

Combined Chemical and Mechanical Debridement Enhances Salivary Protein Removal from Titanium While Maintaining Biological Properties

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Background

Effective decontamination of dental implants is essential for managing peri-implant diseases, yet its impact on the salivary pellicle and cell response remains unclear. As the pellicle mediates bacterial and host cell interactions, investigating how decontamination alters its composition is key to understanding the effects on biological outcomes.

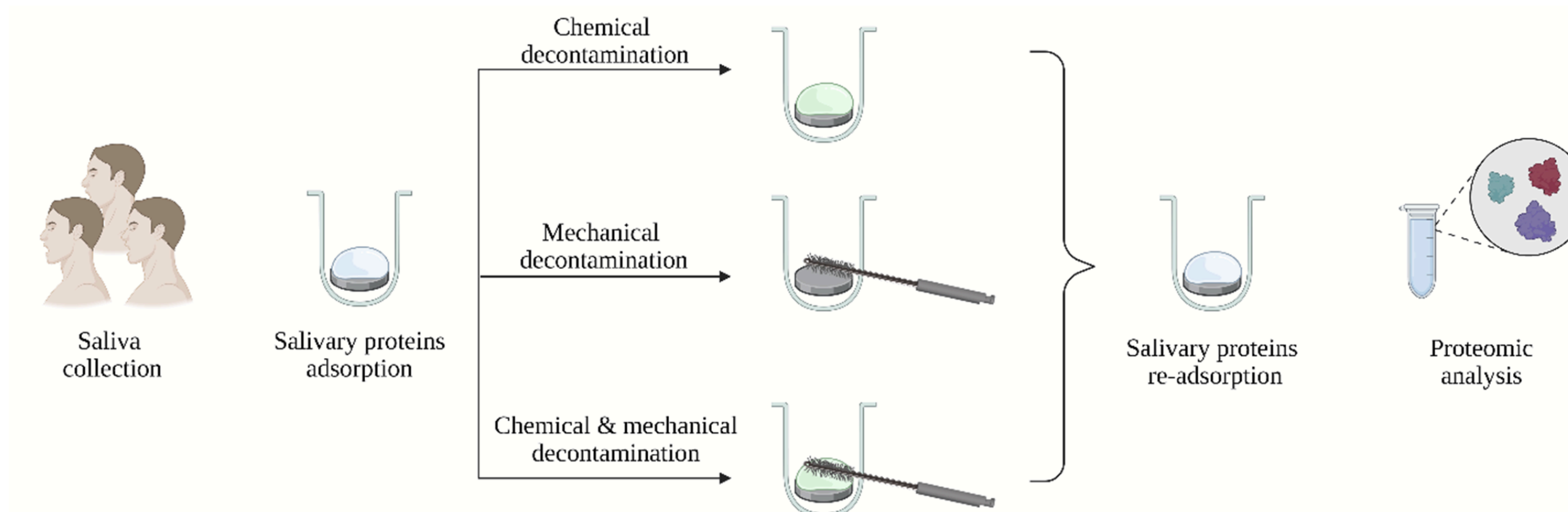
Aim

The aim is to examine how a Poloxamer 407 (P407) hydrogel, a P407 + hydrogen peroxide (H₂O₂) hydrogel, a titanium brush, and their combinations influence the adsorbed salivary proteins and cell adhesion on OsseoSpeed®-like titanium surfaces.

