Package prepared by Indiana University Archives – Bloomington.

For Seventh and Eighth Grade Levels

Contact Information:

Walaa Al Salmi
walsalmi@indiana.edu
INTRODUCTION TO JOSEPH C. MUHLER PAPERS PACKAGE

DR. JOSEPH MUHLER

Dr. Muhler, a biochemist by training, led the team that came up with the original formula for Crest, a Procter & Gamble best seller, in the 1950's. He started its development in 1945 when he gathered the grants that allowed him to start his research through graduate school. At the time, dentists favored sodium fluoride, but there are many other fluoride compounds, and Dr. Muhler experimented with some 100 of them. His findings proved that stannous fluoride is the most effective in hardening tooth enamel and protecting it from acids. He proved it through research and experiments on thousands of children and adults.

He led the clinical field tests that proved the effectiveness of stannous fluoride as an ingredient in toothpaste. Procter & Gamble test-marketed Crest in 1955, and it went on sale nationally the next year. Crest became the leading seller, especially after 1960, when the American Dental Association endorsed the product.

Joseph Charles Muhler was born in Fort Wayne. He received his D.D.S. in 1948 from Indiana University, followed by a doctorate in chemistry in 1951. That year he became an assistant professor of chemistry. In 1972, he was named a research professor of dental science and director of the School of Dentistry's Dental Research Institute. Even when he retired in 1984, he continued to write in his field. Muhler died on 1996, but his legend lives through his collection at Indiana University Archives.

LESSON PLAN PACKET

This packet is intended for outreach purposes. Because some schools are unable to visit the archives, we wanted to prepare a package that would take the archives to the class and teach students about the principles of archival practice while presenting lessons on Joseph Muhler, dental hygiene, electromagnetic waves, patents, and marketing principles that meet the Indiana

Curriculum Standards. Website: http://dc.doe.in.gov/Standards/AcademicStandards/StandardSearch.aspx

INSTRUCTIONS FOR ARCHIVAL MATERIAL

The lesson plans divide students into five groups. Each group receives an archival box. Each box has 9 archival folders. Folders 1-9 contain records from the Joseph Muhler Papers at Indiana University Archives. These folders correspond with the material section in the lesson plans. The records are in Appendix A through F. Place records in the appropriate folders. Then, in each lesson plan, students will process the folders and add information in the processing sheet as required. See Appendix G for the processing sheet.

FIGURE: Dr. Joseph C. Muhler, School of Dentistry, Indiana University.
1 | THE HISTORY OF ORAL HYGIENE

INDIANA STATE CURRICULUM STANDARDS:

**English**

7.2 Students read and understand grade-level-appropriate material. The selections in the Indiana Reading List illustrate the quality and complexity of materials to be read by students. At Grade 7, in addition to regular classroom reading, students read a variety of nonfiction, such as biographies, autobiographies, books in many different subject areas, magazines, newspapers, reference and technical materials, and online information.

7.5 At Grade 7, students continue to write narrative, expository (informational), persuasive, and descriptive texts. Students are introduced to biographical and autobiographical narratives and to writing summaries of grade level appropriate reading materials.

**Science**

7.6 Students gain understanding of how the scientific enterprise operates through examples of historical events. Through the study of these events, they understand that new ideas are limited by the context in which they are conceived, that the ideas are often rejected by the scientific establishment, that the ideas sometimes spring from unexpected findings, and that the ideas grow to transform slowly through the contributions of many different investigators.

**OBJECTIVE:** Students will learn about the history of dental hygiene and its evolution.

**PREP TIME:** Five minutes to form five groups and distribute the article. Each student will receive a copy of the article assigned to the group.

**MATERIALS:** a dictionary per group. See Appendix A for clips of the article: Fischman, S. L. (1997). The history of oral hygiene products: How far have we come in 6000 years? Periodontology 2000, 15, 7-14.

1. **SHARE THE FOLLOWING WITH YOUR STUDENTS:**

   Cavities and periodontal disease are the two most common chronic human diseases. Their prevalence is undoubtedly higher than in prehistoric times.

2. **ACTIVITY: (45 Minutes)**

   Appendix A divides dental hygiene into five topics: Mouthrinse, Toothpicks, Miswak, Toothbrushes, and Flossing. Each group receives a topic. Give the students the following instruction:
   - Read the article.
   - Highlight new vocabulary (at least one new vocabulary per student in the group)
   - Use the dictionary to define new terms.
   - Discuss the article in the group.
   - Prepare a three minute presentation for the class about your topic.
   - Use online resources if needed.
   - Give a Three minute presentation to class.
   - Include new vocabulary.

3. **SHARE THE FOLLOWING WITH YOUR STUDENTS:**

   Many dental epidemiological studies indicate that people are keeping their teeth longer than ever before in this century. Agents and devices have evolved, by custom and by research, to enable people, with professional assistance, to maintain good oral health.

4. **HOMEWORK:**

   In a 400 word essay, discuss the importance of dental hygiene. Include a narrative of your daily routine and discuss two or more of the following: mouthrinse, toothpicks, miswak, toothbrushes, and flossing.
2| JOSEPH C. MUHLER (1923-1996)

INDIANA STATE CURRICULUM STANDARDS: English
7.2 Students read and understand grade-level-appropriate material. The selections in the Indiana Reading List illustrate the quality and complexity of materials to be read by students. At Grade 7, in addition to regular classroom reading, students read a variety of nonfiction, such as biographies, autobiographies, books in many different subject areas, magazines, newspapers, reference and technical materials, and online information.
7.5 At Grade 7, students continue to write narrative, expository (informational), persuasive, and descriptive texts. Students are introduced to biographical and autobiographical narratives and to writing summaries of grade level appropriate reading materials.

OBJECTIVE: Students will learn about Joseph Muhler and his contribution to the study of dental hygiene. Students will start processing the Joseph Muhler collection and learn about the principles of archival practice.

PREP TIME: Five minutes to form five groups and distribute archival boxes.
MATERIALS: An empty archival folder with a processing sheet. See Appendix G. Folders 1, 2, and 3 from the archival box. These three folders contain three biographical notes from the Joseph Muhler Papers at Indiana University Archives. See Appendix B.

1. SHARE THE FOLLOWING WITH YOUR STUDENTS:
Joseph Muhler studied dental hygiene to develop toothpaste that helped in fighting cavities. He succeeded in 1958 when he experimented and compared different compounds of fluoride. He found that stannous fluoride was the most effective. The process of this development was long and required intensive research and money.

2. ACTIVITY ONE: (35 Minutes)
Folders 1, 2, and 3 contain a biographical note, a magazine article, and a death notice. Request the following from students:
   o Each group will write a biographical essay on Joseph C. Muhler.
   o Read the articles.
   o Each student from each group will write a 100 word summary of a part of Joseph Muhler’s life. For example, one student will write about his birth, education, and marriage. Another student will write about his accomplishments, and the third student will write about his career...etc.

3. SHARE THE FOLLOWING WITH YOUR STUDENTS:
Joseph Muhler’s Papers are at Indiana University Archives. The archive is an organized body of records produced by the public, university administrators, researchers, and professors. The records are evidence of transactions of the university’s affairs. Since Muhler was a professor at Indiana University, his achievements are preserved at the archives. Part of an archive’s missions is to provide access to these records. Finding aids are description of collections prepared by archivists. Muhler’s collection needs a finding aid; therefore, we will create one.

