

ACP Technology

Amorphous Calcium Phosphate forming Fluoride Varnishes

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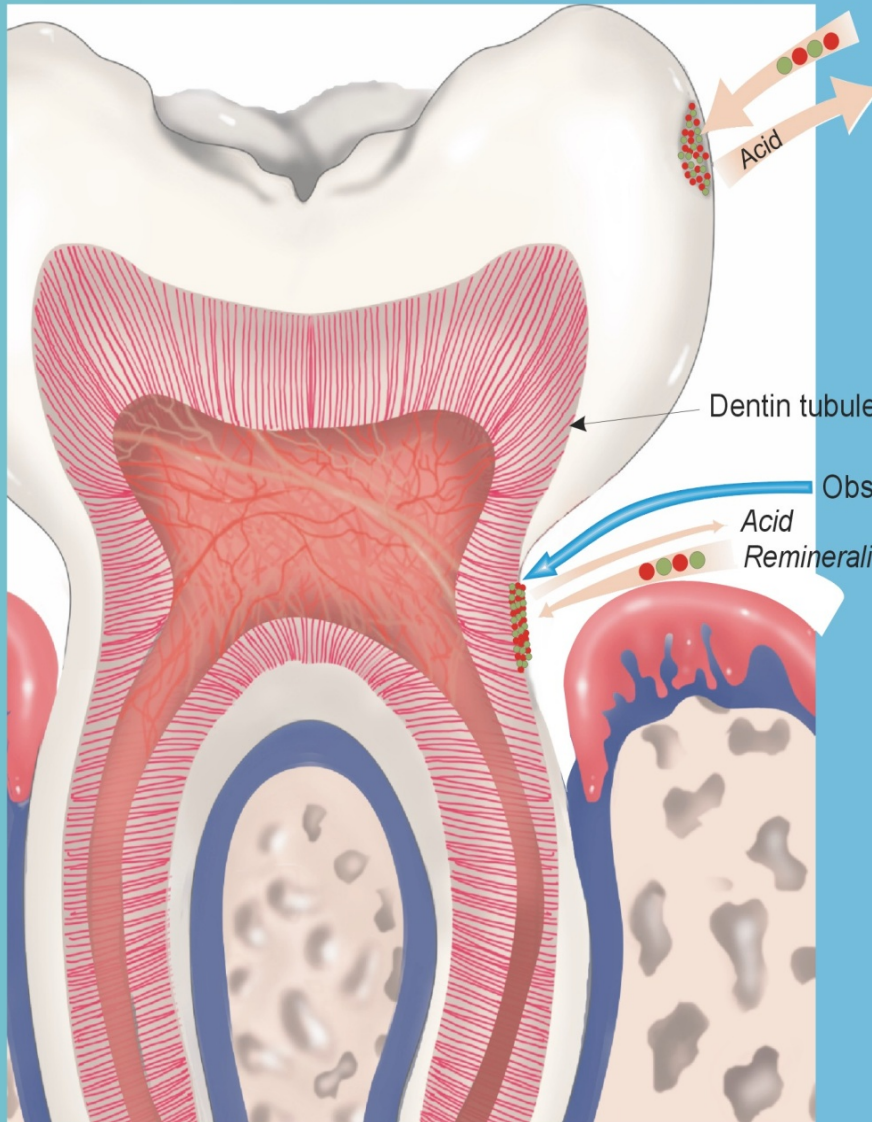
National Institute of Standards & Technology

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Dental Education | Access to Care | Research | Charitable Assistance

Rapid Remineralization with ACP (Amorphous Calcium Phosphate)

- Calcium
- Phosphate

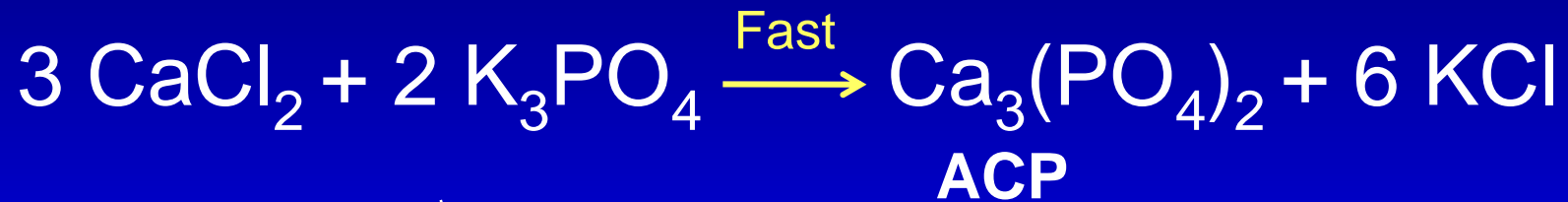


- Repair and Prevent Cavity by Replacing Lost Enamel with ACP
- Fill and Obstruct Dentin Tubules with ACP
- ACP Converts to Tooth Mineral

