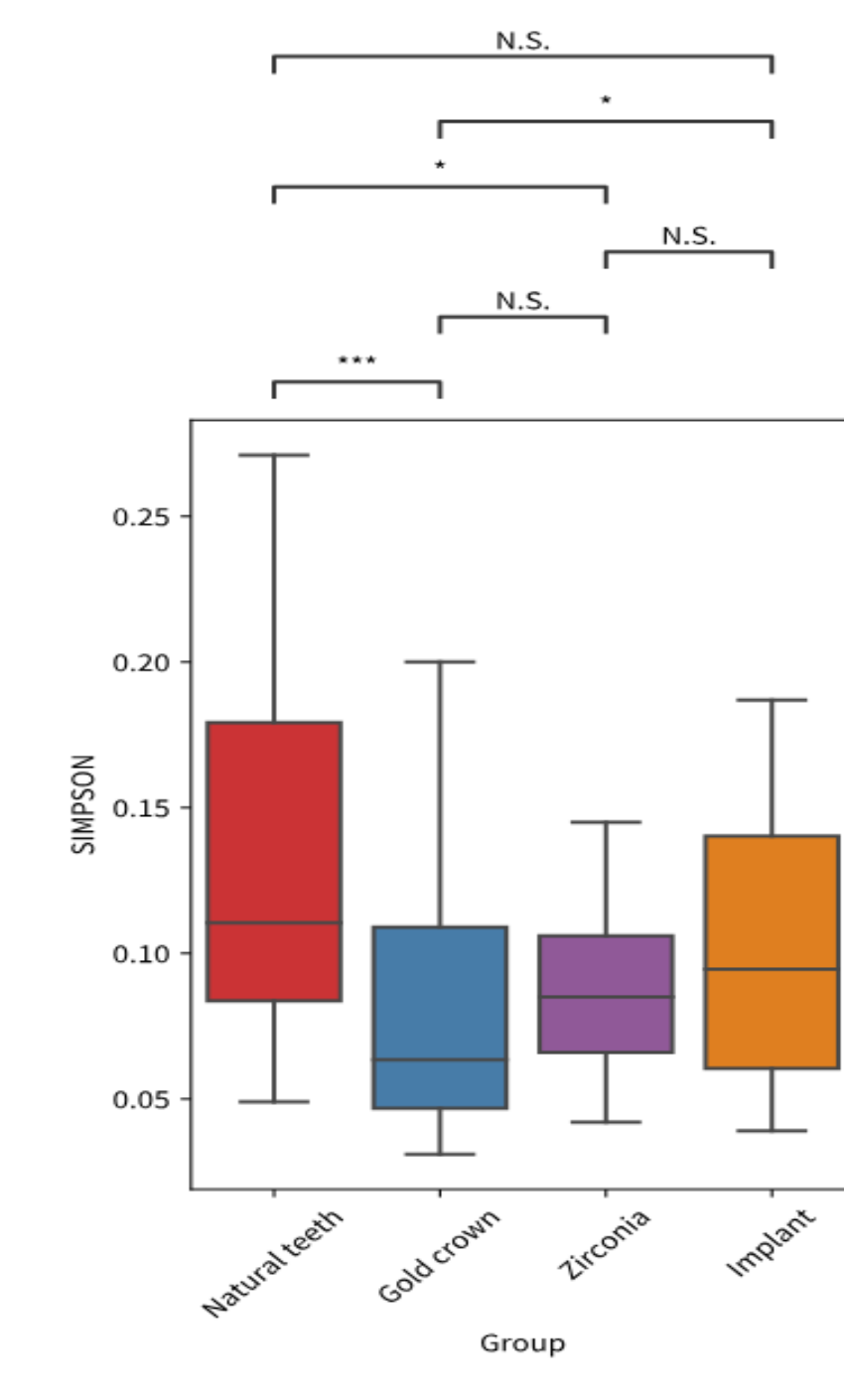


Fig 5. Alpha diversity SIMPSON

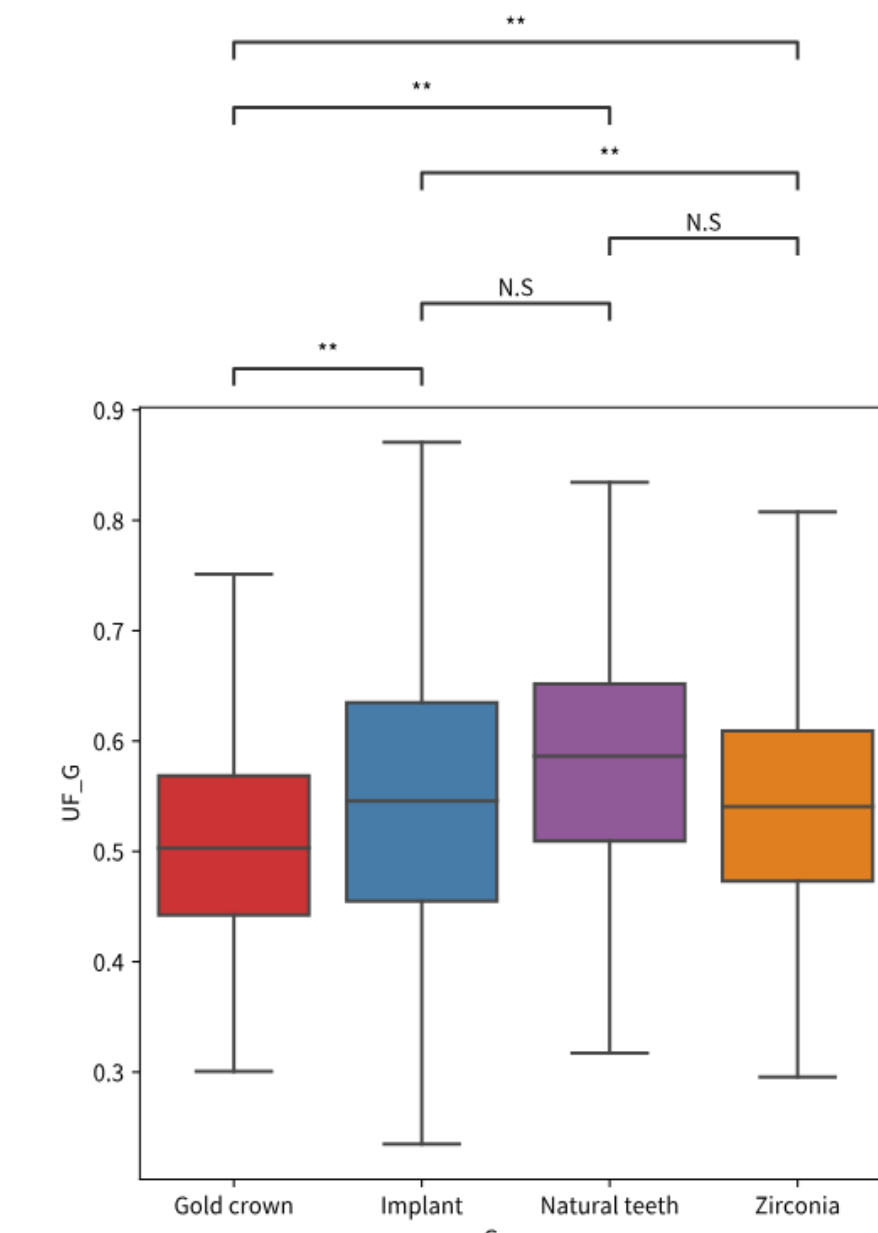


