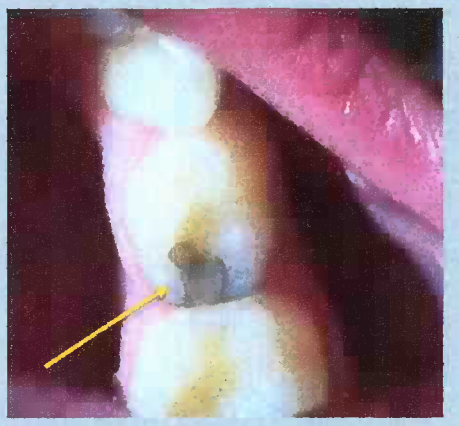
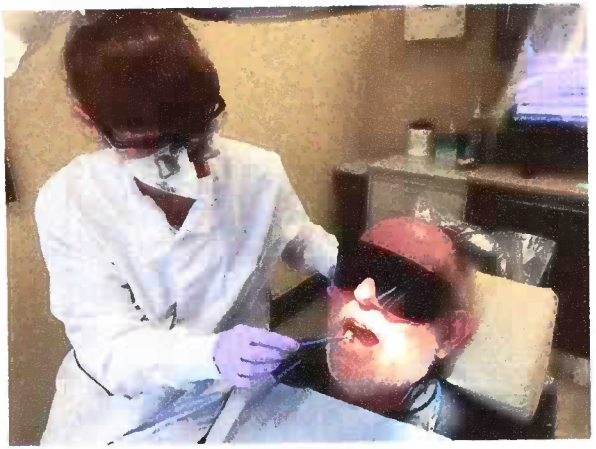
# MINIMALLY INVASIVE DENTISTRY

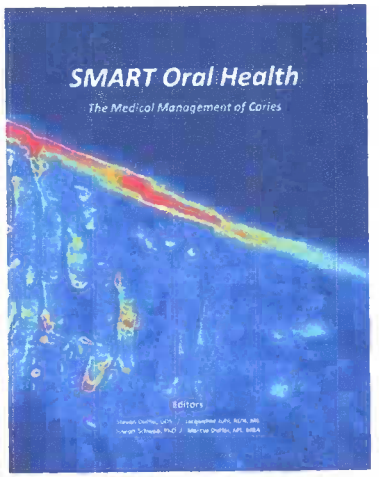


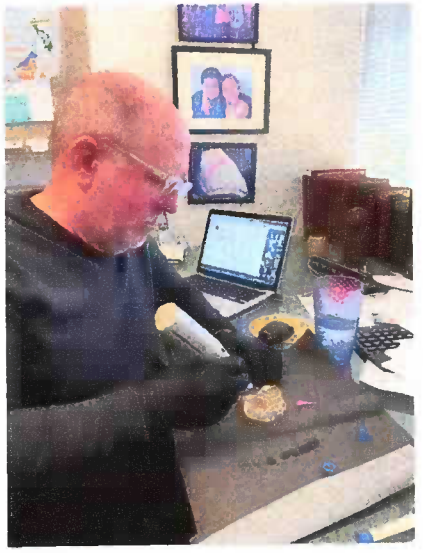
Materials Science, toxicity and efficacy
Silver, Fluoride and GIC

# STEVE DUFFIN, DDS
## DECLARATIONS

- Owner of Shoreview Dental, LLC
- Partner in NoDK, LLC
- Editor/author Smart Oral Health text
- Dental Director Oral Health Outreach, LLC