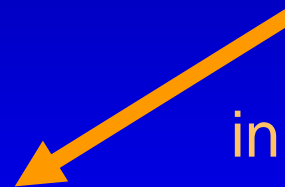


Obstruction of Dentin Tubules
after 2 Minute Treatment

Formation and Conversion of Amorphous Calcium Phosphate (ACP)



very slow ↓



in situ transformation

Tooth Mineral (Apatite)

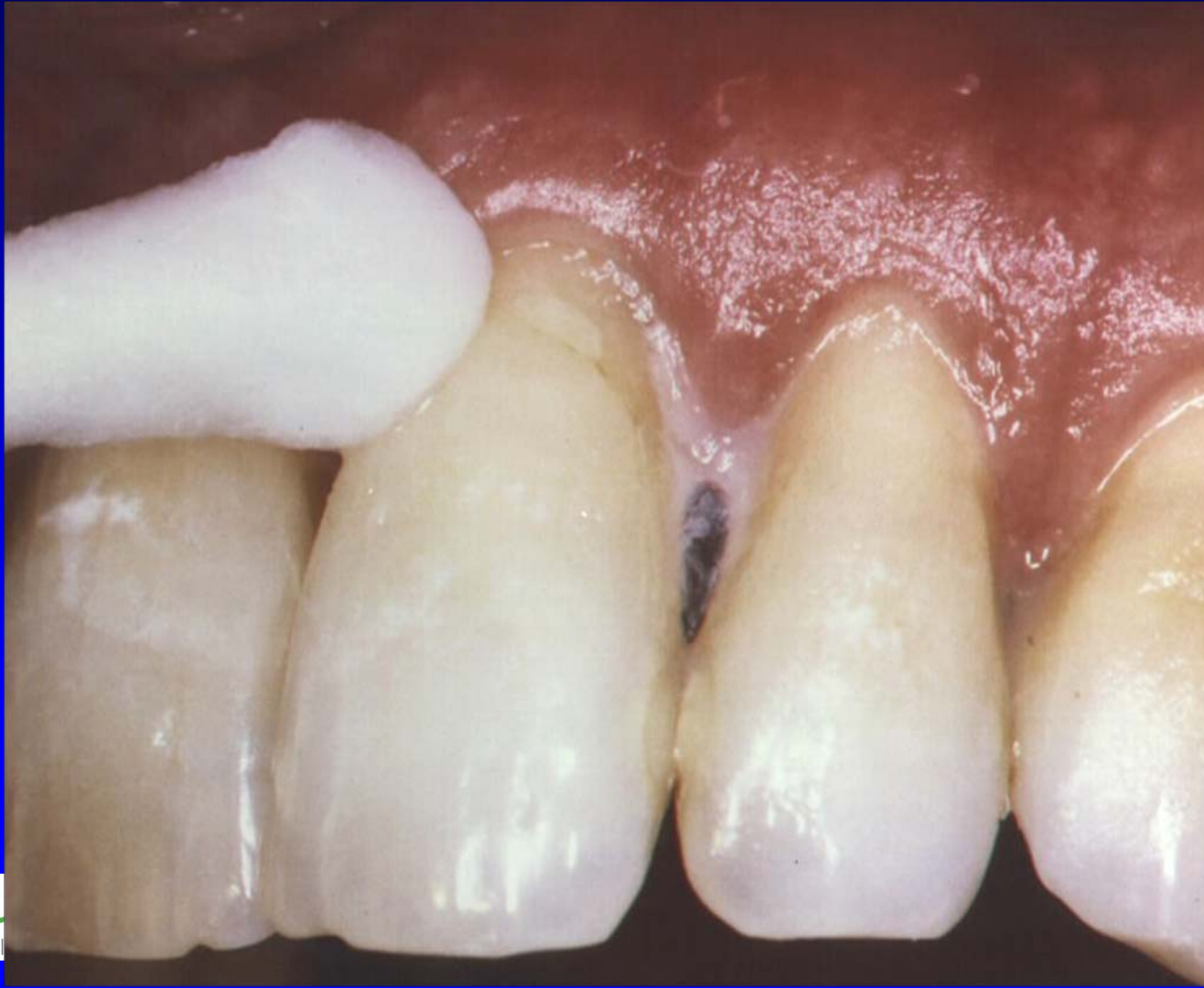
Why ACP ?

