# In situ protection of enamel erosive lesions by F toothpastes: network meta-analysis

*#2172*

**Jonathan Creeth*[1], Andrew Butler[1], Avinash Patil[2], Anderson Hara[3], Domenick Zero[3]**

1: GlaxoSmithKline Consumer Healthcare, Weybridge, UK

2: Syneos Health, Pune, India

3: Indiana University School of Dentistry, Indianapolis, USA

# Conflict of Interest statement

- These studies were funded by **GSK Consumer Healthcare**, which markets the Pronamel products tested.
- **Jonathan Creeth and Andrew Butler** were employees of GSK Consumer Healthcare at the time of the analysis.
- **Avinash Patil** is an employee of Syneos Health, which has received funding from GSK Consumer Healthcare.
- **Anderson Hara** and **Domenick Zero** are employees of Indiana University, which has received funding from GSK Consumer Healthcare.

# Introduction + Aims

- Multiple in situ clinical erosion remineralisation studies performed using consistent methodology (11 in all)

– **What can we learn looking across the studies**…

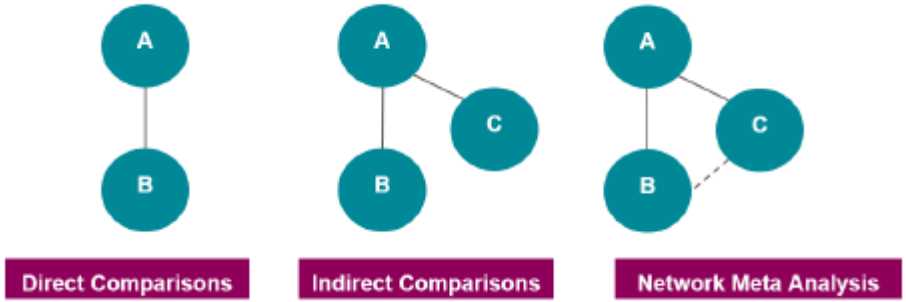
- …About the performance of the model?
- …About the performance of NaF-$KNO_3$ toothpaste?
- …About effects of different products/excipients on F performance in this model?

→ Network Meta-analysis (NMA)

# NMA methodology

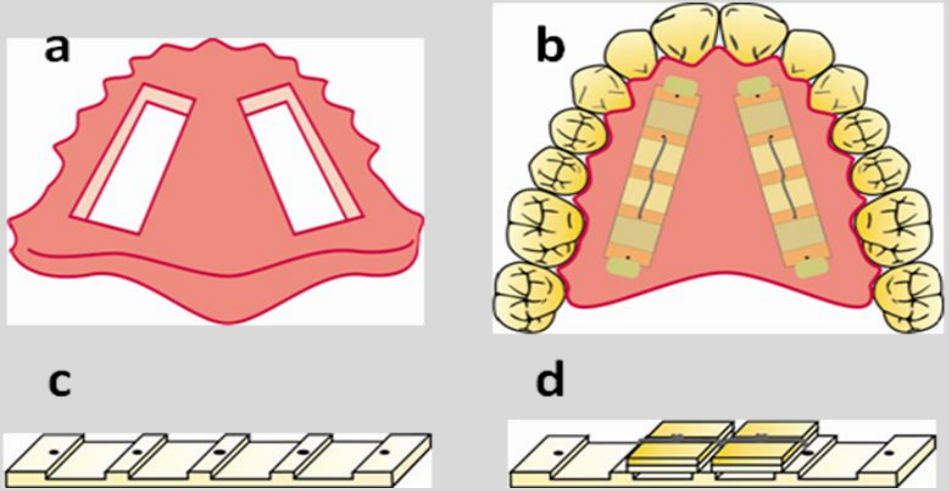
NMA:

- Determines effect of a treatment as mean value adjusted across a set of studies with (near-) identical protocol
- Allows comparisons between treatments not tested in same study



# In situ methodology: intra-oral appliance design

(a) Palatal appliance contains two slots;
(b) Appliance with two plastic holders, each with four enamel specimens;
(c) Side view of plastic holders;
(d) Plastic holder with two mounted enamel specimens



# Clinical in situ methodology

- Single-centre, randomized, multi-way crossover* in situ study, ethics committee-approved (OHRI) in healthy adults (N ~50*)
- Examiner-, subject- and analyst-blind
- Bovine enamel specimens* acid-challenged:
  - 25 min in grapefruit juice (citric acid, pH ~3.0).
- Single use of 1.5 g test dentifrice:
  - 25 s brushing + 60 s or 95 s swishing + expectorate + rinse
- 4-hour intra-oral remineralization period
- Re-challenge with acid
- Enamel hardness assessed at each stage via Surface Microhardness (SMH)
  - Wilson 2100 indenter



