

# Microbial approaches for the assessment of toothpaste efficacy against oral species – a method comparison

Pune Paqué<sup>1</sup>, Lamprini Karygianni<sup>1</sup>, Julien Kneubühler<sup>2</sup>, Lorenzo Fiscalini<sup>2</sup>, Daniel B. Wiedemeier<sup>1</sup>, Marcel Müller<sup>1</sup>, Thomas Attin<sup>1</sup>, and Thomas Thurnheer<sup>1</sup>

<sup>1</sup>University of Zurich

<sup>2</sup>privat dental praxis in Zurich

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## Abstract

Antibacterial properties of toothpastes enable chemical plaque control in limited-access tooth regions that are mechanically not sufficiently reached by toothbrushes. Therefore, this study aimed to compare different microbial methods to assess antimicrobial toothpaste properties and evaluate different toothpastes in terms of their antibacterial efficacy against different oral microorganisms in vitro. Six toothpaste suspensions with varying antibacterial supplements were applied to a multi-species biofilm model (*Actinomyces oris*, *Candida albicans*, *Fusobacterium nucleatum*, *Streptococcus oralis*, *Streptococcus mutans*) as well as to each microorganism. A culture method was used to assess the anti-biofilm effects and two different agar diffusion assays were performed for testing the antimicrobial effect on each microorganism. The measurements of the culture and diffusion analyses were statistically normalized and compared and toothpastes were ranked according to their antimicrobial efficacy. The results of both agar diffusion assays showed a high correlation across all tested species (Spearman correlation coefficients  $\rho_s > 0.95$ ). The results of the multi-species biofilm model, however, substantially differed in its assessment of antibacterial properties ( $\rho_s$  ranging from 0.22 to 0.87), compared to the results of both diffusion assays. Toothpastes with amine fluoride with and without stannous fluoride, and triclosan resulted in the highest antimicrobial efficacy, while activated carbon supplements were comparable to the negative control NaCl. The appropriate selection of a broad range of oral microorganisms seems crucial when testing the chemical impact of toothpastes and toothpaste supplements.

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