- ◆ Fastest formation and dissolution
- ◆ Solid solution: Incorporate other beneficial ions readily.
- ◆ Therapeutic agents and also as the carrier for long term releases
- ◆ Transform to apatite: Put back loss tooth mineral.
- ◆ One ACP unit is 0.9 nanometer: Fill and obstruct dentin tubules and prevent the dentin hypersensitivity
- ◆ Easy to prepare and apply

Application and Delivery Vehicles

1. Solution
2. Varnish
3. Gel
4. Toothpaste
5. Prophylaxis Paste
6. Composite
7. Tooth Mousse
8. Chewing gum
9. Candy
10. Mouth Rinse
11. Dental Floss

Applications of calcium & phosphate solutions



Applications of calcium & phosphate solutions on Etched Dentin Surface



before



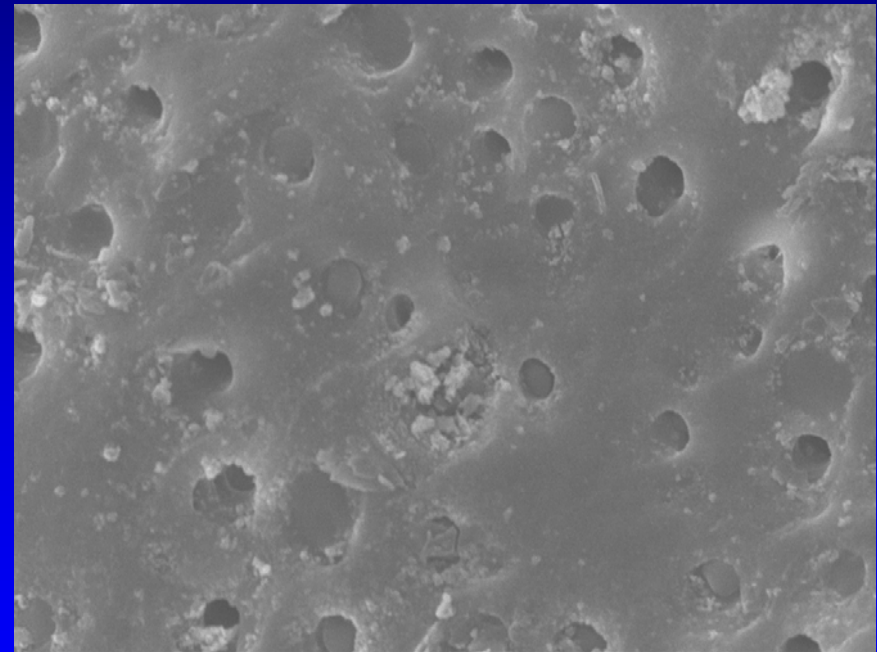
after

Fluoride Varnish with ACP

Dentin Surface treated with ACPF varnish