4. ACTIVITY TWO: (15 Minutes)
Students will start the first steps in creating a finding aid for the Joseph Muhler Papers. On the processing sheet, write the following:
   o The collection number. (Random number)
   o The Location.
   o Creator. (Example: John V. Lenson, 1912-1995)
   o Title. (Example: The John V. Lenson Papers)
   o The summary from activity one under Biographical Notes.
   o Series. (Choose a proper series name for the three biographical folders)
   o Write a title and a date on each of the three unlabeled folders describing their contents. Then, write the list under Series.
3 | STANNOUS FLOURIDE IN TOOTHPASTE

INDIANA STATE CURRICULUM STANDARDS: English
7.2 Students read and understand grade-level-appropriate material. The selections in the Indiana Reading List illustrate the quality and complexity of materials to be read by students. At Grade 7, in addition to regular classroom reading, students read a variety of nonfiction, such as biographies, autobiographies, books in many different subject areas, magazines, newspapers, reference and technical materials, and online information.

Science
7.1 Students further their scientific understanding of the natural world through investigation, experiences, and readings. They design solutions to practical problems by using a variety of scientific methodologies.
7.3 Students collect and organize data to identify relationships between physical objects, events, and processes. They use logical reasoning to question their own ideas as new information challenges their conceptions of the natural world.

OBJECTIVE: Students will learn about the importance of Stannous Fluoride in dental hygiene. Students will continue processing the Joseph Muhler collection and learn about the principles of archival practice.
PREP TIME: Ten Minutes to form five groups, and distribute archival boxes and experiment material.
MATERIALS: Folder 4 from the archival box. This folder contains the article “An announcement of importance of the dental profession” from the Joseph Muhler Papers at Indiana University Archives. See Appendix C. Materials for the experiment include: Stannous Fluoride 0.63% - Dental Rinse, vinegar, a color food dye (blue or red), magnifiers, paper towels, tweezers, a scale, and experiment sheet (See Appendix H).

1. SHARE THE FOLLOWING WITH YOUR STUDENTS:
Joseph Muhler’s research found that stannous fluoride is more effective in fighting cavities than sodium fluoride. This finding required many experiments and accurate calculations. In general, toothpaste with fluoride is considered topical treatment. They are most often in the form of rinses, toothpastes and gels. These fluorides aid in the protection of developed teeth, making them more resistant to decay through absorption into the outer layer of tooth surfaces.

2. ACTIVITY ONE: (10 Minutes)
Folder 4 contains an article from the Procter & Gamble Company: “An announcement of importance of the dental profession”. Request the following from each group:
- Skim the article.
- In 100 words, write about the importance of stannous fluoride to dental care.
- From the bibliography, who is the major contributor to these findings?

3. ACTIVITY TWO: (5 Minutes)
Students will continue creating a finding aid for the Joseph Muhler Papers. On the processing sheet, write the following:
- Series. (Choose a proper series name for the scientific research folder)
- Write a title and a date on folder 4 describing its content. Then, list it under the proper Series.
4. EXPERIMENT: (35 Minutes)
Prepare an experiment for students to understand the importance of Stannous Fluoride in dental care.

Each group will receive the following:
- A glass of Stannous Fluoride 0.63% - Dental Rinse
- Two glasses of vinegar
- A glass of water with food color dye.
- A magnifier
- Paper towels
- Tweezers
- Four eggshells

Caution: Solutions containing fluoride ions may be toxic. Do not place your fingers in the stannous fluoride solution or into acidified solutions of treated shells. Use tweezers until the pieces are well rinsed with water. Ask students to conduct the experiment as follows:
- Write a number on each egg shell.
- Weigh each eggshell on the scale before conducting the experiment, and report the weight of each on the experiment sheet.
- Place eggshells number 1 and 2 on the Stannous Fluoride 0.63% - Dental Rinse glass.
- After ten minutes, use tweezers to remove the eggshells. Rinse them in water then dry them in the paper towels.
- Weigh eggshells number 1 and 2 and record the weight on the experiment sheet.
- Place eggshells 1 and 2 in one glass of vinegar and eggshells 3 and 4 in another glass of vinegar.
- Record any reactions noted in the experiment sheet? (eggshells 3 and 4 should start producing bubbles in few minutes)
- After ten minutes, use tweezers to remove the eggshells. Rinse them in water then dry them in paper towels.
- Weigh eggshells number 1, 2, 3, and 4 then record the weight on the experiment sheet.
- Calculate the difference of weight between eggshells 1-2 and eggshells 3-4. Record the difference in the experiment sheet.
- Place eggshells 1, 2, 3, and 4 on a glass of water with food color dye for 5 minutes.
- Use tweezers to remove the egg shells and dry them in the paper towels.

5. DISCUSSION QUESTIONS:
- What did you learn from the experiment?
- How important is stannous fluoride to dental hygiene?
- How did Muhler contribute to dental hygiene?
4 | DR. MUHLER AND X-RAYS

INDIANA STATE CURRICULUM STANDARDS:

**English**

7.2 Students read and understand grade-level-appropriate material. The selections in the Indiana Reading List illustrate the quality and complexity of materials to be read by students. At Grade 7, in addition to regular classroom reading, students read a variety of nonfiction, such as biographies, autobiographies, books in many different subject areas, magazines, newspapers, reference and technical materials, and online information.

**Science**

7.1 Students further their scientific understanding of the natural world through investigation, experiences, and readings. They design solutions to practical problems by using a variety of scientific methodologies.

P.1 Students recognize the nature and scope of physics, including its relationship to other sciences and its ability to describe the natural world. Students learn how physics describes the natural world, using quantities such as velocity, acceleration, force, energy, momentum, and charge.

**OBJECTIVE:** Students will learn about the characteristics of X-ray. Students will continue processing the Joseph Muhler collection and learn about the principles of archival practice.

**PREP TIME:** Five minutes to form five groups and distribute archival boxes.

**MATERIALS:** An Electromagnetic chart. Folders 5 and 6 from the archival boxes, which contain x-ray images and the article “Effects of stannous fluoride, stannous chloride and sodium fluoride on the incidence of dental lesions in rats fed a caries-producing diet” from the Joseph Muhler Papers at Indiana University Archives. See Appendix D.

1. **SHARE THE FOLLOWING WITH YOUR STUDENTS:**
   The frequency and wavelength of a wave determines how much energy a wave has. Frequency is the number of wave crests that pass a point during one second. Wavelength is the distance between two identical points on two adjacent waves. The shorter the wavelength, the more energy the wave has. But as wavelength increases, frequency decreases.

   In science, the electromagnetic spectrum is used to classify the different types of electromagnetic radiation. Electromagnetic radiation is classified according to wavelengths and frequencies. There are eight types of electromagnetic energy in the spectrum: radio waves, microwaves, infrared waves, visible light, ultraviolet light, x rays, gamma rays, and cosmic waves. Humans are only able to see one small portion of the spectrum — visible light.

2. **ACTIVITY ONE: (15 Minutes)**
   Students will take a closer look at one of the eight types of electromagnetic energy in the spectrum: X-rays. Place the chart on the black/white board, ask students to discuss and answer the following questions:
   - What are the characteristics of this type of radiation (wavelength, frequency, key facts)?
   - Where is this type of radiation located on the electromagnetic spectrum in relation to other kinds of radiation?
   - What properties of the wave define why it is found within this area of the spectrum?
   - How is it used or found in our everyday lives or in certain industries? Identify and explain at least two uses.

3. **SHARE THE FOLLOWING WITH YOUR STUDENTS:**
   In order for Joseph Muhler to conduct his study and report his findings, he needed subject studies. He started experimenting on rats. When positive outcomes emerged, he started experimenting on children and adults. He would use stannous fluoride among other treatments on his subjects, and then x-ray their teeth several times over a period of time to calculate his findings.

