**Hardy C, Kanthaiah K, Obiefuna CA, Iftikhar N, Whang K, Cervantes Mendez M, Dyda S, Amaechi BT**

## OBJECTIVE

**The aim of this study was to evaluate the efficacy of a novel device, Cav-Aid, in enhancing the remineralization of initial proximal caries compared to traditional fluoride treatments.**

## INTRODUCTION

Proximal caries develop in areas that are difficult to access, limiting the effectiveness of traditional fluoride treatments. These lesions often progress due to inadequate fluoride exposure and persistent biofilm accumulation.

Various interventions, including fluoride toothpaste and other remineralization agents, have been explored to enhance enamel repair. However, their efficacy in interproximal areas remains a concern.

Targeted fluoride delivery systems are being developed to optimize caries management. Cav-Aid, a novel fluoride delivery device, is designed to provide sustained fluoride exposure to proximal caries, potentially improving remineralization outcomes.

## MATERIALS and METHODS

**Sample Collection**
- 120 bovine enamel tooth blocks harvested from the labial surface of teeth

**Initial Caries Lesion Creation**
- Enamel Blocks demineralized using a microbial caries model for 5 days.

**Baseline Microhardness Measurement**
- Microhardness measured after demineralization.

**Proximal Caries Model Setup**
- enamel blocks inserted into extracted human teeth and mounted in typodonts.

**Remineralization Treatment (14-day pH Cycling)**

- Treatment groups (20/group)

   - AS: Artificial Saliva Only

   - CA: Cav-Aid Only

   - CA+F: Cav-Aid + 2x Daily Fluoride Toothpaste

   - FV-Floss: Fluoride Varnish by Flossing

   - FV-Paint: Fluoride Varnish by Interdental Painting

   - F-Mouthrinse: Daily Fluoride Mouthrinse

**Post-Remineralization Microhardness Measurement**

- Microhardness is measured after 14-day pH cycling treatment

## RESULTS

Following the demineralization phase, all groups demonstrated significant reductions in surface microhardness (SMH) compared to the initial sound enamel condition ($p < 0.001$). After the 14-day remineralization phase, all treatment groups exhibited significant increases in SMH compared to their post-demineralization values ($p < 0.001$).
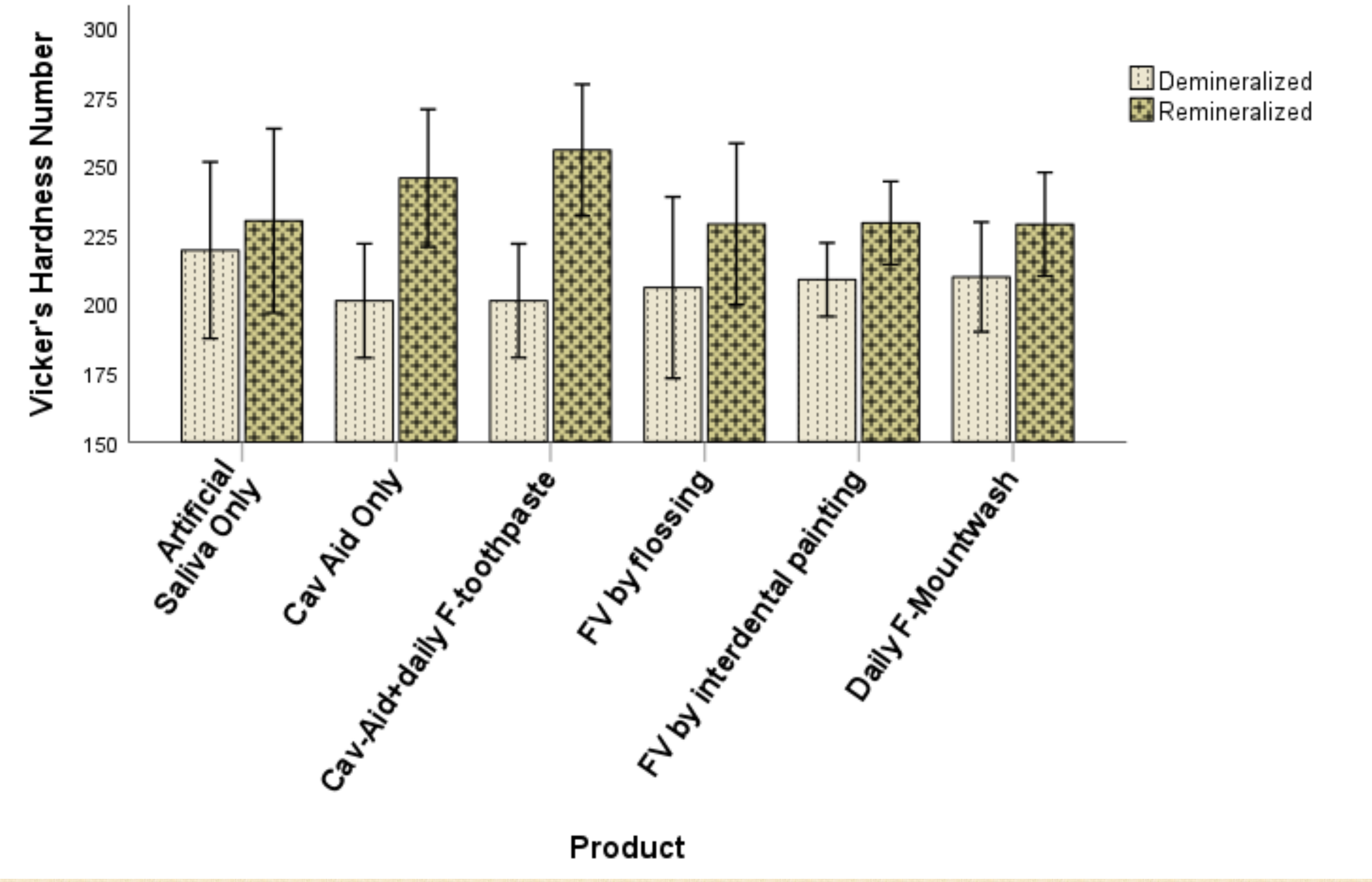