** Number depending on specific study*

# Analysis

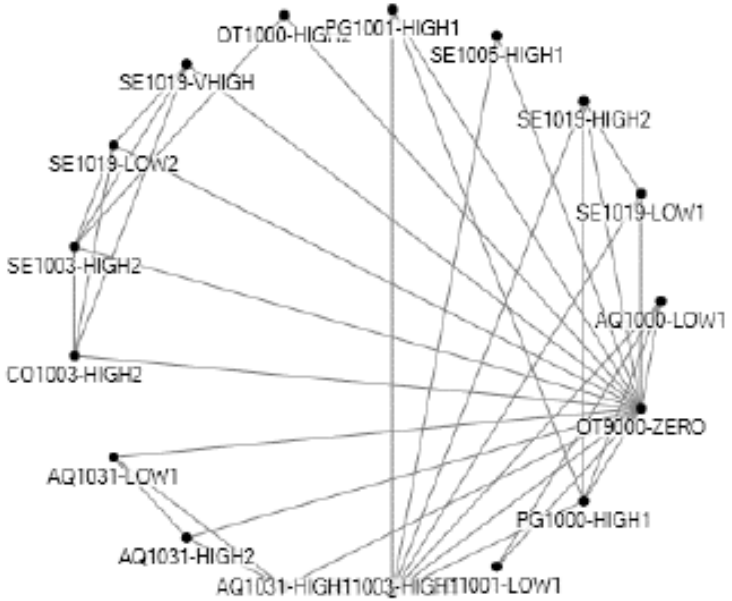
Approach

- SMH measures used to calculate SMHR & RER values
- Analyzed by ANOVA, using fixed- and random-effect models
- Factors for study and treatment (toothpaste) included as terms

Values determined:

- Adjusted mean, standard deviation and standard error for each treatment

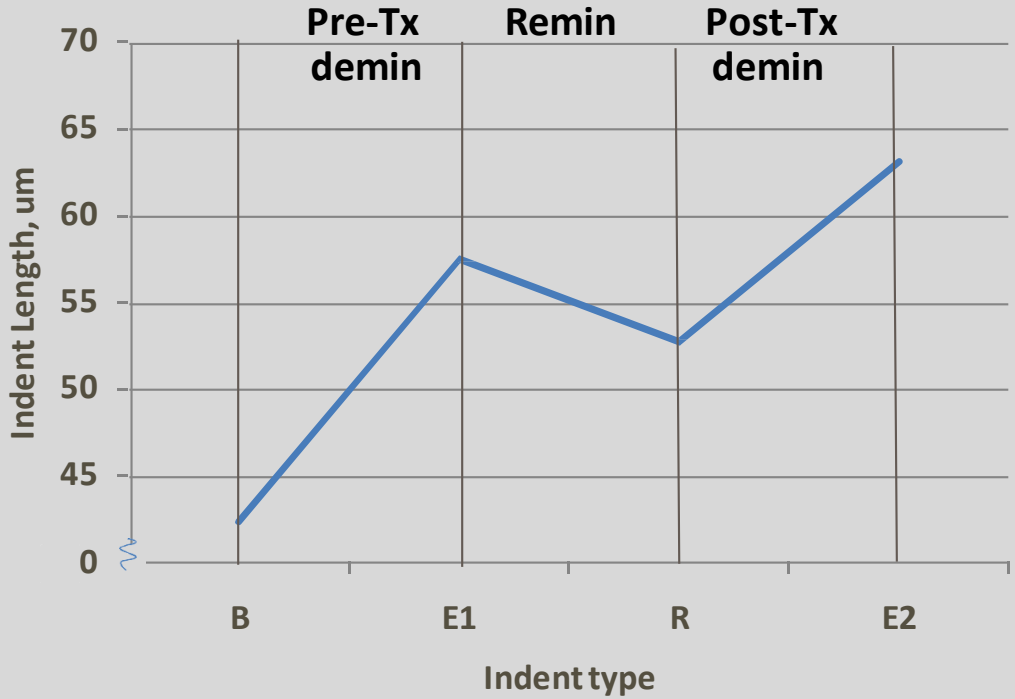
# NMA ‘map’ of direct product comparisons



