



Background

Exposure to vitamin D during early life may contribute to preventing dental caries through various potential mechanisms.¹ Vitamin D plays an essential role in enamel and dentin formation, as ameloblasts and odontoblasts are target cells for its active form, 1,25-dihydroxyvitamin D.² Additionally, vitamin D deficiency has been associated with neonatal enamel hypoplasia and hypocalcification, which create a conducive environment for cariogenic bacteria to colonize and adhere to teeth, thereby increasing caries risk.^{2,3}

The aim of this in-vitro study is to investigate the remineralization effect of salivary vitamin D (VD3) on artificially initiated carious lesions by analyzing changes in enamel microhardness and crystallization.

Materials and Methods

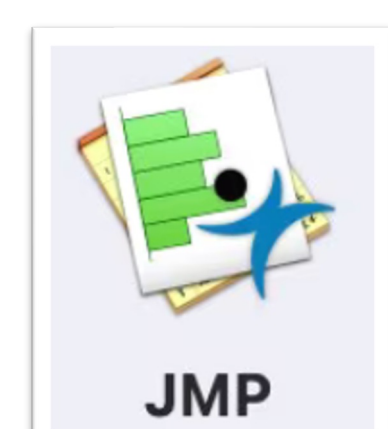
- Total of **31** unidentified extracted human **primary teeth** were selected for the purpose of this in-vitro study.
- Teeth were embedded in epoxy resin for stabilization.
- Sectioning of teeth was performed using IsoMet 5000 precision saw.
- Polishing was conducted using Buehler EcoMet 250/AutoMet 250 polisher.
- Teeth were randomly divided into **4** groups (n=7 teeth per group) based on vitamin D concentration.

- Group **A**: Control group - **Artificial saliva**⁴
- Group **B**: Artificial saliva with **20 nM** of vitamin D
- Group **C**: Artificial saliva with **40 nM** of vitamin D
- Group **D**: Artificial saliva with **100 nM** of vitamin D

- Treatment cycling included **8 hours** immersion in artificial carious solution,⁴ rinsing with distilled water, and **16 hours** in VD3 solution.
- Vickers microhardness testing conducted at multiple stages: **before** the experiment, **after** exposure to **artificial carious solution**, **midway** through the study, and **after 10 days** at the end.
- Enamel crystallization examined using field emission scanning electron microscope (FESEM) with various magnifications, with one tooth analyzed from groups A, C, D.

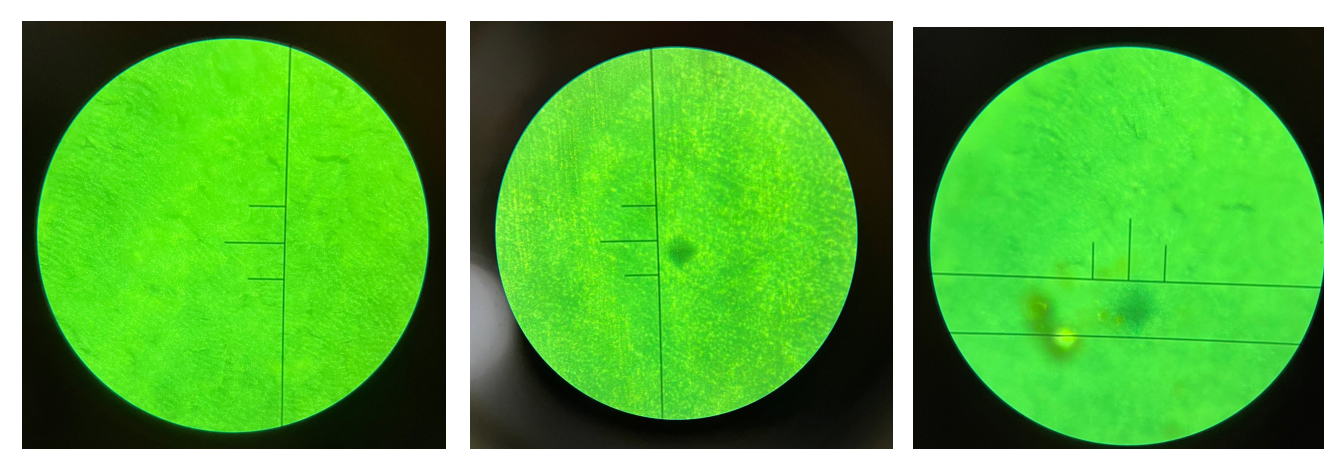
Data Analysis:

- JMP Pro 17 software.
- Descriptive analysis and multiple factorial ANOVA.