**Figure 1: Paired samples t-test**

Indicates changes in surface microhardness (SMH) after remineralization:

- Artificial Saliva (AS): Smallest increase (+10.7 HV)

- Cav-Aid (CA): Greater increase (+44.3 HV)

- Cav-Aid + Fluoride Toothpaste (CA+F): Largest increase **(+54.4 HV)**

- Fluoride Varnish Floss (FV-Floss) & Fluoride Varnish paint (FV-Paint): Similar moderate increases (+21.5 HV, +22.9 HV)

- Fluoride Mouthrinse (F-Mouthrinse): Moderate increase (+19.1 HV)

A higher HV increase indicates greater enamel remineralization.
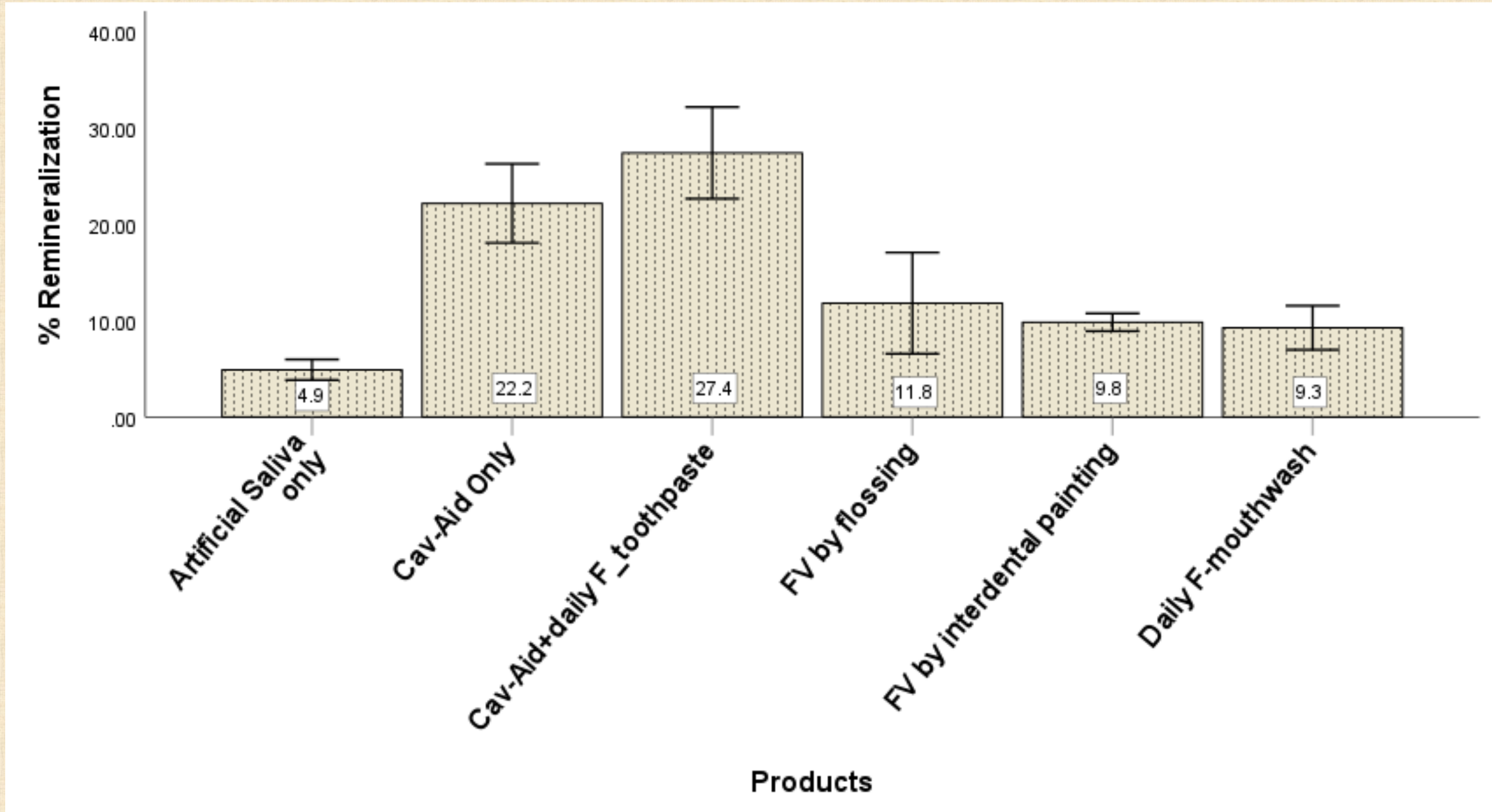
## RESULTS



**Figure 2.** The ANOVA analysis ($p < 0.001$)
Demonstrates significant differences in percentage remineralization across groups:
- Cav-Aid + Fluoride Toothpaste (CA+F): Highest efficacy **(27.39%).**
- Cav-Aid (CA): High efficacy (22.16%).
- Fluoride Floss (FV-Floss), Fluoride Paint-On Gel (FV-Paint), and Fluoride Mouthrinse (F-Mouthrinse): Comparable lower efficacy (9.25%–11.80%).
- Artificial Saliva (AS): Lowest efficacy (4.89%).

Percentage remineralization indicates the degree of enamel recovery, with higher percentages reflecting more effective remineralization.

## CONCLUSIONS

*Cav-Aid and Cav-Aid + Fluoride Toothpaste showed the highest efficacy in enamel remineralization, with CA+F achieving the greatest surface microhardness (+54.4 HV) and the highest percentage remineralization (27.39%).*

*Fluoride Varnish Floss (FV-Floss) provided moderate improvements, significantly better than Artificial Saliva (AS) but less effective than CA and CA+F. FV-Paint and Fluoride Mouthrinse showed minimal effectiveness, with no significant difference from AS.*

*Artificial Saliva (AS) exhibited the lowest efficacy across all measures, with the smallest increase in SMH (+10.7 HV) and only 4.89% remineralization.*

*Statistical analysis confirmed significant differences in % remineralization, with CA and CA+F outperforming all other treatments.*

*In summary, Cav-Aid and Cav-Aid + Fluoride Toothpaste are the most effective treatments for remineralization, particularly in the proximal regions of the tooth.*