4. **ACTIVITY TWO: (25 Minutes)**
   Folder 5 contains an article from the Journal of the American Dental Association, “Effects of stannous fluoride, stannous chloride and sodium fluoride on the incidence of dental lesions in rats fed a caries-producing diet”, by Joseph Muhler. Inform students that this is a research article.
Ask students to skim the article and discuss the following questions within their groups:
- What are the different sections of the research article? (Example: background information, introduction, methodology, results, conclusion, and summary)
- Why are these sections important in a research article? (Example: the methodology illustrates how the research is conducted to the reader)
- In page 533 of the article, look at Fig. 1 and read the caption.
- Why did Muhler compare stannous fluoride against sodium fluoride, stannous chloride, and a subject with no added supplement?

After 15 minutes, lead a discussion with the whole class on the questions and write students answers on the board. Then, ask students to open folder 6. Inform them that this folder contains x-rays from Muhler’s research. Explain to students that Muhler needed thousands of children and adults to conduct his study. Ask students to look closely at the x-rays and identify cavities (Tip: Look at the area between the teeth).

5. **ACTIVITY THREE: (5 Minutes)**
Students will continue creating a finding aid for the Joseph Muhler Papers. On the processing sheet, write the following:
- Write a title and a date on folder 5 and 6 describing their contents. Then, list it under the proper Series.

6. **DISCUSSION QUESTIONS:**
- How were x-rays important in Muhler’s research study?
- What other kinds of research studies can scientists utilize x-rays?
- Do you have a personal experience with x-rays in the dentist?

![FIGURE: Electromagnetic energy in the spectrum](image-url)
5| DR. MUHLER AND PATENTS

INDIANA STATE CURRICULUM STANDARDS: English
7.2 Students read and understand grade-level-appropriate material. The selections in the Indiana Reading List illustrate the quality and complexity of materials to be read by students. At Grade 7, in addition to regular classroom reading, students read a variety of nonfiction, such as biographies, autobiographies, books in many different subject areas, magazines, newspapers, reference and technical materials, and online information.

7.5 At Grade 7, students continue to write narrative, expository (informational), persuasive, and descriptive texts (research reports of 500 to 800 words or more). Students are introduced to biographical and autobiographical narratives and to writing summaries of grade-level-appropriate reading materials.

United States Government
USG.1.3 Describe the purposes and functions of government.

Business, Marketing & Information Technology
IT.46.1.3 Compare/contrast the rights granted under copyright, patent, and trademark.

IB.2.4.7 Compare and contrast the differences among copyrights, patents, trademarks and other intellectual property protection methods.

OBJECTIVE: Students will learn about patents and the protection of intellectual property. Students will continue processing the Joseph Muhler collection and learn about the principles of archival practice.

PREP TIME: 5 minutes to form five groups, and distribute archival boxes.

MATERIALS: Folder 7 from the archival box. This folder contains a patent for stannous chlorofluoride from the Joseph Muhler Papers at Indiana University Archives. See Appendix E.

1. SHARE THE FOLLOWING WITH YOUR STUDENTS:
A patent is the exclusive right granted by the United States Patent and Trademark Office to an inventor for a fixed period of time in exchange for a disclosure of the invention. This right prevents others from making, using, selling, or distributing the invention without permission. A patent application includes a claim defining the invention which must be new, inventive, and useful. For a patent to be granted, the patent office examines the application for compliance with the office’s requirements.

2. ACTIVITY ONE: (35 minutes)
Request each group to discuss the following questions and prepare a two minute presentation on their rationale:
- What is the rationale behind a patent? Talk about its effect on scientific research, economy, and licensing.
- Why is disclosure of the invention important? Talk about different scenarios, such as the consequence of keeping inventions secret.
- When are patents criticized? Talk about different scenarios such as granting a patent for a known unclaimed invention, or excluding competitors from using the invention, even if the competitor subsequently develops the same invention independently.

3. SHARE THE FOLLOWING WITH YOUR STUDENTS:
When the Indiana University Foundation sponsored Joseph Muhler to conduct his research and invent the chemical compound used in stannous fluoride, the Foundation submitted a patent application on 1955. Since his invention was new, inventive, and useful, the patent office granted the Foundation exclusive rights to the invention from 1958 to 1982.

4. ACTIVITY TWO: (15 Minutes)
Folder 7 contains a patent for stannous chlorofluoride. Request the following from groups:
- Examine the patent.
- What kind of information is included in the patent?
- Write a patent disclaimer. Include the following information: group name, date, a drawing of the invention, a description of the invention, examples of where it will be used, and why your invention is unique.
The teacher will review the patents and explain to the class how they will be assessed.

5. **ACTIVITY THREE: (5 Minutes)**
   Students will continue creating a finding aid for the Joseph Muhler Papers. On the processing sheet, write the following:
   - Write a title and a date on folder 7 describing its content. Then, list it under the proper Series.

6. **HOMEWORK:**
   In a 300 word essay, describe how patents affect people’s daily life. Use at least two secondary sources.
INDIANA STATE CURRICULUM STANDARDS:

**English**

7.2 Students read and understand grade-level-appropriate material. The selections in the Indiana Reading List illustrate the quality and complexity of materials to be read by students. At Grade 7, in addition to regular classroom reading, students read a variety of nonfiction, such as biographies, autobiographies, books in many different subject areas, magazines, newspapers, reference and technical materials, and online information.

**Marketing**

**BL.1.11** Students analyze the functions/uses of commercial paper.

**BF.4.3** Students explain the role of pricing in the marketing process.

**MA.12.1** Students understand the concepts needed to communicate information about products, services, images, and/or ideas to influence behavior.

**BMS.BOM.4.1** Basic Functions of Management and Marketing Students analyze management and marketing functions and their implementation and integration in the business environment.

**OBJECTIVE:** Students will learn the basic marketing requirements for a product. Students will continue processing the Joseph Muhler collection and learn about the principles of archival practice.

**PREP TIME:** 5 minutes to form five groups, and distribute archival boxes.

**MATERIALS:** Folder 8 and 9 from the archival box. These folders contain correspondence between Muhler and Herman B Wells concerning the sales of crest, and a newspaper advertisement from the Joseph Muhler Papers at Indiana University Archives. See Appendix F.

1. **SHARE THE FOLLOWING WITH YOUR STUDENTS:**

Marketing is an activity and the processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large. Marketing is influenced by psychology, sociology, and economics. Through creative advertising, the industry targets costumer’s needs and wants. In order for a marketing plan to succeed, it requires the following: (1) a product that meets the user’s needs, (2) the pricing of the product should be reasonable, (3) distributing the product through a channel (online or in store) and for specific geographical regions, and (4) promoting the product through advertisement, sales promotion, and branding.

2. **ACTIVITY ONE: (40 Minutes)**

Folder 8 contains a newspaper clip for a toothpaste advertisement. This activity will use the advertisement to trigger student’s awareness of marketing approaches. Request groups to discuss the following:

- Examine the advertisement.
- What techniques do advertisers commonly use to influence us to purchase their products? (Examples: doctor recommendations, catchy phrases, different font styles…etc.)
- Which techniques influence your decision to buy the product? Why?
- Which techniques did not influence you to purchase the product? Why?
- Considering the responses, each group will create an advertisement for a product. Each advertisement should include a product’s name, a slogan or catchy phrases, and key considerations.
- Each group will have a spokesperson that will present the product in one minute. Then other groups will share their inputs on the different techniques used in the advertisement.