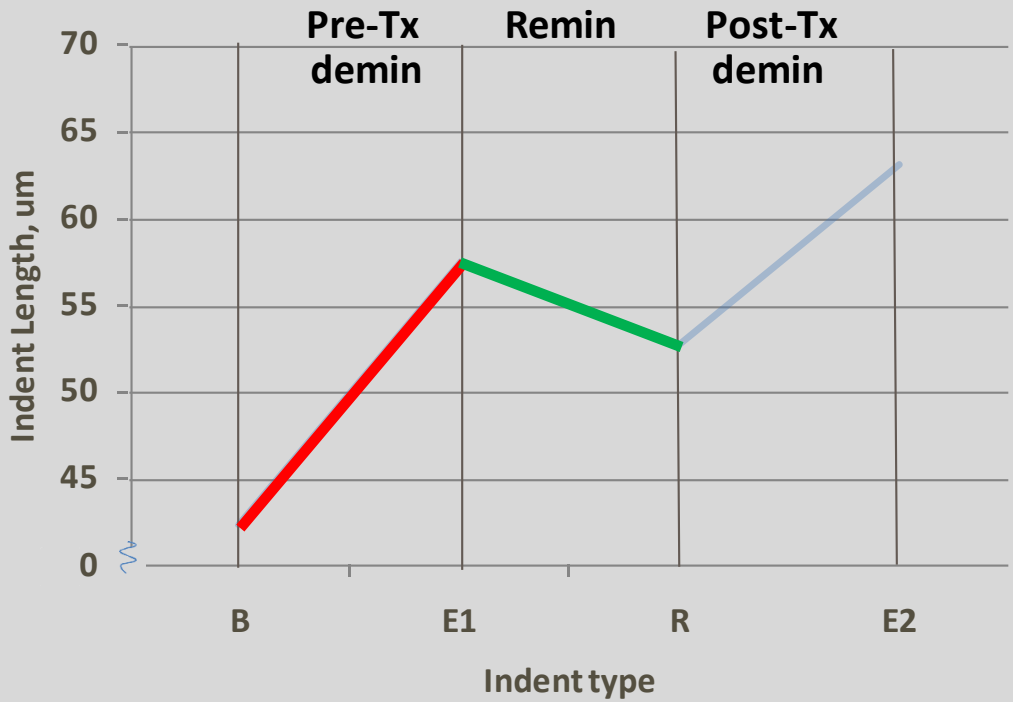
# Selection of Products tested

- **Placebo** (non-F)
- **NaF-$KNO_3$ 1150**
  - 1150ppm F as NaF (non-ionic surfactant): *Pronamel Daily Protection (US)*
- **NaF-$KNO_3$ 1450**
  - 1426ppm F as NaF (non-ionic surfactant): *Pronamel Daily Protection (RoW)*
- **NaF-SLS 1100**
  - 1100ppm F as NaF: sodium lauryl sulfate (SLS) surfactant: *Crest Cavity Protection (US)*
- **NaF-SLS 1450**
  - 1450ppm F as NaF: (SLS) *Blend-a-Med (EU)*
- **NaMFP 1000**
  - 1000ppm F as monofluorophosphate (K-citrate, Zn-citrate, SLS): *Colgate Sensitive Multi-Protection (US)*
- **$SnF_2$ 1100**
  - 1100ppm F as $SnF_2$ (hexametaphosphate, SLS): *Crest Pro-Health Advanced (US)*