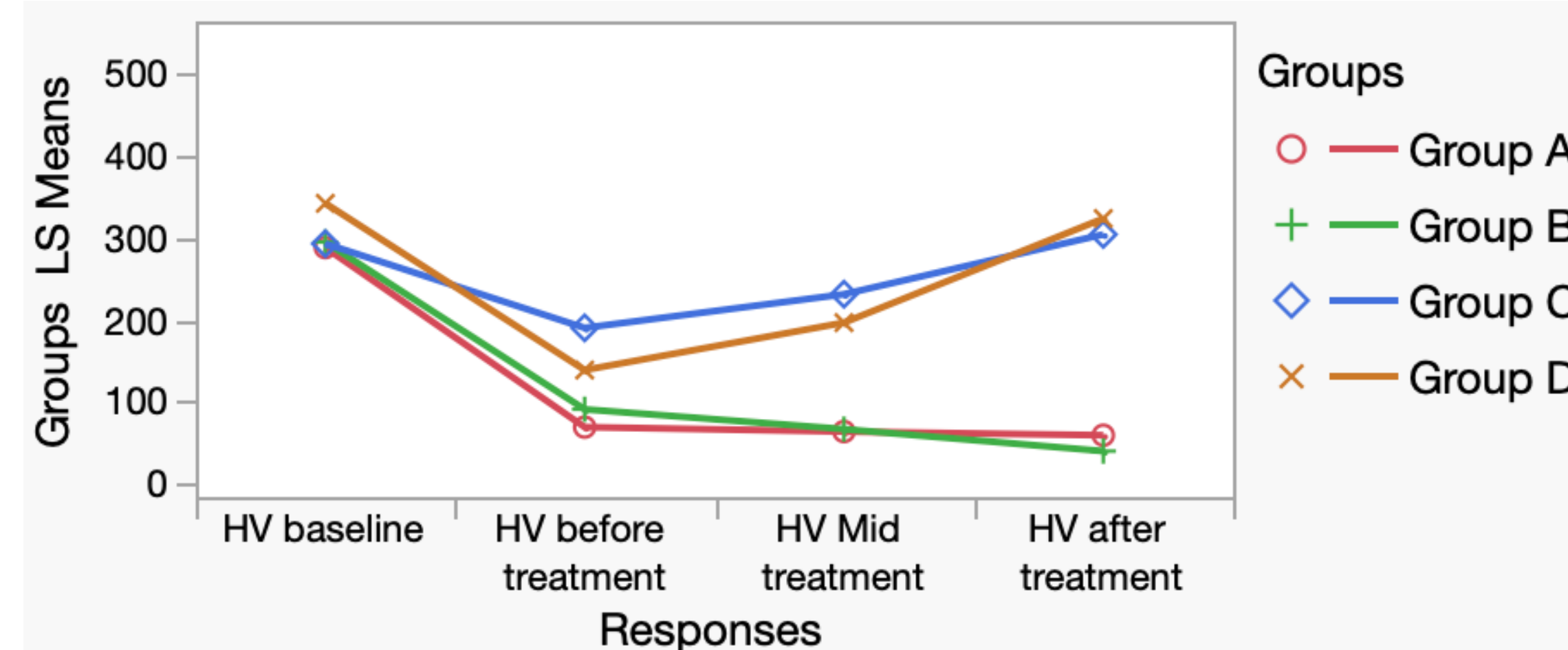
Results

Vickers Microhardness



HV baseline				(Initiated caries) HV before VD3 treatment				
Groups	N	Mean	Std Dev	CV	Groups	Mean	Std Dev	CV
Group A	7	287.586	69.764	24.26	Group A	68.843	40.897	59.41
Group B	7	294.314	70.676	24.01	Group B	90.571	42.557	46.99
Group C	7	292.386	53.981	18.46	Group C	189.757	35.535	18.73
Group D	7	341.529	95.748	28.03	Group D	138.386	77.751	56.18

HV Mid treatment				HV after treatment			
Groups	Mean	Std Dev	CV	Groups	Mean	Std Dev	CV
Group A	63.414	12.738	20.09	Group A	58.943	37.210	63.13
Group B	66.371	28.215	42.51	Group B	39.614	19.713	49.76
Group C	230.800	79.739	34.55	Group C	303.700	110.665	36.44
Group D	196.129	34.989	17.84	Group D	323.000	115.219	35.67



All Between					
Test	Value	Exact F	NumDF	DenDF	Prob>F
F Test	3.2256508	25.8052	3	24	<.0001*
Intercept					
Test	Value	Exact F	NumDF	DenDF	Prob>F
F Test	26.251673	630.0402	1	24	<.0001*
Groups					
Test	Value	Exact F	NumDF	DenDF	Prob>F
F Test	3.2256508	25.8052	3	24	<.0001*

→ The **mean** values of enamel surface microhardness exhibited a noticeable **increase** in the VD3-treated groups compared to the control group and VD3 deficient group.