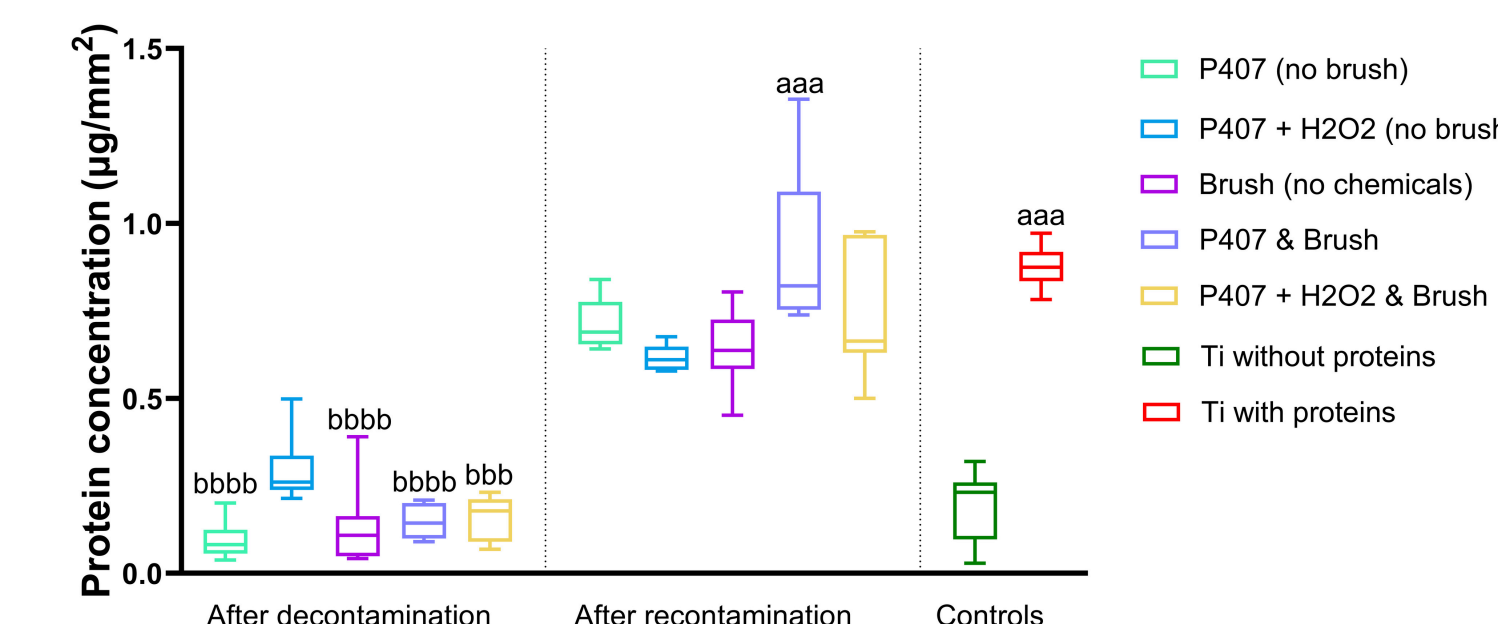
Methodology

- Surfaces were coated with salivary proteins and treated with different decontamination methods before being re-exposed to saliva. Protein-coated and protein-free surfaces served as controls.
- Protein quantity was measured using a MicroBCA assay.
- Proteomic composition and molecular functions of the adsorbed proteins were determined by liquid chromatography-mass spectrometry and gene ontology analysis.
- Human bone marrow mesenchymal stem cell (hBMSC) adhesion was assessed on the surfaces at 30, 60 and 120 minutes.
- Cytotoxicity was evaluated using an LDH assay.

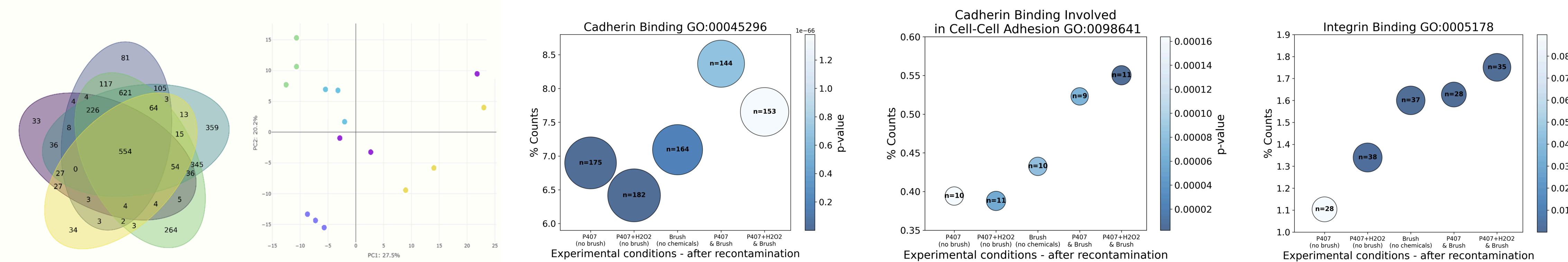
1 Surface coating with salivary proteins