3. **SHARE THE FOLLOWING WITH YOUR STUDENTS:**

When Joseph Muhler finished his research and the Indiana University Foundation applied for a patent, the first steps in marketing began. Users needed a product that would effectively reduce cavities. Therefore, the Indiana University Foundation licensed the company Procter and Gamble to promote the product and brand it as “Crest”. The company chose three cities for test market trial. Folder 9 contains correspondence
between Muhler and Herman B Wells concerning the sales of crest.

4. **Activity Two: (10 Minutes)**
Students will finish creating a finding aid for the Joseph Muhler Papers. On the processing sheet, write the following:

- Write a title and a date on folders 8 and 9 describing their contents. Then, list them under the proper Series. (*Create a new series if needed*)
- Span Date and Bulk Date (*From the earliest record date to the latest: 1934-1976*)
- Extent of collection. (*Record the number of boxes in cubic feet*)
- Primary language/s.
- Abstract. (*What is the collection about?*)
- Arrangement. (*Describe the series and what they contain*)

5. **FINAL NOTE:**
Properly archiving material such as the Joseph Muhler Papers and providing a finding aid for people is essential in preserving our past and setting a foundation for our future. Through these lessons, we learned that Muhler studied dentistry, developed a research study where he experimented with stannous fluoride and collected data from x-rays of participants teeth. After the success of his invention, the Indiana University foundation filed for a patent, and then licensed a company to sell the toothpaste. Today, Crest is still a widely popular toothpaste.

6. **FINAL ASSESSMENT (Essay):**
In 500-800 words, write an essay on a product and describe the process of its creation. Include background information on the inventor, research and findings, the kind of material or equipments used, a filed patent for the invention, and marketing techniques. For this essay, use online websites and reference material.
Appendix A

<table>
<thead>
<tr>
<th>GROUP ONE: Mouthrinse</th>
</tr>
</thead>
</table>

Mouthrinse represents one form of attack on oral malodor. The first reference to mouthrinising as a formal practice is credited to Chinese medicine, about 2700 B.C.E., for treatment of diseases of the gums (14). The recommendation was rinsing with the urine of a child. Mouthrinising as an adjunct to mechanical cleansing became popular with the upper classes in the Roman period. Pliny recommended salty water used in an uneven number of mouthfuls, and Hippocrates advocated a mixture of salt, alum and vinegar. Other old favorites included a mixture of honey, oil and beer and a combination of dill, anise seed, myrrh and pure white wine. “Therapeutic rinsing” was especially popular among the Europeans, and persisted until the early 18th century. Urine was considered as an effective aid in curing many diseased parts of the body because its salt concentration is comparable to that of blood. The possible therapeutic value of urea and ammonia was not considered.

Mouthrinising also had a religious connection. The Talmud contains instructions for rinsing the mouth between meals to remove food remnants and prevent admixing of meat and milk products, a violation of the dietary laws (11). Mechanical tooth cleaning and mouthrinising were established practices by the 16th century (4). The Zene Artzney (Medicines for the Teeth), published in Germany in 1530, the first printed work devoted exclusively to dental therapeutics, contained a section on “How to save the teeth’. The recommendations included washing the mouth with burnt alum mixed with vinegar or myrrh boiled in wine.

<table>
<thead>
<tr>
<th>GROUP TWO: Toothpicks</th>
</tr>
</thead>
</table>

Skeletal remains indicate noticeable occlusal wear of the dentition of our ancestors as well as considerable interproximal bone loss. Toothpicks, in whatever form, probably provided relief from persistent food impaction. The intent of early humans was probably not to clean the teeth but simply to remove an unpleasant subjective sensation. Twigs or splinters of wood, unraveling at their end from rubbing and the softening action of saliva, probably evolved into chewing sticks and primitive brushes. This could be recognized as oral hygiene.

The toothpick eventually became part of a personal care kit along with a depilatory tweezer and an ear wax scoop. The most famous and first-known toilet set was found in a Mesopotamian king’s tomb dating to 3000 B.C.E. Artisans fashioned a golden toothpick, a part of the toilet set, connected to a ring by golden wires and housed in a golden case, conical in form and richly decorated with ribboned filigree work. Variations of this basic toilet set have been found throughout Europe, the Middle East and East Asia.

The Romans often provided toothpicks for guests, along with spoons and knives. The ancient Chinese made cast bronze pendants for use as toothpicks, a practice that was also popular in Europe from the 15th to 19th centuries. Wealthy citizens often carried their gold or silver toothpicks in fancy cases and used them ostentatiously at meals.
### GROUP THREE: The chewing stick (miswak or siwak)


The use of the chewing stick is an ancient pre-Islamic custom (9). Mohammed was an enthusiastic supporter of its use as a “purgative for the mouth, and he developed rules and rituals for the correct and effective use of the miswak.

One of Mohammed’s biographers wrote:

> Even the approach of death did not keep the Prophet from demanding the siwak because it is the most elegant thing that one can use and the most fitting to be found beautiful, for it makes the teeth white, clarifies the understanding, makes the breath fragrant, extinguishes the gall, dries up the phlegm, strengthens the gums around the teeth, makes the glance clear, sharpens the power of the vision, opens the bowels and whets the appetite.

This testimonial suggests why Muslims for hundreds of years have used the miswak and why for some it is not only a personal hygiene aid but a spiritual habit.

Although the miswak (or siwak) may have been used with “toothpowders” and “extract of roses”, it is most commonly used as a single or sole cleansing agent, used as a toothbrush but without toothpaste.

The tufted twig design also was used in Japan and in the Indian subcontinent. The twig end was cut thin and flat to also serve as a tongue scraper. The modern-style brush, with hog bristles, was developed in China in the late 15th century.

### GROUP FOUR: Toothbrushes


Most historians trace the development of the first toothbrushes (hog bristles set in oxbone) to 1498 C.E. in China, although there is evidence that Chinese used ivory brush handles and bristles made of hair from a horse’s mane as early as 1000 C.E. The bristle brush was reinvented in the late 18th and early 19th centuries. Due to the high price of the hog bristle, brushes did not become widely used until the end of the 19th century. In the first part of the 20th century in the United States, a family toothbrush was common among the poor. Shared toothbrushes were found in boarding houses and college dormitories. The affluent not only quickly added toothbrushes to their toilet sets but elevated the handle to an art form. Ornate handles of precious metals were prized, and such Victorian toothbrushes are currently popular collectibles. In the late 1930% less expensive nylon filaments began to replace natural bristles; wood and plastic replaced bone handles, and toothbrushes became inexpensive enough for virtually everybody to own one.

Mechanical plaque removal with a manual toothbrush remains the primary method of maintaining good oral hygiene for the majority of the population. When performed well for an adequate duration of time, manual brushing is highly effective. For most patients, neither of these criteria is fulfilled. The modern power assisted toothbrushes were first introduced in the 1960s, and there have been many modifications. These include oscillating or rotating brushes and “sonic” brushes.
## GROUP FIVE: Flossing


Levi Spear Parmly (1790-1859), the “father” of oral hygiene and the inventor of dental floss, stated that dental caries could be controlled by brushing, by applying a dentifrice polisher of table salt, and by using the waxen silken thread, which though simple, is the most important [for the prevention of dental caries]. It is to be passed through the interstices of the teeth, between their necks and the arches of the gum, to dislodge that irritating matter which no brush can remove and which is the real source of distress.