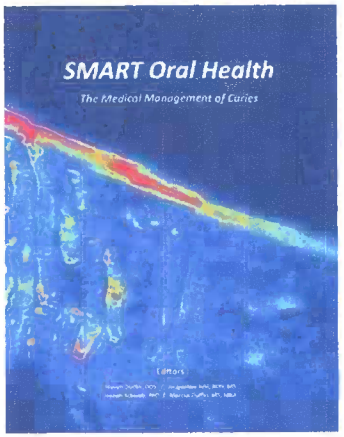


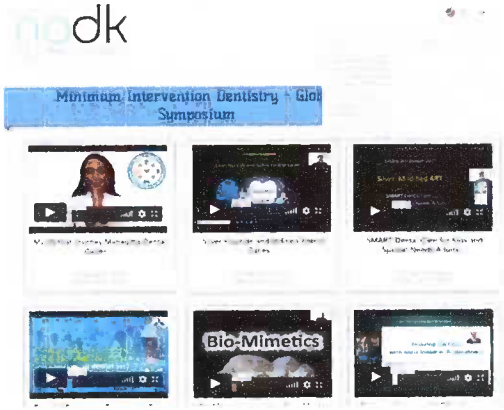

SMART Oral Health
The Medical Management of Caries
Editors



# REFERENCES

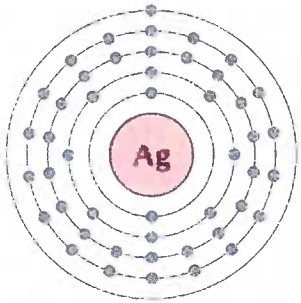
- Smart Oral Health
- NoDK learning platform
- MMC Library




# SILVER

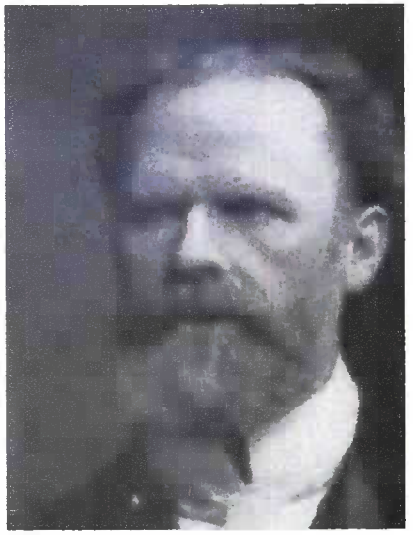
- When and where was it used historically and in medicine
- Introduction to dentistry
- Is it toxic ?
- Does it work ?



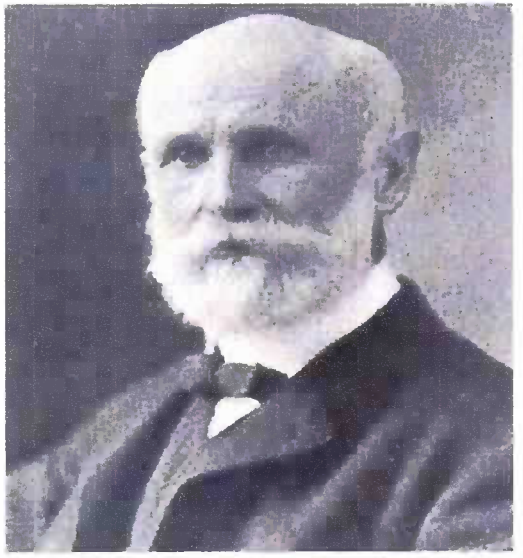
ANCIENT GREEKS PLACED SILVER COINS IN WATER CONTAINERS


# NEWBORN EYE DROPS

# SILVER NITRATE IN DENTISTRY



WD Miller 1890



GV Black 1908

Percy Howe 1917

IS IT TOXIC ?