Fig 6. Beta diversity Uni-Frac boxplot diagrams

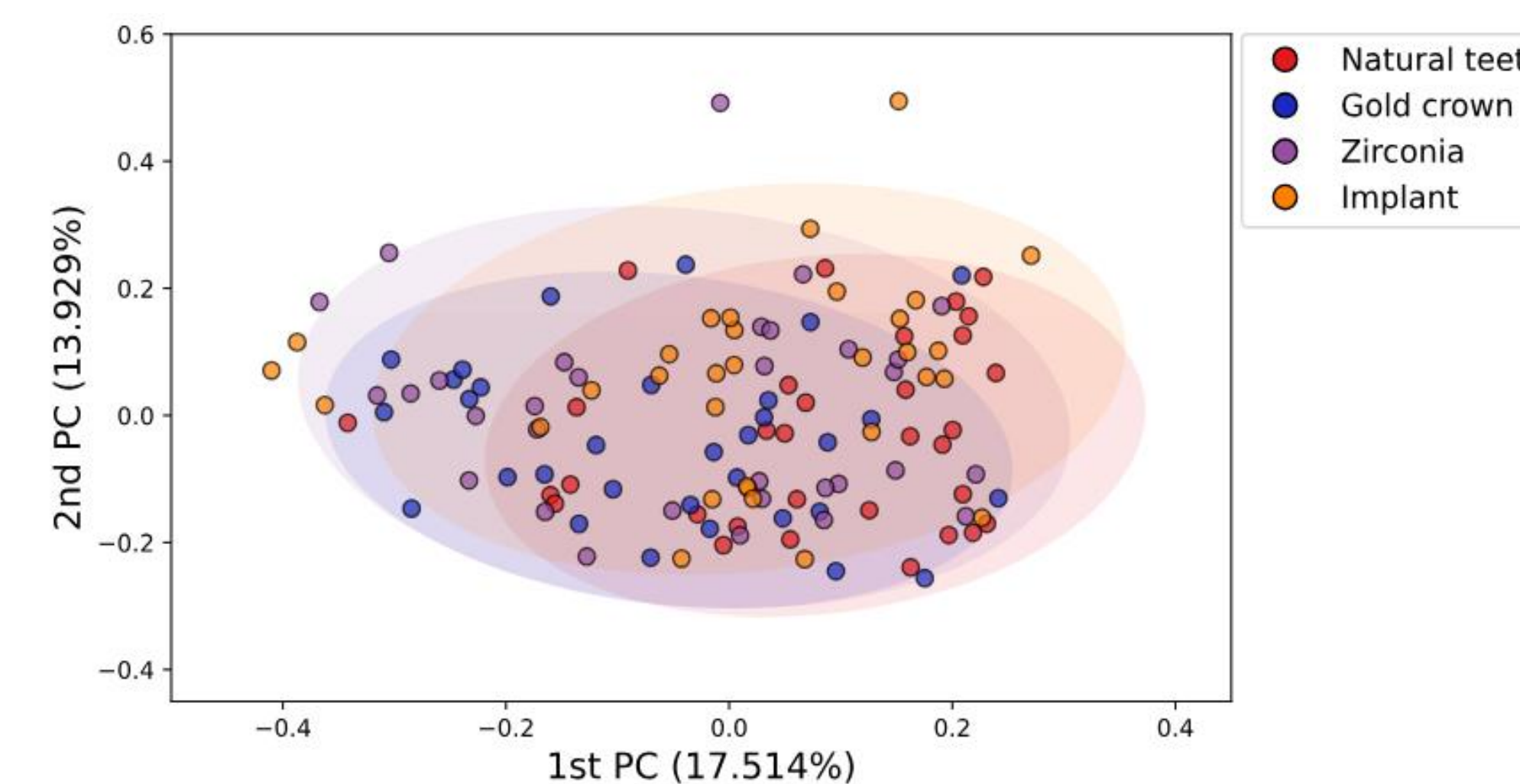


Fig 7. Beta diversity Uni-Frac The plot of principal coordinates analysis (PCoA)