Parmly also understood that gingival tissues could be favorably affected by regular and systematic brushing and flossing. He wrote:

> The brush when first used should be employed rather delicately, as also the waxed silk, until the gums harden, and regain their arched appearance. Although the gums may at first become subject to a slight bleeding, yet in a few days, by a perseverance of the treatment recommended, this bleeding will cease; nor will the slightest pain be experienced.

At the present time, flossing has received the most attention as a method to remove interproximal plaque. However, the difficulty in flossing properly makes this technique less than universal in application.
Appendix B

Folder 1:

Muhler, Joseph Charles

Died 24 Dec. 1976

Now Assistant Professor (Pre Clinic and Research) Indiana University School of Dentistry.

Born Fort Wayne, Indiana, December 22, 1923.
Son of Howard Joseph Muhler and Lauretta Ruth (Zurbuch) Muhler (both deceased).

Educated BS 1945, Indiana University;
DDS 1948, same place.

Children - Joseph Charles Muhler II
James Patrick, July 24, 1959

Record Elsewhere

Record at I U Teaching Fellow, I. U. School of Dentistry, July 1948 - Nov. 1949;
Assistant Professor (Pre Clinic and Research) Indiana Univ. School of Dentistry, Sept. 1, 1951 -


Member - American Dental Assoc.; American Chemical Society;
Indiana State Dental Assoc.; International Assoc. for
Dental Research; Phi Delta Theta; Psi Omega; Society of
the Sigam Xi; Omicron Kappa Upsilon; American Assoc. for
the Advancement of Science; Phi Lambda Upsilon; New York
Academy of Sciences.

Author: Laboratory Manual for Students of Biochemistry,
Harry G. Day and Joseph C. Muhler.

Contributes articles to magazines and periodicals.

Catholic.
Crest co-developer Joseph Muhler dies

Retired IU professor credited with discovering fluoride’s dental use

Associated Press

FORT WAYNE — Dr. Joseph C. Muhler, a co-developer of Crest toothpaste credited with discovering that stannous fluoride could reduce tooth decay, died early Tuesday. He was 73.

As a student at Indiana University dentistry school, Muhler studied fluoride and tooth decay at the suggestion of his biochemistry professor, Harry G. Day. Procter and Gamble began funding the research in 1949.

Muhler, a Fort Wayne native, and Day tested their new toothpaste with Bloomington public school students starting in 1951. Crest made its debut in 1956.

Royalties from the stannous fluoride patent were split between Muhler, Day and another scientist. They gave 50 percent — $2.5 million — to the Indiana University Foundation.

Muhler, a retired distinguished research professor at IU, also wrote several articles on dental work and decay for various scientific organizations. In 1967, the U.S. Navy awarded Muhler its highest civilian honor, the Navy Distinguished Public Service Award, for allowing the Navy to test and evaluate his discovery for free.

Muhler, a World War II Navy veteran, lived on his farm in Sturgis, Mich. He died at St. Joseph Medical Center in Fort Wayne.

Muhler is survived by his wife, Majetta Muhler; two sons, Joseph II and James, both of Fort Wayne, and five grandchildren.

Services will be at 2 p.m. Friday at the Cathedral of Immaculate Conception. Burial is in Catholic Cemetery.

Friends may call from 6-9 p.m. today at D.P. McComb & Sons Lakeside Park Funeral Home, 1140 Lake Ave., Fort Wayne.

Memorial contributions may be made to the Well House Society in Bloomington.
Appendix B

FOLDER 3:

Dr. Joseph Mueller, who developed the fluoride toothpaste, and near Carrolla Walters check teeth of seven-year-old John Paloush, of Bloomington, Ind., one of 3,600 "guinea pigs" who noted the discovery of the antidecay effect to begin. And the percentage of protection, while close to 50 per cent, is only an approximation. But there is no doubt at all that the toothpaste really does reduce decay.

It works a good deal like sodium fluoride solutions that are commonly wrapped or sprayed on children's teeth by family dentists. The toothpaste's radium fluoride, like the sodium fluoride drops dentists use, comes in contact with the surface enamel of the tooth and makes it considerably more resistant to the mouth acids that cause decay. In its effect, the toothpaste is also a remineralizing agent that aids in healing decayed teeth, and they are especially well able to resist decay.

Dr. Mueller hopes the toothpaste will help the large number of persons who, for one reason or another, do not benefit by either of these other, well-established methods of treatment. The toothpaste is no substitute for community water fluoridation," Dr. Mueller has said. "That's the best decay-prevention measure we know—the only way of making certain that all the kids in a town, rich and poor alike, are protected. But many communities are taking painfully long to fluoridate their water, and forty per cent of the population doesn't drink any water. At least 18,000,000 families, most of them living in rural areas, can never be included in the water fluoridation program.

"And while fluoride applications by a dentist are fine, four treatments are required over a period of several years, and each treatment costs at least $15. This expense is a serious burden. Only a small fraction of the country's children are actually being treated."

It appears, furthermore, that the toothpaste will benefit an even larger group: the nation's adults. Until now, only about 200,000 people in their teens and twenties had been exposed to radium fluoride treatment when they were young. But the effects of the adults in the country—could do nothing about it. But now, a Massachusetts study has shown that according to the test results, offers them protection. The Bloomington study showed that the toothpaste reduced the cavities (tooth-decay) rate for adults almost to the same degree as for children.

A man with a toothache hardly needs to hear a sales talk on the value of decay prevention. But because there are hundreds of millions of cavities in the United States, and because a neglected cavity eventually kills the tooth, a major public-health question is involved. This fact was impressed on the armed forces during World War II, when thousands of young men were rejected because they couldn't meet the embarrassingly low minimum dental requirements. On account of the dental shortages (only one for every 1,900 persons), a big improvement in decay prevention appears to be the only practical solution to the problem.

Dr. Mueller hastens to point out that his toothpaste, by itself, won't solve the dilemma. "I believe the answer lies in the combination of things," he says. "Besides fluoride protection, it will involve better nutrition, better oral hygiene and probably other factors not yet known. But I am sure that the toothpaste should be a very big help."

America's giant toothpaste industry, which sells $100,000,000 worth of its products per year, agreed completely. Nearly every major toothpaste company is making a fluoride toothpaste. The fact is that Dr. Muller's experiments, which have been underway for several years, are of great concern in peaceful Bloomington, here that this toothpaste business is on its legislate ear.

A few weeks ago Dr. Muller was busy working in his Dental School Clinic, a long, low, concrete building that is about the center of the University campus. The building is set in a broad sweep of lawn that is often dotted with his young and unsuccessful cycles. The clinic has been the headquarters for

NEXT:


FLUORIDE TOOTHPASTE

By BRUCE BLIVEN, JR.

Joseph Charles Muller, D.D.S., Ph.D., associate professor at Indiana University School of Dentistry, is a purposeful young man. He is a strong, bony fellow with black hair, neatly combed, and a rather handsome face. His usual expression is one ofaffle solemnity, as if he had something urgent on his mind and yet might, with cut warmth, break out into a joyous grin. And he has something to grin about. At the age of thirty-three, after ten years of research, Dr. Muller has developed a new toothpaste of remarkable promise. He has added a particularly effective fluoride—radium, so far, fluoride—to a specially treated denisturb. The objective: to protect the teeth against tooth decay, man's most prevalent disease after the common cold.

And the new toothpaste works. In a vast field study, largest of its kind in the history of dental research, it has cut tooth decay almost in half. The results have taken place in Bloomington, Indiana, site of Indiana University and a pleasant town surrounded by fertile farms interspersed with limousine quarters. Thirty-six hundred Bloomingtonians, both children and grownups, have served as volunteer guinea pigs. They have been brushing daily, each in his own normal tooth-brushing manner, for as long as three years. Some have been brushing with the new toothpaste. Some have been using a toothpaste control toothpaste for comparison purposes. And Dr. Muller, with the help of a 12-man staff, has been keeping careful count of the incidence of new cavities in their teeth.