*Research Reports: Clinical*

# Silver Diamine Fluoride in Children Using Physiologically Based PK Modeling

Journal of Dental Research
1–7

DOI: 10.1177/0022034520917368
journals.sagepub.com/home/jdr

**K.-F. Chen[1], P. Milgrom[2], and Y.S. Lin[1]**

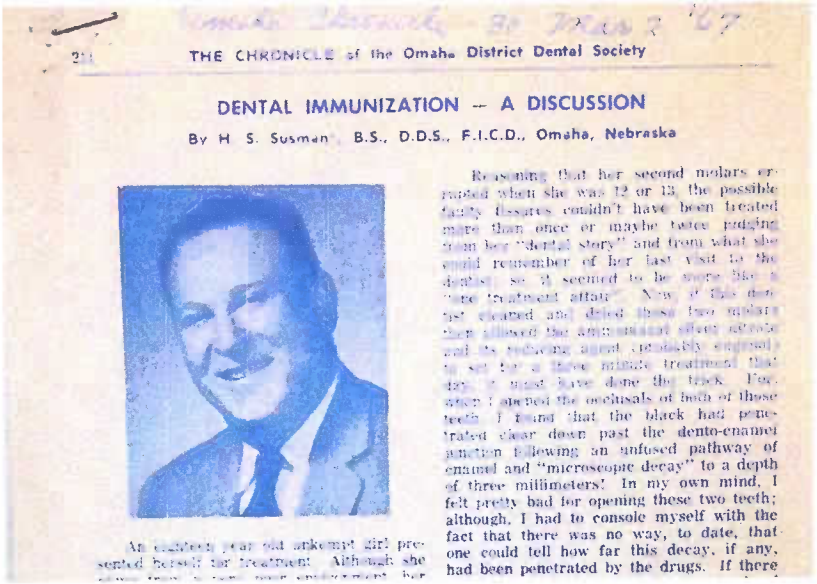
**Abstract**

Silver diamine fluoride (SDF) is used topically to prevent or arrest dental caries and has been tested clinically in toddlers to elderly adults. Following SDF application, small quantities of silver can be swallowed and absorbed. To monitor silver concentrations, pharmacokinetic studies can be performed. However, pharmacokinetic studies are time-consuming, resource intensive, and challenging to perform in young children. The objective of this study was to develop a physiologically based pharmacokinetic (PBPK) model to predict silver disposition in children. The PBPK model for silver was developed using Simcyp software (version 17.0) based on information obtained from literature sources. The predictive performance of the model was assessed by comparing the predicted PK profiles and parameters with the observed data from published rat and human data following intravenous or oral silver administration. The predicted silver concentrations were within 2-fold of observed blood and tissue silver concentrations in rats and within the 95% confidence interval of observed plasma silver concentrations in healthy human adults. The PBPK model was applied to the pediatric population by accounting for developmental physiological changes. For a given SDF dose, the simulated peak silver concentrations were 5.2-, 4.3-, 2.7-, and 1.3-fold higher in children aged 1 to 2, 2 to 4, 5 to 10, and 12 to 17 y, respectively, compared to adults. As silver is reportedly excreted in the bile, the half-life of silver was comparable in all ages and plasma and tissue silver concentrations were predicted to return to baseline levels within 2 wk after SDF application. The simulation in children suggests that conventional SDF application to teeth to prevent or arrest dental caries results in plasma and tissue silver concentrations lower than toxic concentrations. PBPK modeling offers a novel approach to studying dental exposures in younger children, where pharmacokinetic studies would be difficult to conduct.

