Characterization of the antibacterial potential of the protein SCPPPQ1

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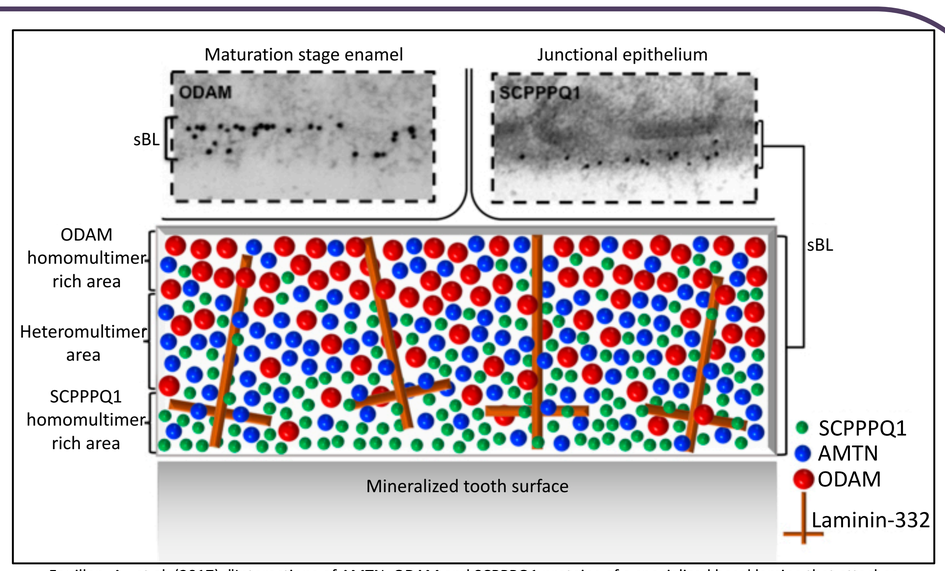
BACKGROUND

Periodontal diseases (PD) in its various forms affect 4 out of 5 adults worldwide. In addition to oral manifestations, they are linked to major systemic complications that are life-threatening. **Bacteria are the primary causative agents** of these diseases. Invasion of the internal areas of the periodontium by bacteria ultimately leads to the loss of teeth and bone. Formation of periodontal pockets open the door to a more aggressive phase of PD. These pockets originate either by detachment of junctional epithelium (JE) cells from the tooth surface or through weakening cell cohesion and separation of these cells. Our team recently demonstrated that PD-associated bacteria can alter the structural organization of the specialized basal lamina (sBL) that mediates adhesion of the JE to the tooth, and more specifically degrade all its components (AMTN, ODAM, Lam332) but one (**SCPPPQ1)**.

In addition to its resistance, we have further shown that **SCPPPQ1** expresses strong antibacterial activity against *Porphyromonas gingivalis (P. gingivalis)*. This unexpected finding may represent a novel component of the innate response of the body to PD.



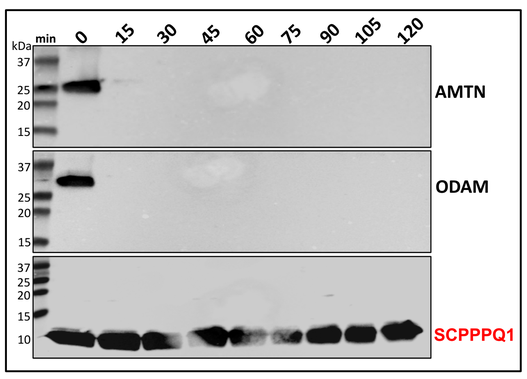
Fouillen, A., et al. (2017). "Interactions of AMTN, ODAM and SCPPPQ1 proteins of a specialized basal lamina that attaches epithelial cells to tooth mineral." Sci Rep **7**: 46683.