The results of the Bloomington study have been published in the Journal of Dental Research and the Journal of the American Dental Association, and read before appropriate scientific meetings. Some questions have not yet been answered. No one knows, for example, exactly how long it takes...
Appendix B

In recent weeks five major manufacturers have announced multimillion-dollar plans to market fluoridated toothpastes.

the three-year field study. One end is furnished as a bright, cheerful, five-chair dental office, with a small waiting room where the ending materials, in defiance to the preponderance of children in the small town located toward some months. On this particular day it was filled with small girls, including four or five almost identical sized who went there to give a fifth (of matching height) company — and to check the new comic books. Dr. Muller, wearing a dentist's coat, was examining the teeth of one of his 3,000 subjects, a girl about twelve years old. When he had finished, he stepped back long enough to explain how the field study, which began in May, 1953, has been run.

Once a VOLUNTEER had agreed to join the study. Dr. Muller said, the subject's teeth were cleaned and examined, both by X-ray and visual inspection, and a careful record was kept of the subject's history. The next time a subject was seen, the same examiner who had previously seen him was put in one or another of the several groups of subjects. He was given several free toothbrushes and a new toothpaste. It looked like any ordinary toothpaste, except that the cardboard containers, and the tubes themselves, were a white, opaque color, marked only with a small, unobtrusive letter or design. Compared with the mass of commercial toothpaste packaging, the stuff looked rather dull and drab. Three were brushed and toothpaste eaten for the subject's entire family. At least everyone living under the same roof.

The idea has been to minimize the chance that a participant, accidentally, might brush into the bathroom and grab the wrong tube. The subject was told simply to go home and brush his teeth as usual, using the free toothpaste and not other, and to report back to the clinic at a scheduled time, usually six months.

The idea has been to minimize the chance that a participant, accidentally, might brush into the bathroom and grab the wrong tube. The subject was told simply to go home and brush his teeth as usual, using the free toothpaste and not other, and to report back to the clinic at a scheduled time, usually six months.

The idea has been to minimize the chance that a participant, accidentally, might brush into the bathroom and grab the wrong tube. The subject was told simply to go home and brush his teeth as usual, using the free toothpaste and not other, and to report back to the clinic at a scheduled time, usually six months.

The idea has been to minimize the chance that a participant, accidentally, might brush into the bathroom and grab the wrong tube. The subject was told simply to go home and brush his teeth as usual, using the free toothpaste and not other, and to report back to the clinic at a scheduled time, usually six months.

The idea has been to minimize the chance that a participant, accidentally, might brush into the bathroom and grab the wrong tube. The subject was told simply to go home and brush his teeth as usual, using the free toothpaste and not other, and to report back to the clinic at a scheduled time, usually six months.

The idea has been to minimize the chance that a participant, accidentally, might brush into the bathroom and grab the wrong tube. The subject was told simply to go home and brush his teeth as usual, using the free toothpaste and not other, and to report back to the clinic at a scheduled time, usually six months.
worked alone from six o'clock in the morning (after delivering newspapers to add to his income) to seven thirty, and again, after classes, from late afternoon until midnight, with just enough time out to eat and keep up with his dental studies.

To get the materials he needed for his experiment, he wrote every mayor and a good many minor administrative officials, together he got more than 300 different kinds of fluoride salts. From the Dental School he obtained teeth that had been extracted—hundreds of these—and ground them to powder by hand in a diamond mortar. Then, hour after hour, and week after week, he treated tooth enamel samples with solutions of the different fluorides.

The tests showed conclusively that stannous fluoride was far more effective than any of the others in protecting the ground tooth enamel from decay—and was nearly twice as effective as sodium fluoride, the known and most commonly used fluoride. With Dr. Van Hovey, Mulher performed the results of his experiment in 1947.

Mulher graduated from the Dental School in 1948 with Indiana's best honors record in 23 years. The school, in no one's surprise, gave him a job as a teaching fellow, and for the next two years Mulher worked on the second phase of his experiment: Would stannous fluoride be as effective on the teeth of live animals?

I had never worked on animals before," Dr. Mulher recalls, "and I didn't realize that 1,200 rats and a small army of burners are a big responsibility. If they don't need feeding, their cages have got to be cleaned. They have to be counted, pumpered and showered with love and affection.

Nevertheless, as Dr. Mulher reported to the Journal of the American Dental Association and in the Journal of Nutrition, stannous fluoride did reduce the decay in animals.

In 1959, he married Margaret Stewart, whom he had met five years earlier in a Shakespeare class. "I got a C in that course," Dr. Mulher says. "It was my worst mark, and well worth it." (The Mulhers now have a five-year-old son, Joseph Charles II.)

That same year, while Mulher was attending a dental convention in Chicago, a Proctor & Gamble research scientist approached him. As the two men strolled along Lake Shore Drive, the Proctor & Gamble man said his company had been following Mulher's work with interest, and that if he needed help of any kind, the firm might be able to supply it. Not long afterward, Proctor & Gamble made a research grant to the Indiana University Foundation, and has done so every year since. The total sum, up to now, is close to $300,000.

It was Charles L. Howell of the Indiana State Board of Health, not Dr. Mulher, who took the experiment a third step. The question was whether stannous fluoride, which had worked on animals, would work equally well on children. In 1951, Dr. Howell treated the teeth of 1,200 school children by direct application, using stannous fluoride in some cases and sodium fluoride in the others. The children in the stannous-fluoride group fared by far the best. The reduction in new decay was as high as 65.5 percent.

THIS WAS no certainty, even at this point, that stannous fluoride could be used in a toothpaste. All fluorides combine readily with other substances, including the ordinary abrasives in toothpaste. The big problem was to find a formula that would leave the stannous fluoride free to combine with tooth enamel, not just the abrasive in the dentifrice. For a time that seemed practically impossible. Then Dr. William H. Nebergall, a graduate student helping with the experiment, happened to put a sample of abrasive in a laboratory oven and bake it. When the stub was removed, investigation showed the fluoride would not combine with the abrasive. Rest treatment was the impure test which Mulher had been looking. "It seemed wonderfully simple afterward," Dr. Mulher says, "because every chemist knows that heat deactivates salicylic. But baking the stuff was really just a lucky accident." All of this laboratory work, the basic research that lies behind the toothpaste formula, took six years. As a result, Dr. Mulher was practically positive—one of the fluoride-compatible abrasives turned up—that his toothpaste would work. The field study, begun two months later, confirmed his expectations.

Dr. Mulher likes the thought that stannous-fluoride toothpaste promises to help preserve the nation's teeth. He's delighted that Indiana University, through the foundation that owns the patent on the new toothpaste and has licensed Proctor & Gamble to manufacture it, stands to make considerable sums out of royalties on every tube sold. Now he needn't worry about the commercial toothpaste battle now shaping up. "He's free to concentrate on his own research. (I'll bet he's in the field of nutrition and have nothing at all to do with fluorides.)