→ There is a **statistically significant difference** in enamel surface microhardness among groups B, C, D and control group A (**p < 0.05**).

Crystal morphology

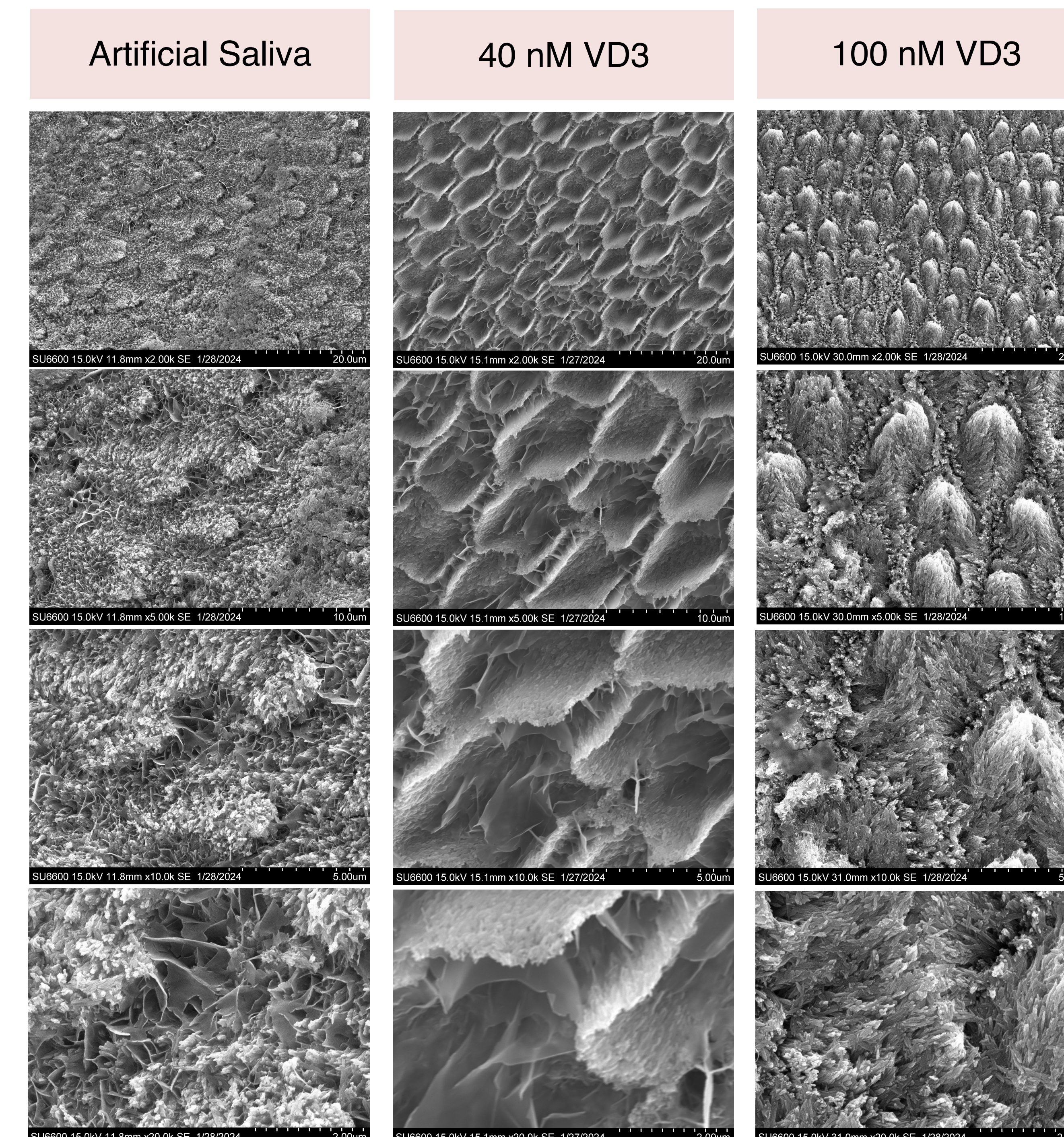


Plate-like crystals

Needle-like apatite crystals.

Discussion and Conclusions

- The ability to carry out experiments in a well-controlled environment is advantageous for this type of study. However, one of the limitations is that in-vitro studies remain unable to fully simulate the complex biological processes involved in caries.
- The application of Vitamin D demonstrated a notable enhancement in the densely crystalline enamel morphology and an improved surface microhardness.
- The findings of this in-vitro study suggest the clinical importance of maintaining optimal vitamin D levels in children for effectively remineralizing incipient carious lesions.
- Vitamin D acts as a preventive measure against dental caries and related complications.
- Future research should focus on utilizing vitamin D as an active agent in preventive materials

Reference



Please scan for references