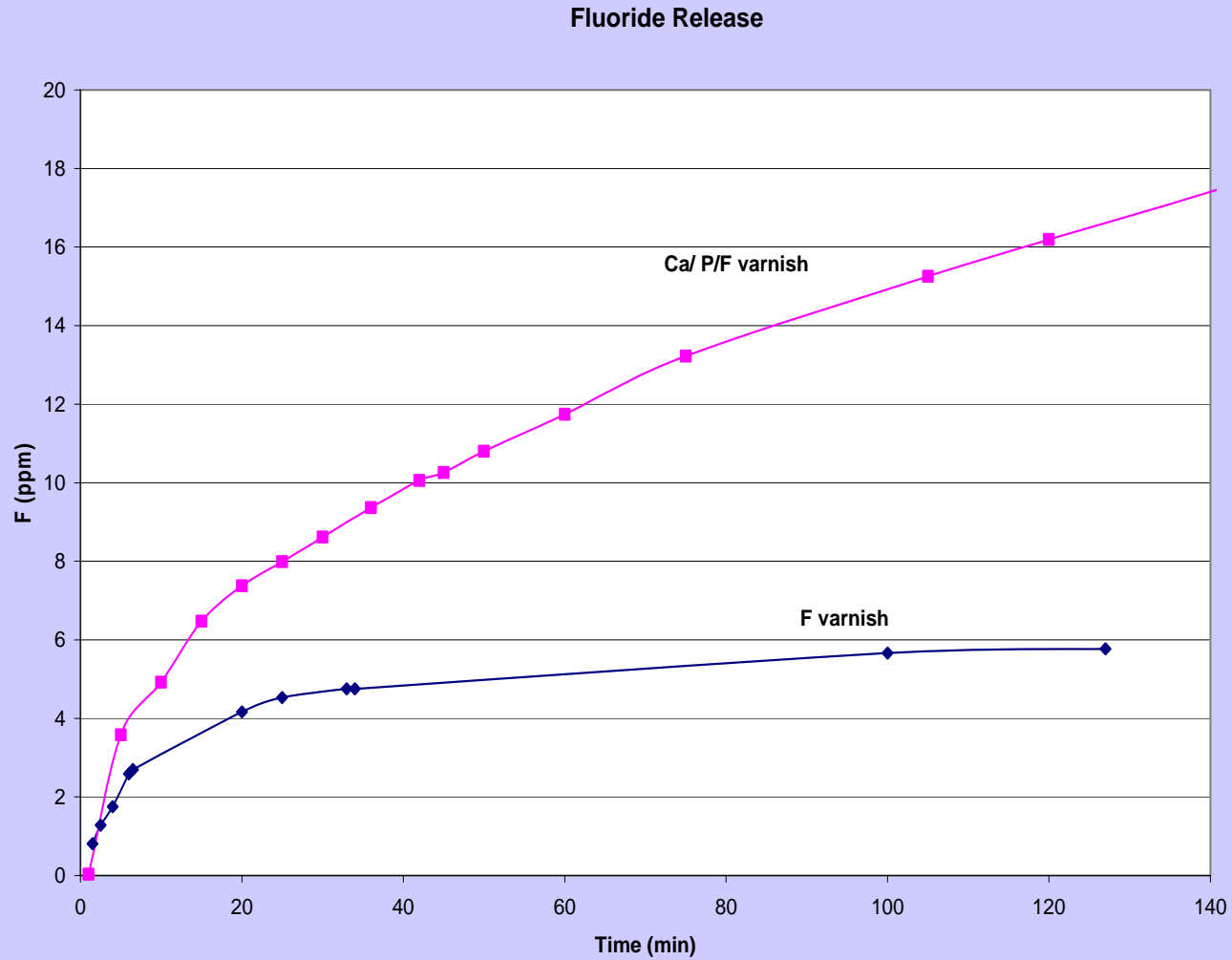


before

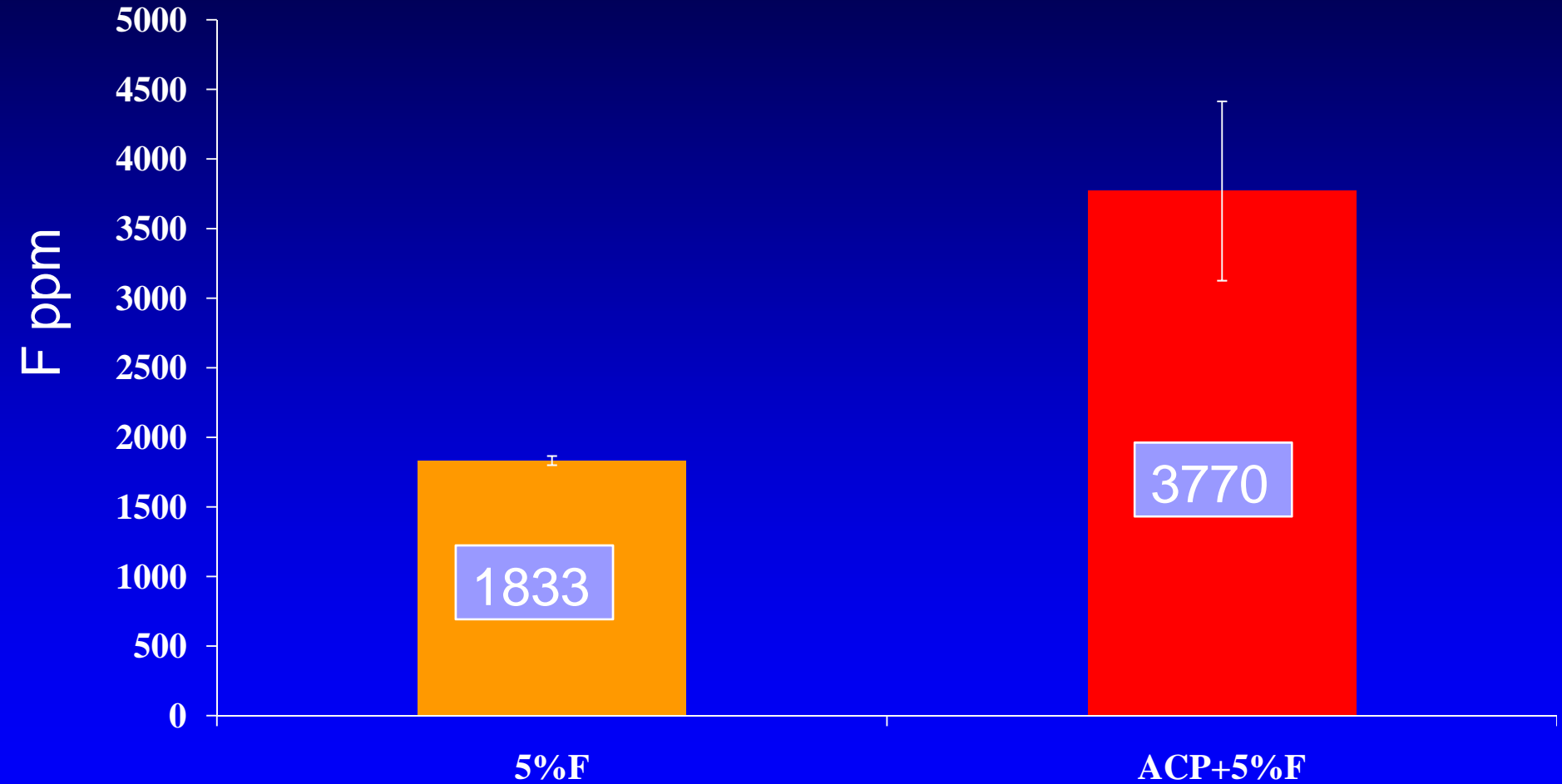


after

Releases from ACPF varnish



Enamel F uptake treated with Varnishes

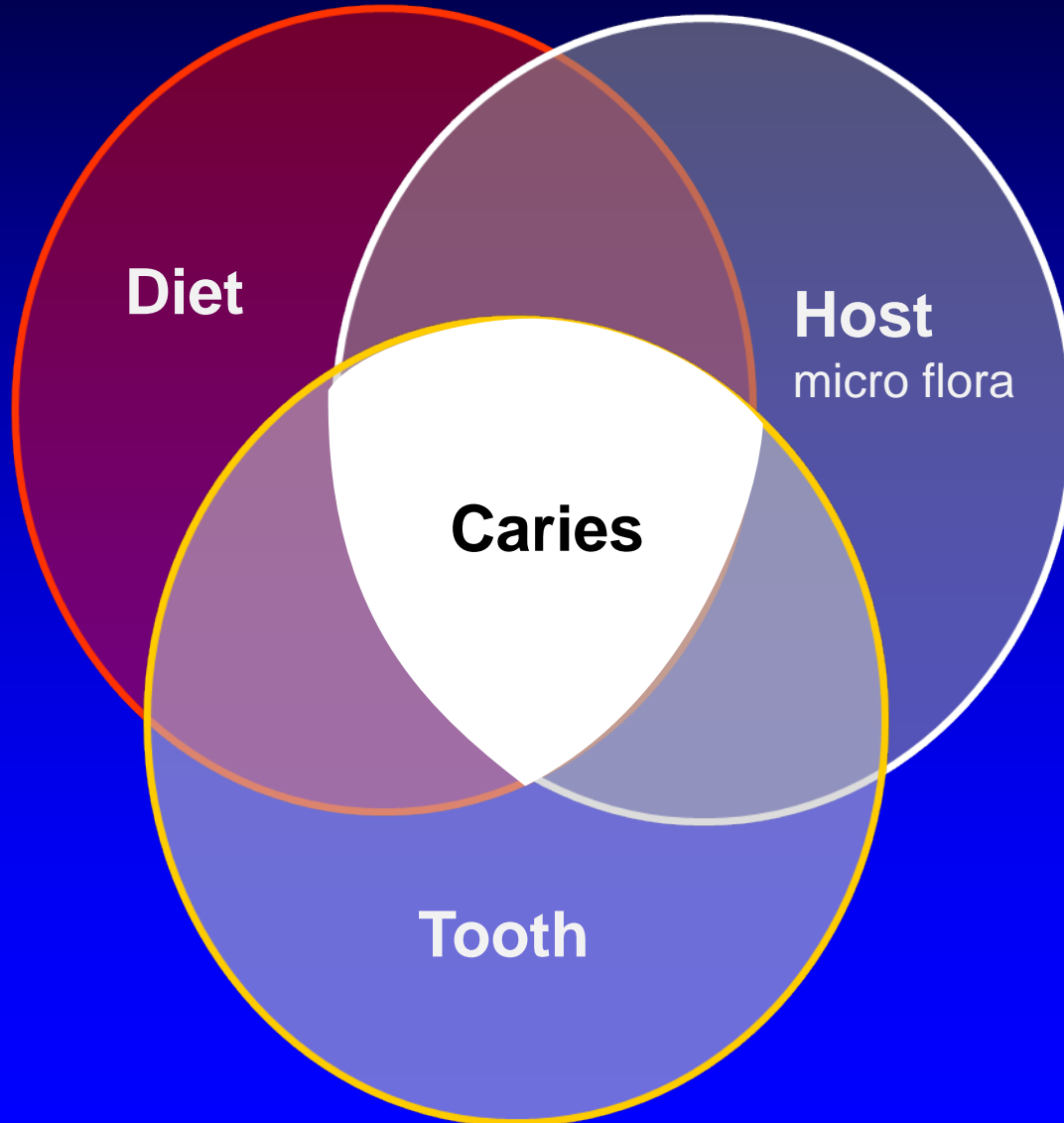


Results of ACP Technology

- ◆ Remineralize the tooth: Put back the tooth mineral and increase the hardness.
- ◆ Increase fluoride efficacy: more release and more uptake
- ◆ Obstruct the dentin tubules: Decrease hypersensitivity.

Next Generation ACPs

Multifactorial Etiology and Multimodal Intervention



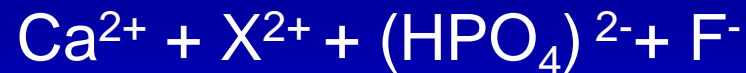
2nd Generation ACP Multimodal Intervention

- ◆ ACPF Varnish with Chlorhexidine:
Antimicrobial and Remineralizing
- ◆ ACPF Varnish with Arginine/Chlorhexidine:
Antiacidic, Antimicrobial and Remineralizing