GOAL

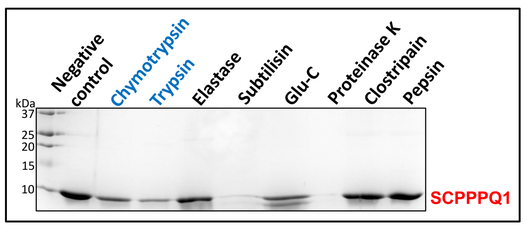
The aim of this work is to determine how SCPPPQ1 achieves its antibacterial effect with the objective of using this unique protein and its derivatives in novel therapeutic strategies for the treatment of PD.

METHODS AND RESULTS

Digestion profiles of SCPPPQ1



Western blot analysis of digestion profiles by *P. gingivalis* at different incubation times show the resistance of SCPPPQ1 to enzymes produce by the bacteria.



Western blot analysis of digestion profiles by various enzymes after 1h of incubation show the resistance of SCPPPQ1.

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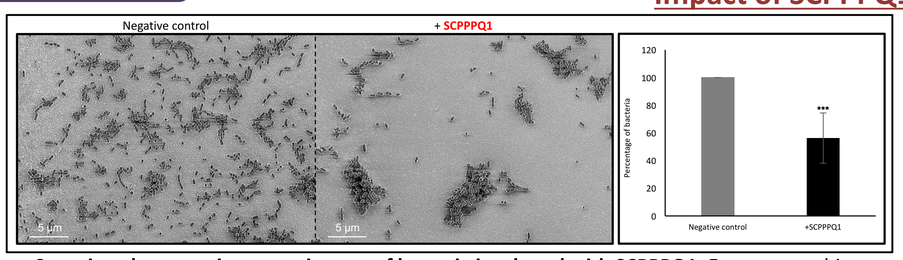
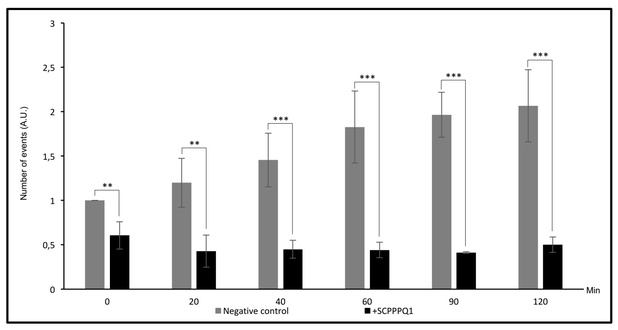
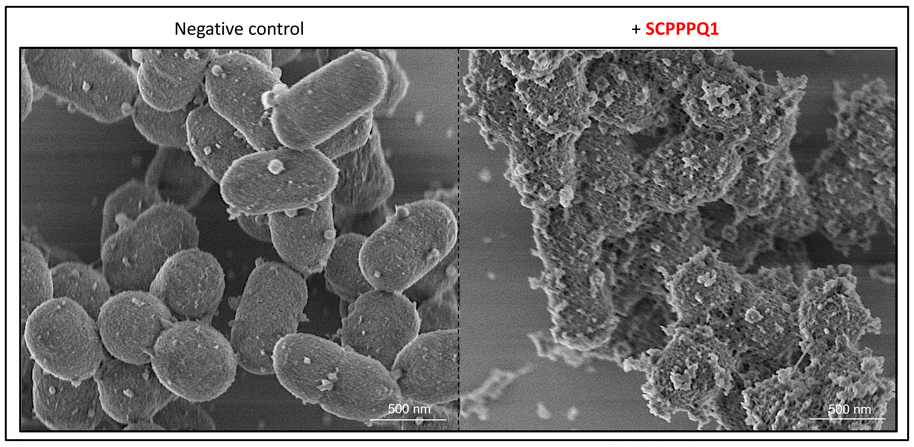
Impact of SCPPPQ1 on *P. gingivalis*



Scanning electron microscopy images of bacteria incubated with SCPPPQ1. Exposure to this protein induces significant diminution of bacteria on titanium surfaces.

