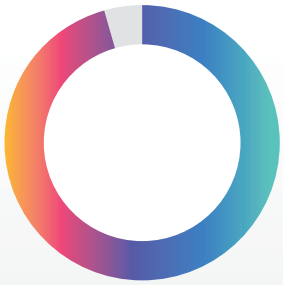
Role of Stannous Fluoride Dentifrice stabilized with nitrate and phosphate in Reducing Bacterial Metabolism and Viability

The efficacy of stannous fluoride is strongly correlated with the stability of the stannous ion.

The stabilisation of stannous fluoride with tetrasodium pyrophosphate and potassium nitrate (SNaP) provides sustained in vitro antibacterial efficacy in toothpaste, outperforming other stannous and sodium fluoride formulations.

REDUCTION COMPARED TO SnF TOOTHPASTE STABILISED WITH SODIUM GLUCONATE:

95.6% ↓
in bacterial respiration

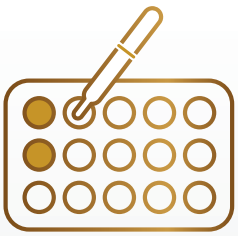


65.7% ↓
in bacterial glycolytic activity

Real-time measurements of bacterial metabolic function following treatment with stannous toothpaste formulas were used to measure antibacterial performance.

IN VITRO STUDY DESIGN

48h saliva-derived biofilm



Seeding of dislodged biofilm and toothpaste treatment

Bacterial metabolism measured over 200 minutes

CLINICAL STUDY ESSENTIALS

- Type of Study: In vitro study using an aged salivary biofilm model
- Number of Participants: Not applicable (in vitro study)
- Duration of the Study: No specific duration mentioned for the in vitro tests
- Chakraborty B, et al. J Dent Res. 2024;103(Spec Iss A):2563

IMPLICATION FOR PRACTICE

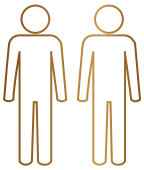
This study suggests that toothpaste containing SNaP (0.454% stannous fluoride stabilised with nitrate and phosphates) can provide sustained antibacterial properties. This can be a significant consideration for dental health products aiming to prevent gingivitis and promote overall oral hygiene.

SUPPLEMENTARY STUDY INFORMATION

Products under investigation

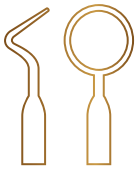
Toothpaste formulations containing:

- SNaP (0.454% stannous fluoride stabilised with nitrate and phosphates)
- Other 0.454% stannous fluoride toothpaste stabilised with gluconate (positive control)
- Non-antibacterial sodium fluoride toothpaste (negative control)
- NaF + KNO^3: 0.24% sodium fluoride desensitising dentifrice containing 5% potassium nitrate
- MFP: non-desensitising regular fluoride dentifrice containing 0.76% sodium monofluorophosphate



Study participants

Not applicable (in vitro biofilm model used).



Methods

The study used the Seahorse Extracellular Flux Analyzer to measure bacterial metabolic function in real-time over 200 minutes. Metrics such as total oxygen consumption rate (OCR) and extracellular acidification rate (ECAR) were utilised to evaluate the impact of the different toothpaste formulations on bacterial bioenergetics.

Trial procedure

- The study employed an aged salivary biofilm model to mimic real-life conditions
- Various toothpaste formulations were tested for their effect on bacterial metabolism and viability, comparing the results across different products

Conclusion

The specific stabilisation strategy used in SNaP toothpaste is critical for the antibacterial performance of stannous fluoride, as this formulation was more effective at reducing in vitro bacterial metabolic activity than a toothpaste containing the same amount of stannous fluoride stabilised with gluconate. This indicates that the SNaP formula is more effective in inhibiting bacterial respiration and energy generation within oral biofilms, suggesting its potential in promoting better oral health.