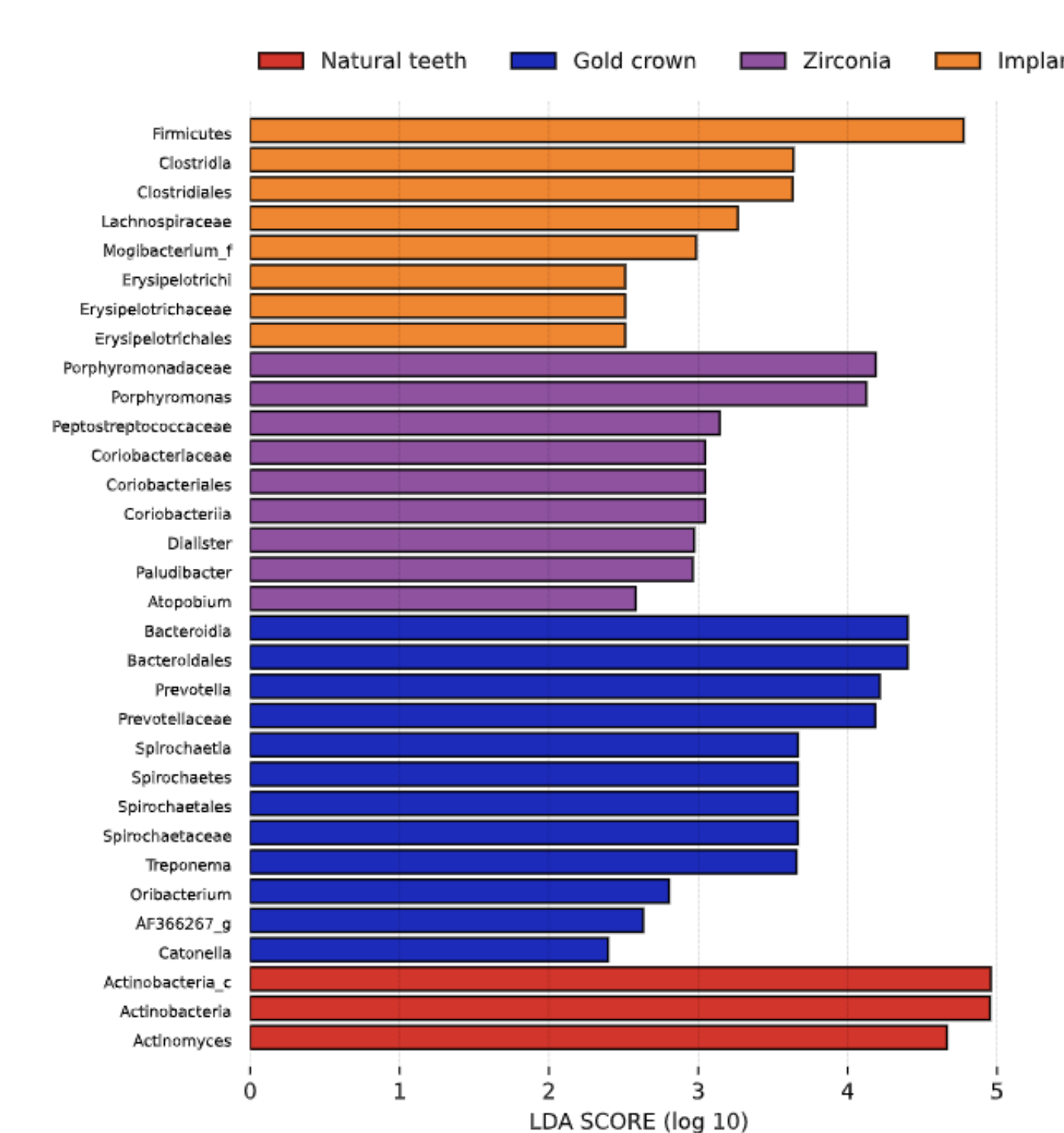


Fig 8. Taxonomic Biomarker LefSe plot

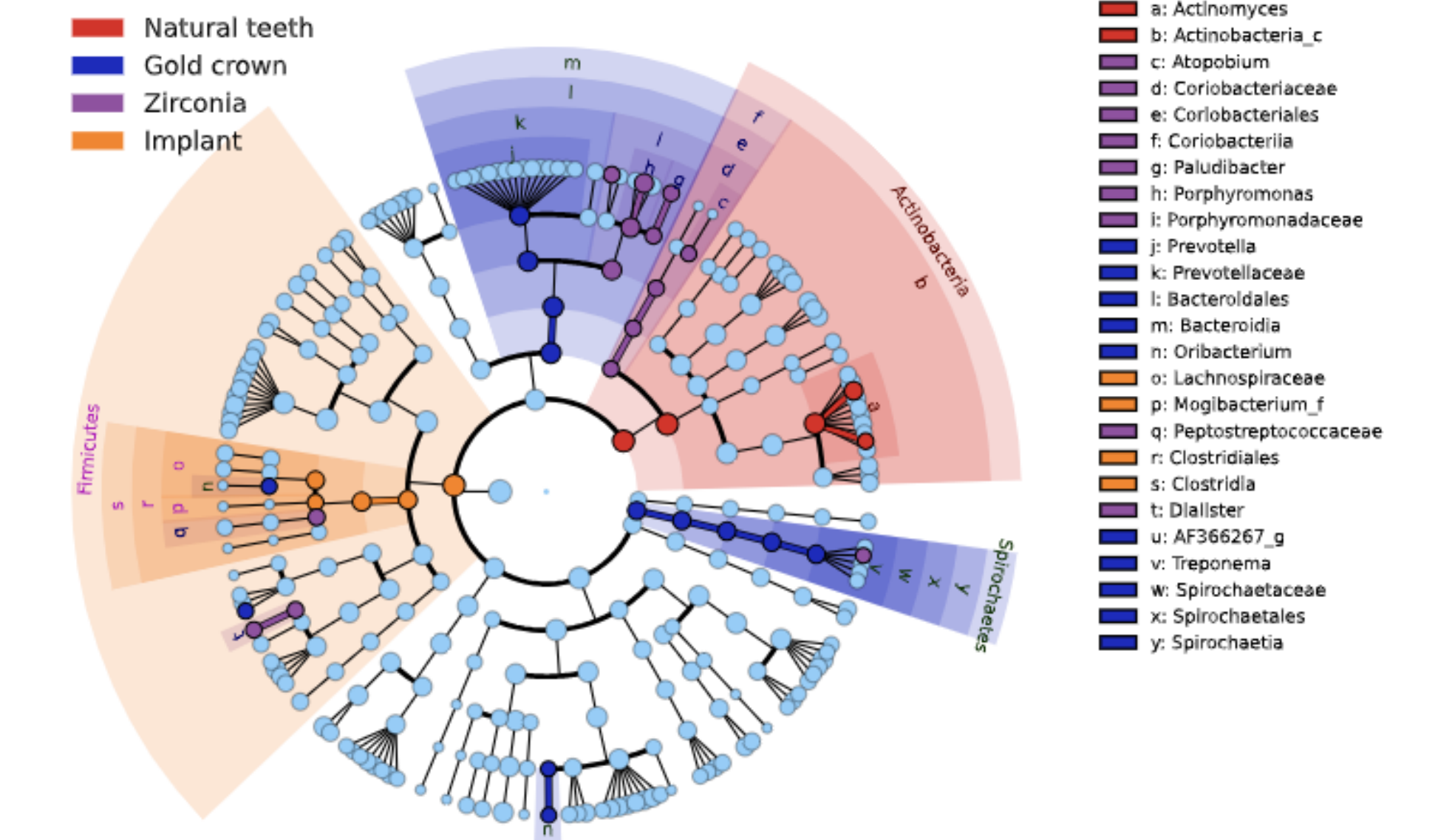


Fig 9. Taxonomic Biomarker LefSe cladogram

## Results

- ✓ Dental restorative materials play a crucial role in shaping the supra- and subgingival microbiome.
- ✓ Surface characteristics influence microbial adhesion, biofilm composition, and diversity.
- ✓ Understanding microbial shifts across different materials can aid in optimizing restorative material selection to maintain oral microbial balance.
- ✓ Future research should investigate the long-term stability of microbial communities and their clinical implications, including the risk of peri-implantitis and other complications.

## Selected References

1. Herrmann, H., et al. (2020). Early and mature biofilm on four different dental implant materials: An in vivo human study. *Clin Oral Implants Res*, 31(11), 1094-1104.
2. Guo, M., et al. (2022). Differences in supragingival microbiome in patients with and without full-crown prostheses. *Dentistry Journal*, 10(8), 152.
3. Sánchez, M., et al. (2014). An in vitro biofilm model associated with dental implants: Structural and quantitative analysis. *Dental Materials*, 30(10), 1161-1171.
4. Di Spirito, F., et al. (2024). Microbiota of peri-implant healthy tissues, peri-implant mucositis, and peri-implantitis: A comprehensive review. *Microorganisms*, 12(6), 1137.
5. Daubert, D.M., & Weinstein, B.F. (2019). Biofilm as a risk factor in implant treatment. *Periodontol* 2000, 81(1), 29-40.
6. Al-Ahmad, A., et al. (2018). Shift of microbial composition in peri-implantitis-associated biofilm. *J Med Microbiol*, 67(3), 332-340.
7. de Melo, F., et al. (2020). A systematic review of microbiota composition in peri-implant conditions. *Arch Oral Biol*, 117, 104776.
8. Langille, M.G., et al. (2013). Predictive functional profiling of microbial communities. *Nat Biotechnol*, 31(9), 814-821.