Development of a Broadly Protective Vaccine Targeting Dental Cavities

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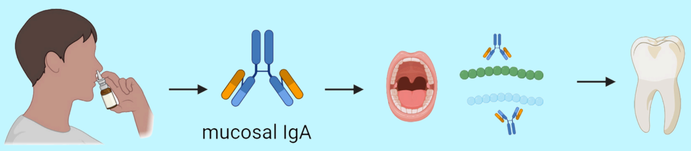
Background

Oral diseases are among the most prevalent non-communicable conditions worldwide, affecting an estimated 3.5 billion people. Praetorian Bio is developing first-in-class vaccines targeting both dental caries and *P. gingivalis*. Dental caries, driven primarily by *Streptococcus mutans* and *Streptococcus sobrinus*, is the most common childhood disease. Current interventions remain reactive and procedure-based, relying on costly dental care infrastructure that is often inaccessible in low-resource settings.

First-in-class vacccine

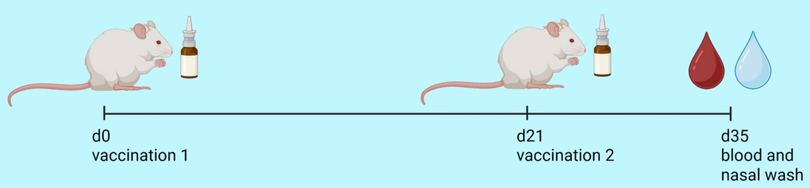
Praetorian Bio is developing a first-in-class vaccine targeting the microbial drivers of dental cavities at their root. The approach aims to generate broad mucosal immune responses that provide durable protection against complex, biofilm-associated pathogens including *Streptococcus mutans* and *Streptococcus sobrinus*. A schematic overview of the mechanism is provided below.



Methods

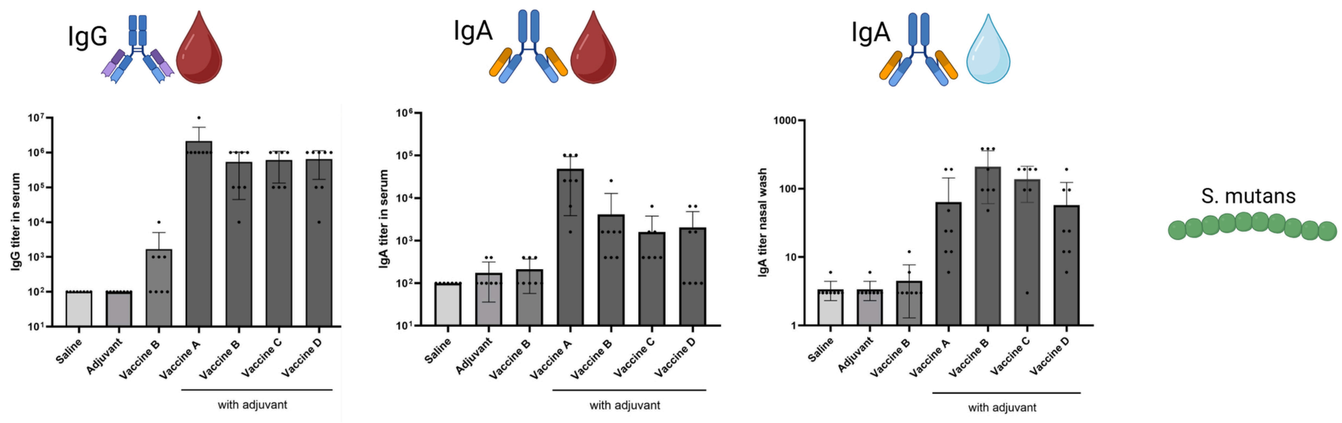
BALB/c mice were intranasally immunized on Days 0 and 21 with different vaccine formulations. All included a potent mucosal adjuvant, except Concept B, which was also tested without adjuvant. Two weeks post-boost, serum and nasal washes were collected. Antigen-specific IgG and IgA responses, as well as reactivity against whole-cell *Streptococcus mutans* and *S. sobrinus*, were quantified by ELISA.

