Removal of dental plaque biofilm on titanium discs using different plasma devices and settings

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Dental biofilms plays a major role in the pathogenesis of peri-implantitis. Biofilm removal is a prerequisite for a successful therapy of peri-implant lesions; In this study we evaluated different plasma sources with different gas mixtures concerning biofilm removal.

We assessed the biofilm removal of kINPen08, (1,8 MHz, 2-6 kVpp, 5-8 slm), with and without an additional metal cap to exclude the influence of charge carriers but to let radiation and reactive species pass and a needle discharge (13 kV with argon or 10 kV with helium, 5 W with both gases) with 5000 sccm argon, 5000 sccm argon+6.5 sccm O_2 , 5000 sccm argon+50 sccm O_2 , 5000 sccm helium, 5000 sccm helium+6.5 sccm O_2 and 5000 sccm helium+50 sccm O_2 plasma against subgingival multispecies anaerobe biofilm grown on titanium discs *in vitro*. The biofilm was stained with Mira2ton® and treated with plasma for 1, 3 and 5 min respectively. Efficacy of plasma treatment was determined by the microscopically captured, unstained area without biofilm.

The biofilm removal of kINPen08 was very intensive and the treated surface was clean without protein residues. The other devices remove biofilm, too, but in a sparser way. This removal rate was under the detection rate of our measurement system, because here, we also measured stained bacterial protein residues. The biofilm removal is a time-dependent process. The longer the treatment, the greater the ablated surface (Fig. 1). Moreover, the higher the oxygen admixture, the higher the biofilm free surface. This was the case for both gases, helium and argon. Furthermore, the biofilm removal is increased by adding oxygen.

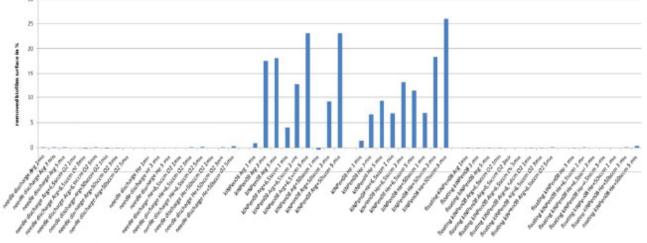


Figure 1: *Removed biofilm on the surface in % of the whole disc surface* KINPen08 is the most potent plasma source concerning biofilm removal. Because of the high heat generation of this plasma device a new needle discharge plasma device was developed. To ensure patient safety a kINPen08 with a metal cap was used as well. Both safety devices did not remove the biofilm in the same extend like kINPen08. Therefore it is necessary to combine the plasma process with mechanical biofilm removal.