# Surface microhardness profile (theoretical)

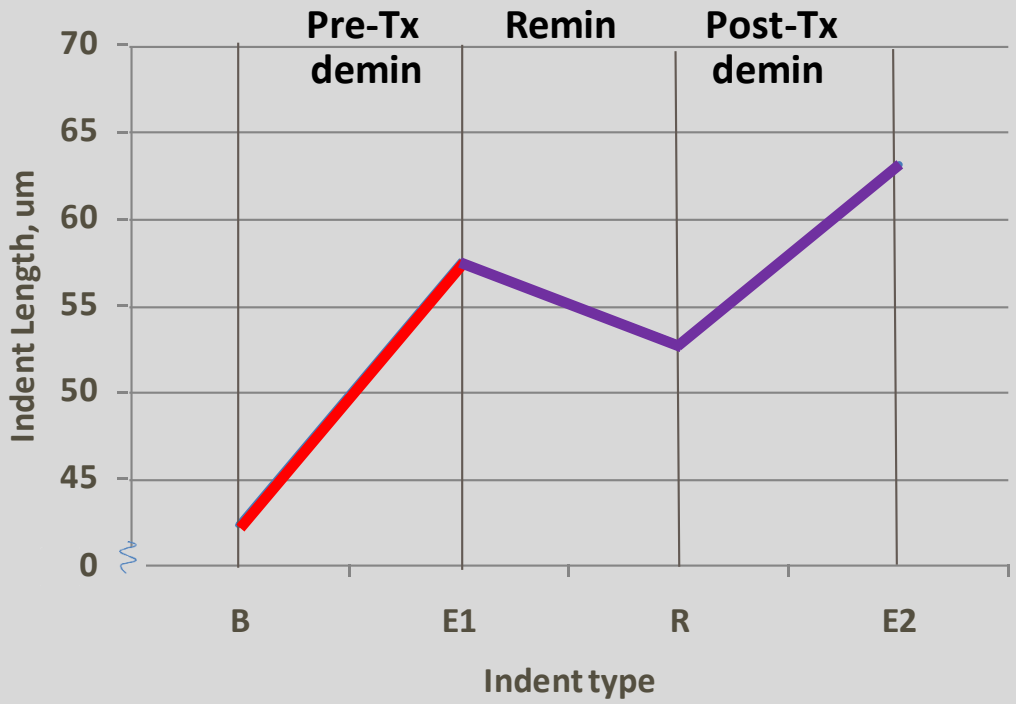


# Surface microhardness recovery (theoretical)




$$SMHR = \frac{(E1-R)}{(E1-B)}$$

# Relative Erosion Resistance (RER) (theoretical)