Plates were coated with whole cell bacteria to determine the capacity of induced antibodies to recognize membrane proteins in their native conformation.



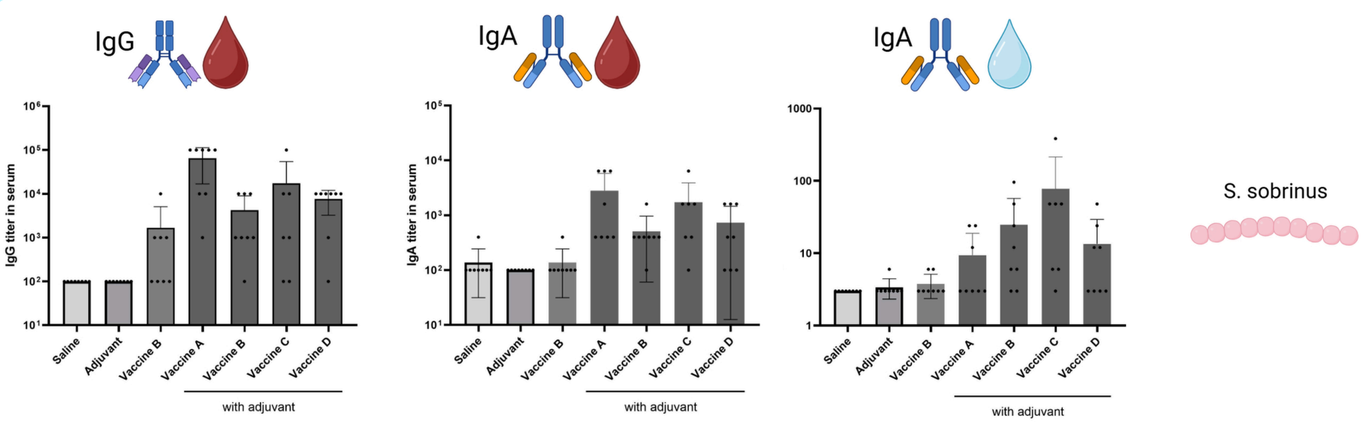
Induction of systemic and mucosal immune responses against *S. mutans*

The induction of an immune response against S. mutans after intranasal vaccination with the vaccine candidates was determined using ELISA. Plates were coated with whole cell S. mutans to determine the capacity of induced antibodies to recognize membrane proteins in their native conformation. All candidates induced strong systemic IgG and detectable serum IgA responses. The absence of adjuvant markedly reduced antibody titers, confirming the adjuvant effect. Most importantly, all candidates also elicited *S. mutans*–specific mucosal IgA in nasal washes.



Reactivity against *S. sobrinus*

To achieve broad-spectrum protection, reactivity was also tested against whole-cell *S. sobrinus*. Systemic IgG, systemic IgA, and mucosal IgA were consistently detected, though titers were slightly lower than for *S. mutans*. These results demonstrate that the vaccine candidates can elicit cross-reactive humoral responses against both *S. mutans* and *S. sobrinus*—the two main bacterial drivers of dental caries—supporting their potential to establish a comprehensive immune barrier at systemic and mucosal levels.



Conclusions

First proof-of-concept achieved for a mucosal caries vaccine. Intranasal vaccination with our candidates induced strong systemic IgG and IgA responses against *S. mutans* and generated detectable mucosal IgA at the site of infection. The antibodies also recognized *S. sobrinus*, extending protection to both major cariogenic pathogens. These results provide proof-of-concept for a first-in-class mucosal vaccine to prevent dental caries.

Take-home messages

- Intranasal vaccination induces strong systemic and mucosal antibody responses.
- Cross-reactivity with *S. mutans* and *S. sobrinus* broadens protection.
- Proof-of-concept achieved for a first-in-class caries vaccine.
- Praetorian Bio is advancing this and other oral vaccines towards the clinics.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