# DOES IT WORK ?

# A DENTAL IMMUNIZATION

# THEN AND NOW



THE CHRONICLE of the Omaha District Dental Society

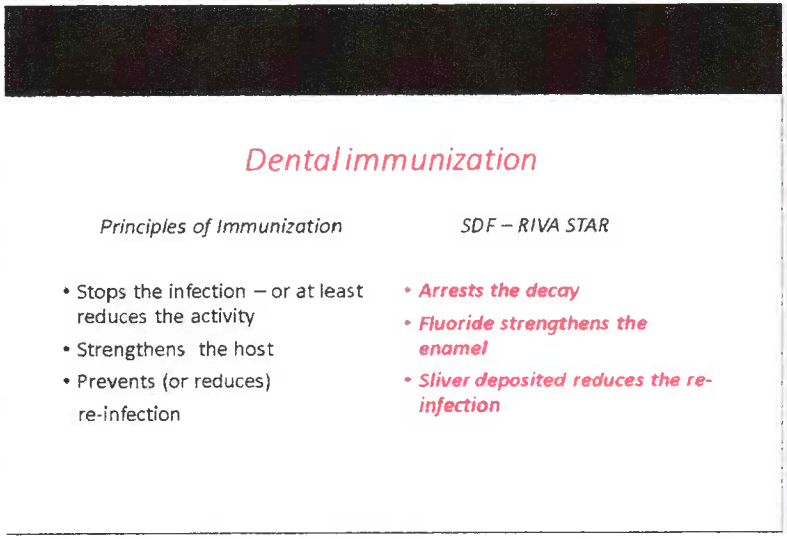
## DENTAL IMMUNIZATION — A DISCUSSION

By H. S. Susman, B.S., D.D.S., F.I.C.D., Omaha, Nebraska



Reasoning that her second molars erupted when she was 12 or 13, the possible faulty fissures couldn't have been treated more than once or maybe twice, judging from her "dental story" and from what she could remember of her last visit to the dentist, so it seemed to be quite like a "one treatment affair". Now if this dentist cleaned and dried these two molars then allowed the ammoniacal silver nitrate and its reducing agent (probably eugenol) to set for a three minute treatment that day, it must have done the trick. For, upon inspection of the occlusals of both of these teeth, I found that the black had penetrated clear down past the dento-enamel junction following an unfused pathway of enamel and "microscopic decay" to a depth of three millimeters! In my own mind, I felt pretty bad for opening these two teeth; although, I had to console myself with the fact that there was no way, to date, that one could tell how far this decay, if any, had been penetrated by the drugs. If there

An eighteen year old arkemyt girl presented herself for treatment. Although she



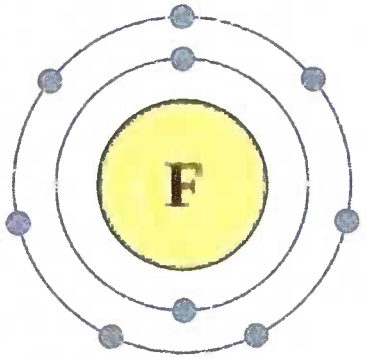
## *Dental immunization*

| *Principles of Immunization* | *SDF – RIVA STAR* |
|---|---|
| • Stops the infection – or at least reduces the activity | • ***Arrests the decay*** |
| • Strengthens the host | • ***Fluoride strengthens the enamel*** |
| • Prevents (or reduces) re-infection | • ***Sliver deposited reduces the re-infection*** |

# FLUORIDE

- What is fluoride ?
- Introduction to Dentistry
- Fluoride delivery systems
- Is fluoride toxic ?

# FLUORINE IS THE 13TH MOST COMMON ELEMENT OF THE EARTHS CRUST



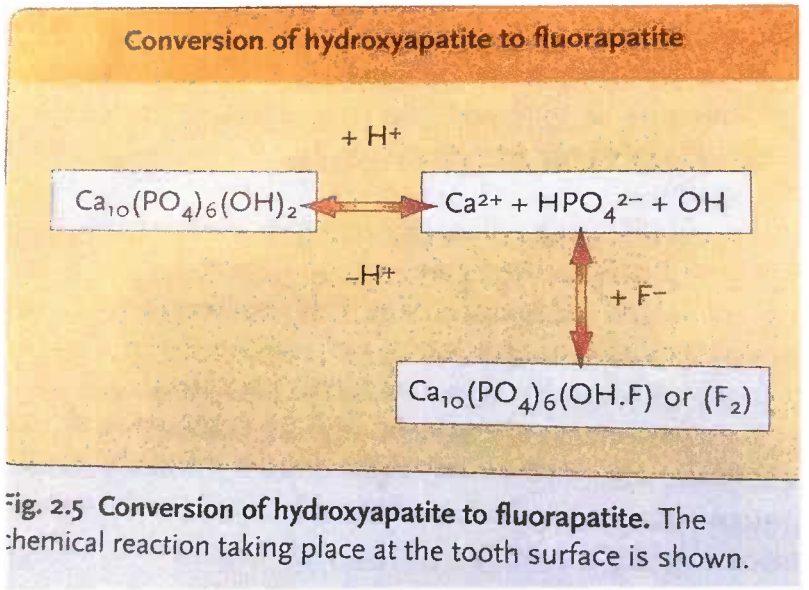




**Fig. 2.5 Conversion of hydroxyapatite to fluorapatite.** The chemical reaction taking place at the tooth surface is shown.