Dr. Mulher in his laboratory may be able to keep calm and cool, but it looks as though the toothpaste manufacturers, in the months ahead, are in for a hot time. In the conviction that the public—soon as it understands what a fluoride in toothpaste can do—will be eager to buy, five of the six largest firms are hurrying to meet the anticipated demand. Proctor & Gamble is the only company producing Dr. Mulher's compound, and Crest, as Proctor & Gamble has named the new toothpaste, is the only one of the group that has stannous fluoride. But there are four other fluoride toothpastes already on sale, or shortly to be on sale, which have been developed in their respective companies' laboratories according to their own formulas: Colgate's衅sick, Bristol-Myers' Sentry, Black Diamond American and Lister's Ant-Ex. And undoubtedly, before the list is complete, others will be added.

It takes millions of dollars to launch a new dentifrice. It's fascinating that, in the course of one summer, all five of these firms—which already, as a group, were selling more than 75 per cent of the nation's toothpaste—should have decided, apparently, that the fluoride idea is so good it cannot be ignored. And if you ask Dr. Mulher, they're right.
The Procter & Gamble Company

DIVISION OF DENTAL RESEARCH

An Announcement of Importance to the Dental Profession

BULLETIN NO. 1
ON CREST TOOTHPASTE WITH FLORISTAN
THE FIRST EFFECTIVE FLUORIDE DENTIFRICE

Bulletin No. 1 contains:
The story behind the development of CREST
Clinical evidence for the efficacy of CREST
The story behind the development of Crest

1. The value of fluorides in the fight against dental caries is widely recognized in the dental profession. The addition of sodium fluoride to drinking water (1-5) and its use in topical application by the dentist (6-8) have been proved to have a marked effect in reducing the incidence of tooth decay.

2. In 1945, a research program was undertaken at Indiana University to explore possibilities of increasing, even further, the benefits of fluorides as an anti-caries agent. Early in this program it was discovered that stannous fluoride was greatly superior to sodium fluoride as an agent to reduce the acid solubility of tooth enamel (9-12). Subsequently, it was shown that stannous fluoride was also more effective in reducing the rate of tooth decay among laboratory animals (13, 14).

3. The use of stannous fluoride as a water fluoridating agent is not practical. There is nothing, however, to contraindicate its use as an agent for topical application. In fact, studies conducted by scientists at Indiana University and a public health agency have shown that it is superior to sodium fluoride for this purpose (17).

4. The problems of reaching a significant proportion of the population with topical treatment are tremendous. Because of the widespread use of dentifrice, it was recognized that a toothpaste would be a most suitable vehicle for extending the benefits of stannous fluoride. A careful study of the physiological properties of this material led to the selection of a concentration that would be most efficient for use in a dentifrice.

5. New and special techniques, using the electron microscope, radio-active teeth and powdered enamel, were developed in the Procter & Gamble Research Laboratories and by others to select the appropriate combination of ingredients to accompany stannous fluoride. The result of this research program was FLUORISTAN.

6. FLUORISTAN is Procter & Gamble's trademark for this combination of stannous fluoride with a fluoride compatible polishing agent. FLUORISTAN is the only way today to obtain the benefits of fluoride in a toothpaste.
Clinical evidence for the efficacy of Crest

NOTE: This bulletin presents, in detail, only the material published to date in scientific journals. Other studies, mentioned briefly here, will be more completely discussed in future bulletins which will be sent to you as soon as the additional results have been published.

ALL OF THE CLINICAL STUDIES ON CREST HAVE BEEN CONDUCTED IN ACCORDANCE WITH PROCEDURES ESTABLISHED BY A GROUP OF THE NATION'S LEADING DENTAL RESEARCH SCIENTISTS FOR TESTING SUCH AGENTS.

Test No. 1  This test is being conducted among children 6-16 years of age. The results after 6 months are summarized below (15).

Examinations after the first year have been completed and the results will be summarized and sent to you as soon as they have been published. Observations covering longer use are now being made.

Test No. 2  This test is being conducted among grade school children and in addition to CREST with FLUORIDE, includes a sodium fluoride dentifrice. At the end of 6 months (16) and at the end of 1 year, the results confirmed the findings of Test No. 1. In addition, it was shown that CREST stannous fluoride dentifrice was superior to the one containing sodium fluoride, although the two products were identical in all other respects. Details of this study will be forwarded after their appearance in scientific journals.

Test No. 3  This test, among adults 18-38 years of age, has shown that the effectiveness of CREST is not restricted to children. The effect among adults, as at the end of 1 year (17) was substantially the same as that found among children in Tests No. 1 and 2.

Test No. 4  This study, among children, is being conducted completely independently of the preceding tests, and is intended to provide confirmation of Tests No. 1 and 2.

Test No. 5  Another independent test, among adults, has been set up at another leading university to confirm the findings of Test No. 3.

The pronounced anti-caries effect of CREST has been accomplished with no sacrifice in other important toothpaste characteristics. CREST is unsurpassed in cleaning power. Its consumer acceptance is extremely high, especially among children who find its delightful flavor a real incentive to improve their habits of dental care.
BIBLIOGRAPHY:


SUMMARY

1. CREST TOOTHPASTE WITH FLUORISTAN MARKS A NEW IMPORTANT ADVANCE IN DENTAL HEALTH.
2. CREST HAS PRONOUNCED ANTI-CARIES ACTION — MORE CONCLUSIVELY ESTABLISHED THAN THAT OF ANY OTHER DENTIFRICE.
3. THE CREST RESEARCH PROGRAM HAS BEEN DETAILED AND COMPLETE, AND HAS BEEN CONFIRMED BY INDEPENDENT RESEARCH.
4. THE CREST RESEARCH PROGRAM CONTINUES. AS MORE RESULTS ARE PUBLISHED MORE BULLETINS WILL BE FORWARD TO YOU.

CREST is not yet available for national distribution, but will be sold soon in a few test market areas, including your community.

We invite your comments, questions and suggestions. Please write to:

The Procter & Gamble Company
Office, Division of Dental Research
Cincinnati, Ohio

THE PROCTER & GAMBLE COMPANY
MAKER OF CREST TOOTHPASTE WITH FLUORISTAN
Effects of stannous fluoride, stannous chloride and sodium fluoride on the incidence of dental lesions in rats fed a caries-producing diet


Reprinted from THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION
VOL. 41
PAGES 338-335
NOVEMBER 1950
Effects of stannous fluoride, stannous chloride and sodium fluoride on the incidence of dental lesions in rats fed a caries-producing diet


For the past few years many conscientious dentists have applied a 2 per cent aqueous solution of sodium fluoride to their young patients' teeth in an effort to prevent partially the development of new cavities. It is a fair statement that there is, in general, a 40 to 50 per cent reduction in the incidence of new carious lesions in teeth which are sound at the time of the judicious application of this compound in the manner prescribed. The procedure is time-consuming for the dentist and must be repeated at intervals. Since dentistry is interested in giving the maximum service to patients, a more effective agent for prevention of caries would be of value.

Sognnaes found a probable reduction of the caries attack rate when concentrated solutions of potassium fluoride were applied to the surface of the molar teeth of rats fed a caries-producing diet. His results suggested that the application of a solution containing 60,000 ppm fluoride to the right molars of rats resulted in a slight caries reduction, as compared to the untreated left molars. Cheyne presented data indicating that the application of a solution containing 500 ppm fluorine as potassium fluoride was efficient in suppressing carious activity in existing lesions as well as in reducing the development of new lesions in deciduous cuspids and molars. Conflicting evidence as to the effectiveness of potassium fluoride was presented in the works of East and his co-workers. They stated that the topical application of potassium fluoride, for two three-minute intervals, to newly erupted teeth of children, offered no protection from dental caries.