Release, Precipitation & Hydrolysis from ACPFX Varnish

ACPFX Varnish

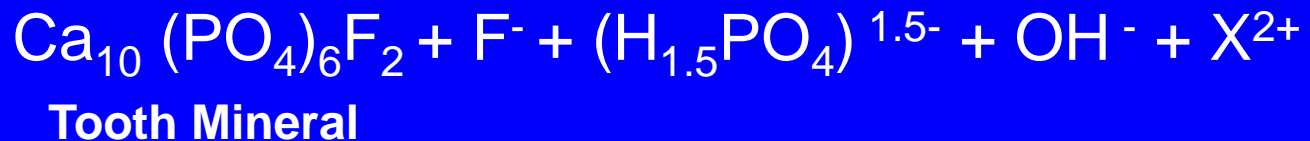
Release ↓



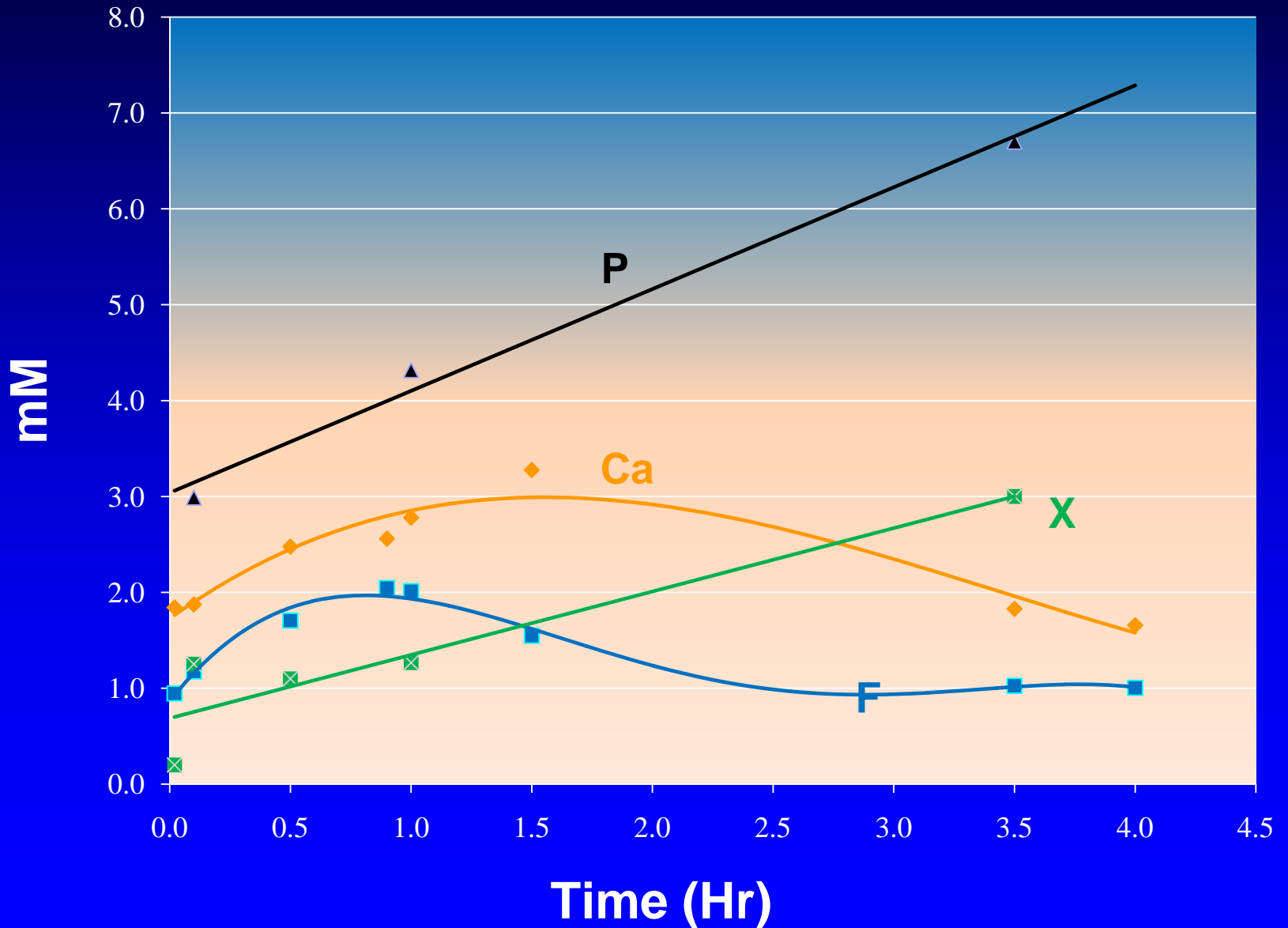
Precipitation ↓



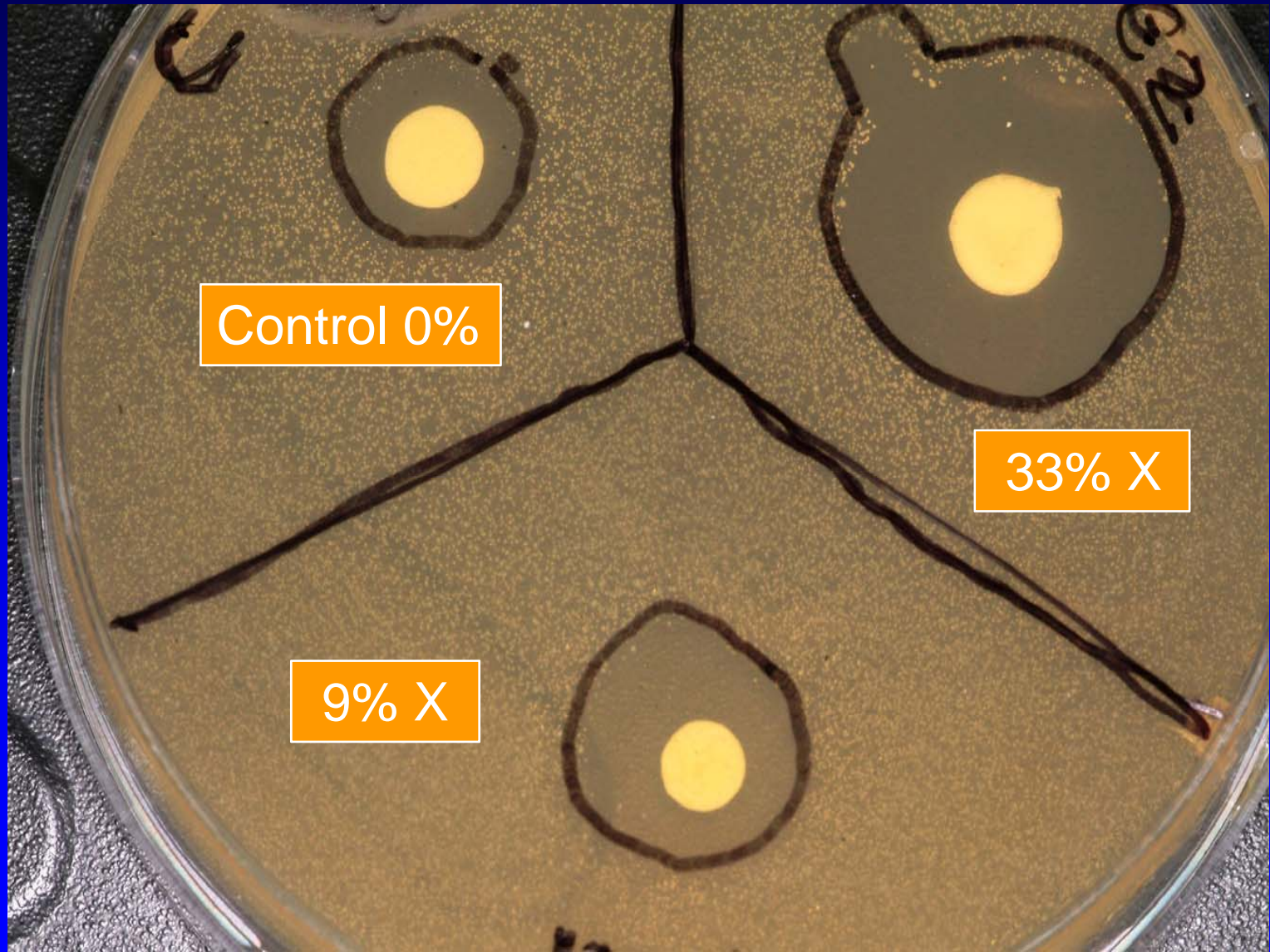
Hydrolysis & Release ↓



Releases of Ca, X, P & F from ACPFX Varnish



Antimicrobial inhibition rings of varnishes containing chlorhexidine (X)



Conclusion

- ◆ ACP Technology is able to remineralize the tooth in clinical applications.
- ◆ ACP can incorporate and deliver beneficial ions: F, Chlorhexidine, and Arginine.
- ◆ Varnish readily deposit ACPs which act as therapeutic agents and also as the carriers for long term releases.
- ◆ Some Products are ready for clinical study.

ACP Products with Multiple Therapeutic Agents and delivery vehicles

- ◆ ACP varnish containing F
- ◆ ACP varnish containing F and X
- ◆ **ACP Varnish containing F, X and Arginine**
- ◆ Other therapeutic agents: STAMPs, xylitol, licorice extract, novel natural therapeutic substances...
- ◆ Potential Products: Mouth rinse, Candy, Sealant, Gel, Toothpaste, Prophylaxis Paste,...