# DISCOVERY OF FLUORIDE EFFECT

1909 Dr. Fredrick Mackay invites GV Black to come to Colorado Springs Colorado to investigate a brown tooth stain.

Reduction in tooth decay !

# FLUORIDE DELIVERY SYSTEMS

- Water fluoridation trial 1945
- Fluoride in tooth paste Crest 1956
- Fluoride varnish 1964
- Fluoride pills, milk, etc.

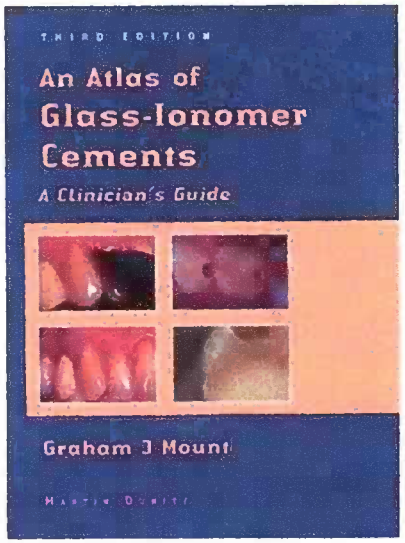
# IS FLUORIDE TOXIC ?

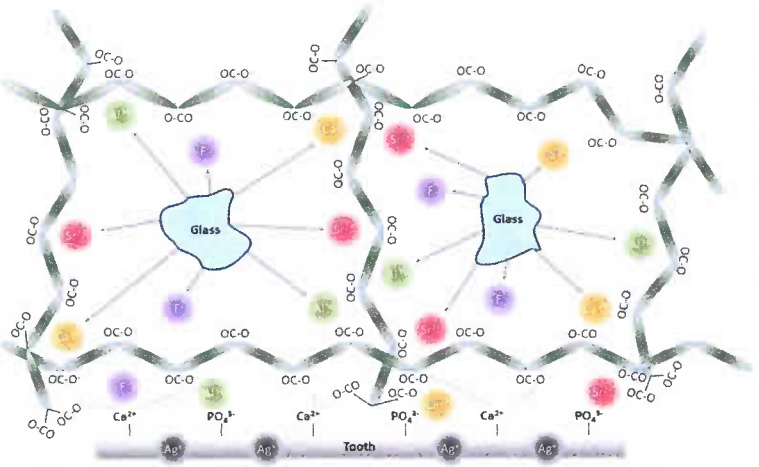
- Gastrointestinal upset, acute effect
- Dental Fluorosis, chronic exposure effect
- Generalized toxic effect after massive exposure

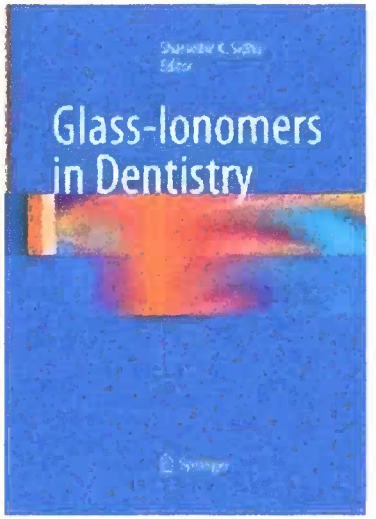
# GLASS IONOMER CEMENT

- When was this product developed ?
- Early versions and applications
  - Jo Frencken and ART
  - Martin MacIntyre and CCT

