Prosthetics of dental implants- surface roughness and *P. gingivalis* growth in vitro

Julius Maminskas¹; Monika Zaleckyte¹; Jurgis Pilipavicius²; Aivaras Kareiva²; Gediminas Zekonis¹; Gintaras Juodzbalys³

¹Department of Prosthodontics, Lithuanian University of Health Sciences, Lithuania; ²Department of Inorganic Chemistry, Faculty of Chemistry, Vilnius University, Lithuania; ³Department of Maxillofacial Surgery Lithuanian University of Health Sciences, Lithuania

**Background:** Undoubtedly the implant success is concerned not only with successful osseointegration, but also with long term functional stability. The function depends on prosthetics and supra-implant restoration is an important for mastication and aesthetics. Moreover, restoration is in a direct contact with peri-implant soft tissues, which can attached on the surface by epithelium junction. The stability of this biological barrier depends on restoration design, choice of materials and theirs surface.

**Aim/Hypothesis:** Evaluate the surface roughness of different materials after polishing and estimate the growth of bacteria *Porphyromonas gingivalis* depending on the roughness of the surface.

**Material and Methods:** Four groups of different prosthetic materials (n = 10) were used in this study- zirconium oxide (YSZ), polyetheretherketone (PEEK), polymethyl methacrylate (PMMA) and titanium grade 5 (Ti). All samples were polished decreasing the size of silicon carbide grains as follows- 1000, 1500, 2000, 2500, 3000, 4000, 6000. The final polishing was done with diamond paste and felt wheel. The 3D analysis of surface micro-morphology and roughness (Ra) measuring was performed with atomic force microscope (AFM). *P. gingivalis* ATCC 33277 monoculture was used for microbiological evaluation. The lyophilized bacterium was sown in Shaedler’s agar with vitamin K1 and 5% sheep’s blood. Anaerobic conditions were made for bacterial growth at 35°C, where they were grown for 48 hours. Subsequently, the colony formation units formed per milliliter (CFU ml) on the surface of all groups were measured. Statistical analysis was performed on SPSS 22 and Kruskal-Wallis, Mann-Whitney, Chi-Square tests was applied.

**Results:** The same polishing of four different materials shows different roughness (Ra) as follows- PMMA - 62.33 nm, PEEK - 49.57 nm, Ti - 22.05 nm, YSZ - 9.36 nm. The highest glossiness was achieved with polished YSZ and vice versa the highest roughness with polished PMMA. Statistically significant results were obtained from CFU ml obtained between all test groups- PMMA, PEEK, Ti and YSZ (P < 0.05). No statistically difference were found between Ti and YSZ. The material roughness rates were significantly correlated with the number of bacteria colonies formed on the surface of the materials. The highest *P. gingivalis* mean was obtained in the group with PMMA 3.27 x 10⁸ CFU ml. YSZ had lowest mean 0.72 x 10⁸ CFU ml.

**Conclusions and Clinical Implications:** The highest glossiness could be achieved with polished titanium and zirconium oxide. The growth of bacteria depends on surface roughness. Titanium and zirconium oxide are the most suitable material for peri-implant support because bacteria have the lowest growth on these materials. However, this study is limited only with monoculture pathogens of peri-implantitis. Moreover, the adhesion of soft tissue cells should be estimated in a future.