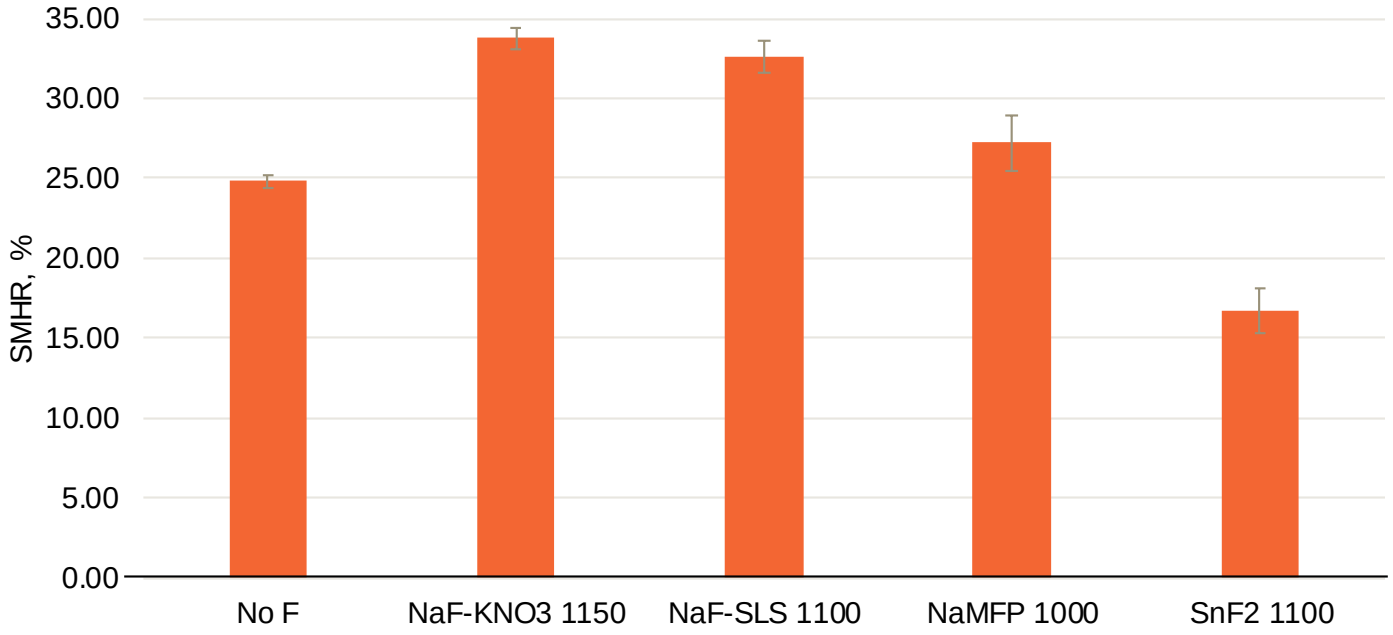



$$RER = \frac{(E1-E2)}{(E1-B)}$$

# Results

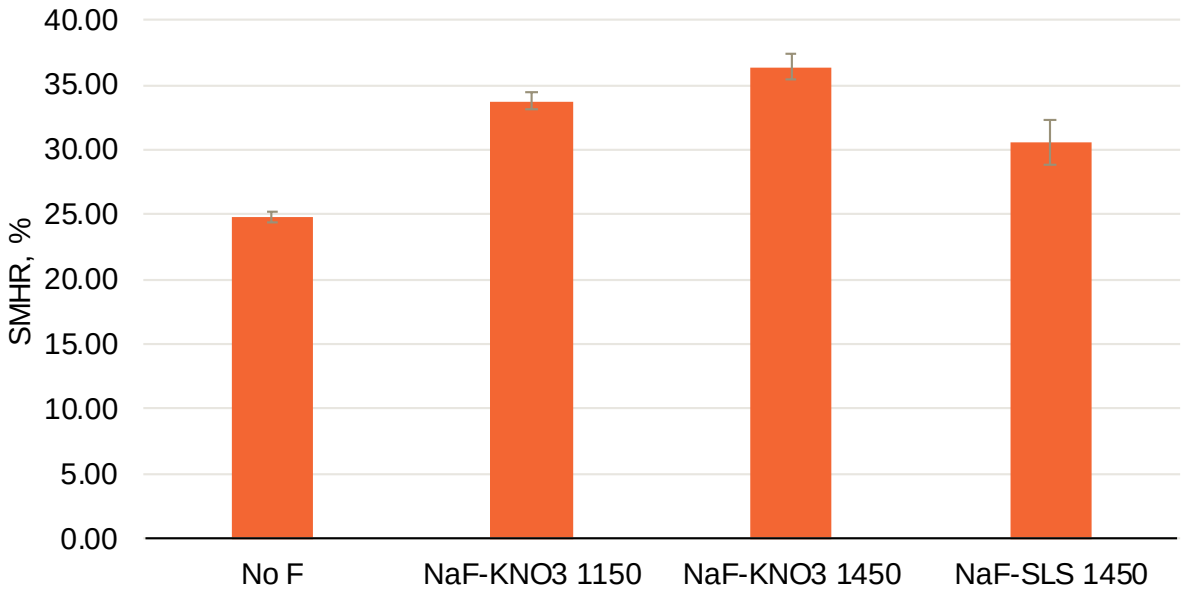
# SMHR: 1100-1150ppm F formulations

NMA–determined values (adjusted mean + standard error)