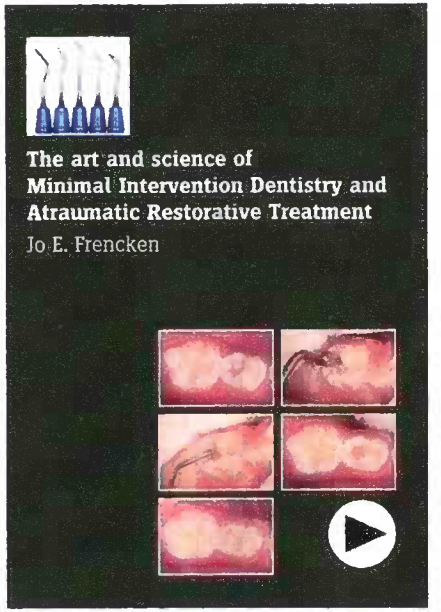
# GIC UNDER DEVELOPMENT 100 YEARS



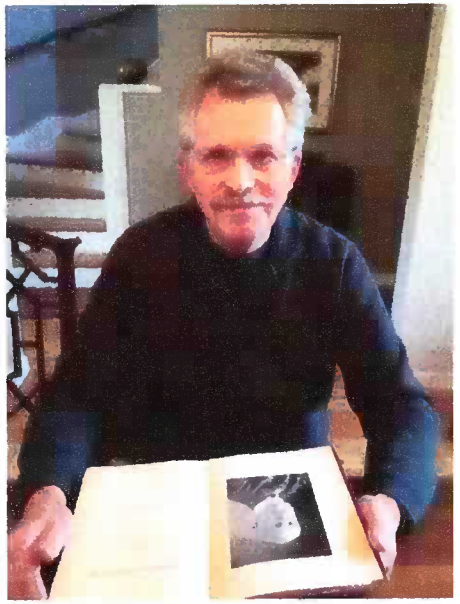



# ART TREATMENTS
# DR. JO FRENCKEN



# CCT TREATMENTS
# DR. MARTIN MACINTYRE



Interview video link http://www.mmclibrary.com/Dr_6.html

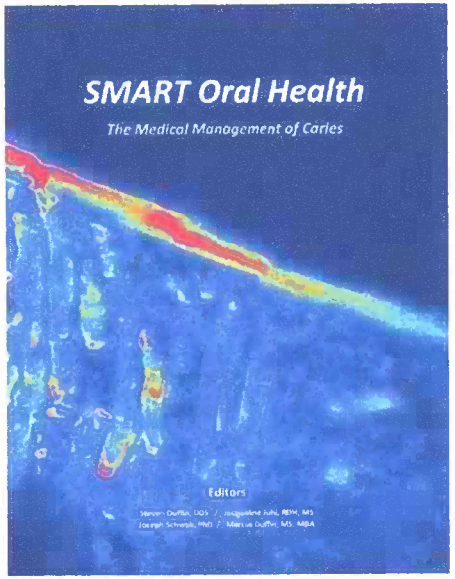
## CARIES CONTROL REGIMEN – RISK ASSESSMENT & TREATMENT

Martin L. MacIntyre, B.A, D.D.S., M.P.H.
martin.macintyre@juno.com
Original 9/1991; revised 9/1998 and 1/2016

### Background

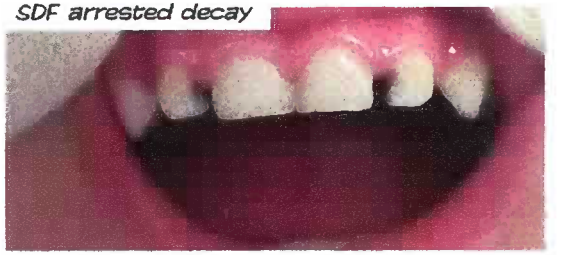
The example of my parents dedication to community service and my liberal arts undergraduate education have been the most important guides for my 55 years as a dentist and led me to a career in public health. I have been in clinical practice, instructional development, private preventive practice, and consulting. Having both experienced and provided dental treatment, I have always interest in prevention and avoiding the painful surgical approach to caries treatment.

# SMART TREATMENTS
# COMBINING SILVER AND GIC




Dr. Jeanette MacLean

SDF arrested decay



Dr. Jeanette MacLean Kidsteethandbraces.com

SMART with 3M Ketac + disking & slow speed

# SMART STEPS

- Stop caries with silver ion
- Start remineralization with fluoride
- Repair damage with glass ionomer cement

# SMART SMILES