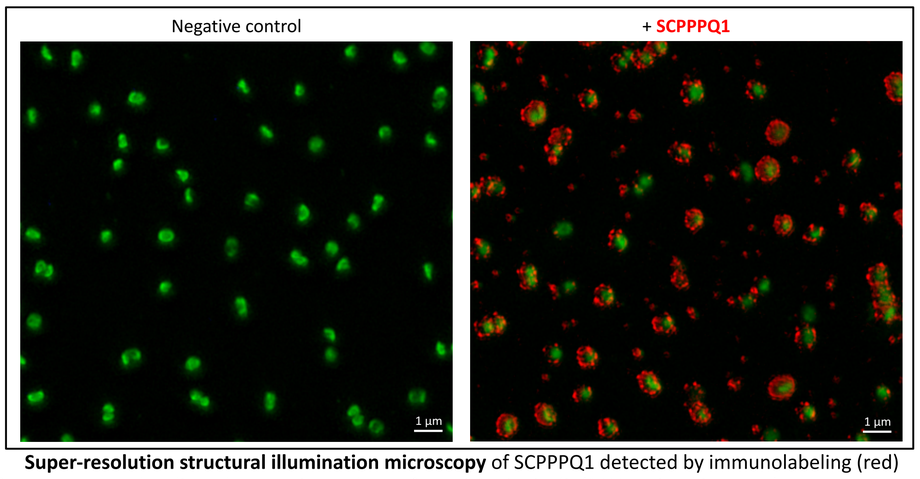
fluorescence-activated cell sorting of bacteria incubated with SCPPPQ1. Exposure to this protein induces significant diminution of bacteria during time.



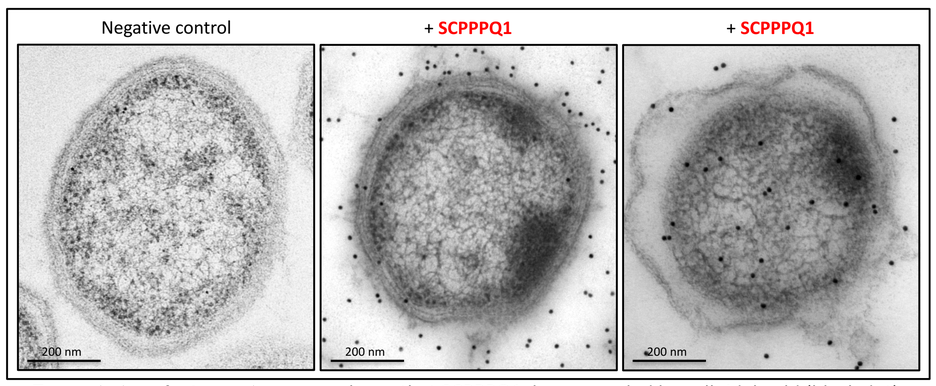


Scanning electron microscopy images of bacteria incubated with SCPPPQ1. Exposure to this protein induces membrane degradation.

Localisation of SCPPPQ1 on *P. gingivalis*



Super-resolution structural illumination microscopy of SCPPPQ1 detected by immunolabeling (red) localizes the protein on the surface of *P. gingivalis* (DNA stained in green).



Transmission electron microscopy shows that SCPPPQ1, here revealed by colloidal gold (black dot), surrounds and/or penetrates the bacteria cells.

CONCLUSION

These results indicate that SCPPPQ1, a unique protein naturally-expressed by the junctional epithelium, can directly attack *P. gingivalis* via the outer membrane, resulting in the death of the bacteria.

ACKNOWLEDGMENTS

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NSERC CRSNG

CIHR IRSC Canadian Institutes of Health Research / Instituts de recherche en santé du Canada

PERSPECTIVES

- The antibacterial potential of SCPPPQ1 promises novel nature-inspired preventive and therapeutic approaches to fight PD.
- Since antimicrobial resistance is a major problem worldwide, a better definition of the antibacterial potential of SCPPPQ1 (or derived peptides) may allow to target a broader spectrum of bacteria, for instance implicated in nosocomial infections or neurodegenerative disorders.