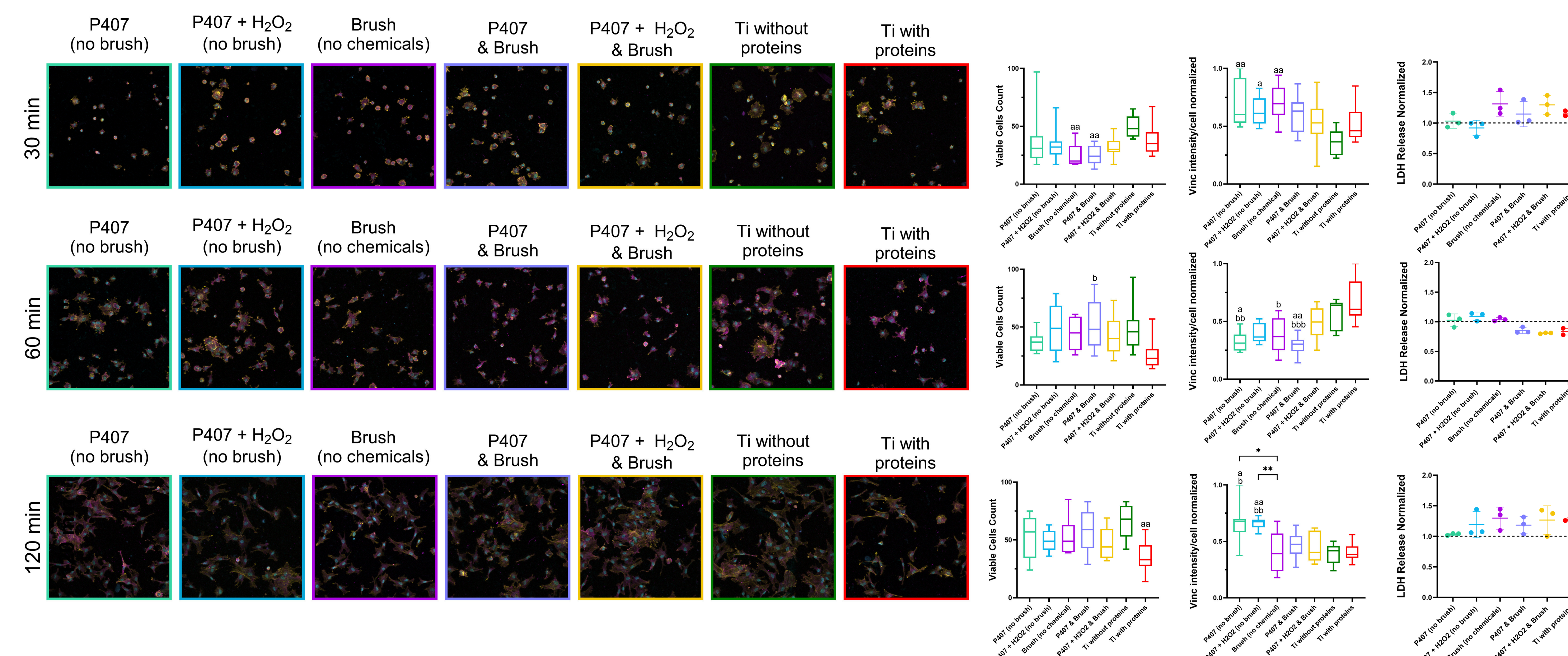
2 Protein quantification



3 Protein diversity, principal component analysis and gene ontology - molecular function analysis



4 hBMSCs adhesion, viable cell counts, normalized vinculin intensity



5 Cytotoxicity

Statistics

*, a and b represent a statistically significant difference among the groups, compared to the protein-free surface and to the protein-coated surface, respectively, according to a Kruskal-Wallis rank-sum test followed by a Dunn's multiple comparison test (*p < 0.5, **p < 0.01, *** p < 0.001).

Conclusions

- Decontamination methods selectively modify the proteomic profile.
- Mechanical action is necessary for improved removal of salivary proteins.
- Combined chemical and mechanical decontamination further enhances the removal of salivary proteins and limits their re-adsorption.
- All decontamination methods preserved cytocompatibility under the experimental conditions.
- P407 hydrogels and titanium brushes hold promise as debridement methods for dental implants.

Acknowledgements

This work was supported by the Research Council of Norway

The Research Council of Norway Grants #295910, 331752, 332148, 359679, 346292

Conflicts of interest

The hydrogels and the titanium brush used in this study are patented innovations assigned to Corticalis AS.