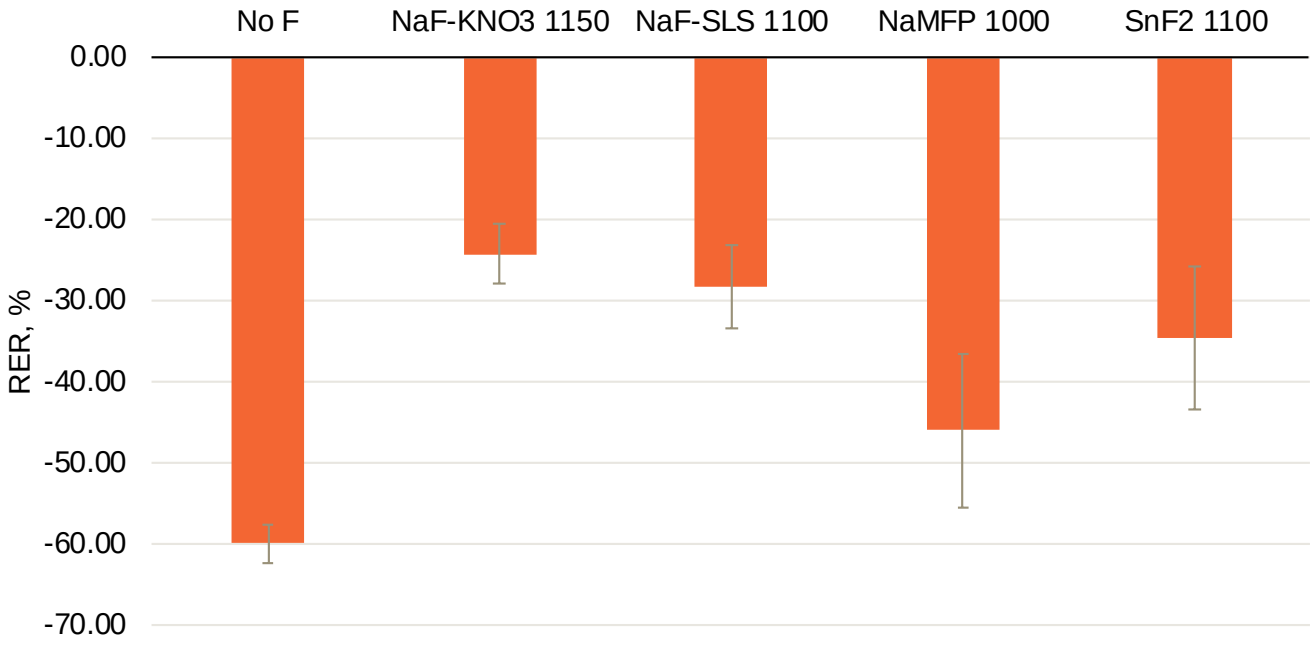
# SMHR: 1400-1500ppm F formulations

NMA–determined values (adjusted mean + standard error)



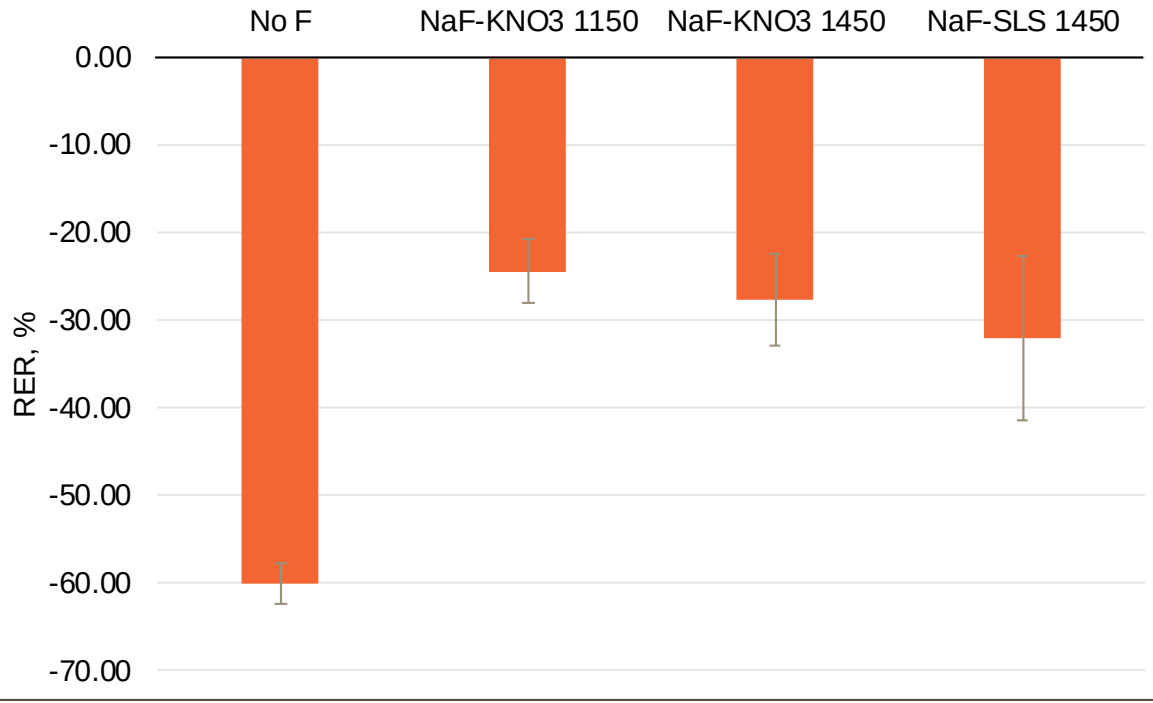
# RER: 1100-1150ppm F formulations

NMA–determined values (adjusted mean + standard error)



# RER: 1400-1500ppm F formulations

NMA–determined values (adjusted mean + standard error)



# Conclusions

- **NMA**: effective tool for this analysis
- **In situ model**: suitable to assess F toothpaste potential to:
  - **promote intra-oral remineralization** of early enamel erosive lesions
  - **reduce subsequent demineralization**
  - **identify ingredients that modulate** these measures
- **NaF-$KNO_3$ formula** (non-ionic surfactant): reproducible strong effect
- **Polyphosphates** and **metal ions** can reduce SMHR
- **But** may impart enamel acid resistance in addition to F