Calcium fluoride is being placed in certain lozenges as an agent to reduce dental decay. Although its value as such is highly doubtful, Miller inhibited experimental caries development in rats by either 250 ppm of fluoride as sodium.
there is very little information on the in vivo effect of the promising compounds. Although the results of animal experimentation are not similar in all respects to what one may find in the human, the phenomenon as it occurs in the experimental animal should be investigated before applying it in the clinic or in general practice. Since stannous fluoride appears to be much more effective than sodium fluoride in reducing the solubility of powdered enamel and dentin, it was decided to investigate its effectiveness in vivo, in rats. It is the purpose of this paper to report findings concerning the effects of sodium fluoride, stannous fluoride and stannous chloride on the incidence of dental lesions in rats fed a caries-producing diet, compared with a control group receiving no added chemical agent.

**EXPERIMENTAL**

Over a period of 12 months a total of 448 weanling rats were separated as to sex, weight and litter mates and placed on the stock caries-producing diet. The diet used was essentially that of Hopper, Webber and Canniff; the modifications are evident from an examination of Table 1.

The animals were divided into six groups. Five groups were given distilled drinking water supplemented as follows: (a) 10 ppm fluorine and 31 ppm tin as stannous fluoride, (b) 2 ppm fluorine and 6 ppm tin as stannous fluoride, (c) 10 ppm tin as stannous chloride, (d) 2 ppm tin as stannous chloride, (e) 10 ppm fluorine as sodium fluoride. The sixth was a control group and received distilled water with no added supplement. The animals received the caries-producing diet and the various solutions ad libitum. They were kept in cages with raised screen floors. The room was air conditioned.

At the end of 140 days, the animals were killed with ether inhalations and the heads were removed. The heads were placed in 10 per cent formalin for two days and then stored in 70 per cent ethyl alcohol. The excess soft tissue was removed and the teeth were dried with an air syringe and examined under a binocular microscope of approximately 10x magnification. The lesions were located with the aid of a small dental explorer and tabulated accurately on an examination form according to location.

The problem of fracture caries and the method of recording the number and approximate size of the carious lesions was given careful attention. On the basis of much evidence it was assumed that caries in its incipient stage involves a microscopic fraction of the tooth on the surface of the enamel. This area of decalcification, whether on the interproximal surfaces, the labial surfaces of the upper incisors or in the fissures of the molars, usually continues its penetration until the dentin is destroyed. The carious lesion usually progresses along the dentinoenamel junction more rapidly than it destroys enamel. It is possible that a hard object brought into forcible contact with this previously undermined enamel will “fracture” this area. Al-
though caries penetration on the surface of the enamel may be small, the application of sufficient force to the area may reveal large degrees of tooth destruction.

It is possible to demonstrate small areas of caries in rats on the Hopper-Webber-Canniff type diet which, in time, certainly would break down under masticatory stress and give the large lesion which sometimes appears on final examination. It was concluded, therefore, that no fractured areas were to be counted as caries unless one or more active carious lesions also could be found elsewhere in the mouth. If, for any reason, a cusp initially became fractured and later decayed, it would be counted as a carious lesion, but speculation as to the nature of the initial lesion in such instances would be useless.

The problem of differences in the size of separate cavities and the number of lesions had to be dealt with. All lesions were therefore arbitrarily classified as 1, 2, or 3; 1 being the smallest that could be detected, 2 being large enough to be readily detected, and 3 a destruction of the fissure or cusp with complete cavitation. In a preliminary analysis of the teeth, there seemed to be distinct differences between the experimental groups. The control animals (no supplement) had number 3 lesions predominantly, the sodium fluoride and stannous chloride rats had number 2 lesions predominantly, and the stannous fluoride animals had number 1 lesions. In order to determine the total number of lesions which appeared initially, it was decided that if the lower first molar, for example, was completely decayed, a total of three lesions would be recorded; for the lower second, two units; and the lower third, one unit. This classification was based on the number of prominent fissures in each respective tooth. This procedure seemed adequate, for the animals all tended to fall into one or the other of the three groups listed above when classified on the basis of the size of the cavity. Therefore, our data represent the total number of cavities observed per animal and carry the connotation of magnitude of the lesions as previously mentioned. All the teeth were examined and classified by the same investigator. In addition, three different qualified persons examined the teeth and agreed with the investigator's findings.

RESULTS AND DISCUSSIONS

The caries-protective results are summarized in Table 2. One strain included 234 rats and the other 219. In each case the period of supplementation was 140 days. The results show unmistakably that stannous fluoride in the drinking water decreased the number of carious lesions in both strains of rats and in both sexes. When present in the concentration of 10 ppm of fluorine, the percentage decrease averaged a little over 40 per cent in the different groups. The effect was decidedly superior to that of sodium fluoride administered at a comparable concentration. The sodium fluoride resulted in a decrease of approximately 20 per cent in the different groups. Even stannous fluoride at a concentration of 2 ppm fluoride had a greater caries-protective effect than sodium fluoride at 10 ppm, the over-all value for the stannous fluoride of lower concentration being a little over 25 per cent in both sexes and in the two different strains.

Such findings suggested that tin itself had something to do with the protective effect. This is indicated by the data in Table 2 from rats of both strains given 10 ppm of tin as stannous chloride in one case and 2 ppm in another. In all cases, in rats given stannous chloride the average number of carious lesions was less than in the controls receiving no supplement in the drinking water. However, the differences were well within the range of variations within the group. Therefore they may not be significant. This is further indicated by the fact that the rats given the lower concentration of
stannous chloride had the same number of lesions as those that received the higher amount. Should the tin itself have a truly protective effect, rats that received the higher amount ought to have had a smaller number of lesions.

It is noteworthy that the unsupplemented McCollum strain of rats had a higher incidence of lesions than the unsupplemented Carl Wilson strain. The former had an average of 9.2 lesions per rat whereas the latter had an average of 7.4. Comparable strain differences have been observed by other investigators. However the stannous fluoride protected both strains in approximately the same degree. This is significant because it suggests that genetic differences between people in susceptibility to dental caries would not be of great consequence in the use of agents such as stannous fluoride, should direct experiments with this compound prove effective in protecting any class of human subjects.

That the stannous fluoride exerted a truly protective effect is shown by a different method of analyzing the data. In this method the average number of teeth with one or more lesions in each group was determined. The system of counting did not take into consideration either the size of the lesions or the possible number per tooth. By this procedure it was found that in both strains combined the groups given stannous fluoride at 10 ppm of fluorine had an average of 3.4 affected teeth per rat; animals given stannous fluoride at 2 ppm of fluorine had 3.8; those given stannous chloride at 10 ppm of tin had 5.5; those given stannous chloride at 2 ppm of tin had 5.8; those given sodium chloride at 10 ppm of fluorine had 5.1; and those given no supplement in the drinking water had an average of 6.0 affected teeth per animal.

In general the animals could be arranged in three main classes, both as to the size of cavities and as to the protection offered by the supplements. The animals treated with stannous fluoride had the smallest lesions and the fewest in number (Fig. 1). Following this was

---

the sodium fluoride group, intermediate between the first and the third. The latter was composed of rats which were given either stannous chloride or no supplement at all (Figs. 1 and 2). The photomicrographs are representative of these three groups.

Because histologic examination of the tissues was difficult, sections were made only of representative arches. Because these sections were decalcified and thus had lost their enamel structure, it was impossible to study the all-important initial lesions. Nevertheless they did reveal the information being sought. Some experimental evidence indicated that no tooth is likely to fracture unless there is first cavitation. The question arose whether the lesions penetrated through the dentin and into the pulp. This information was easy to obtain from the decalcified sections. There was obviously no need for a histological examination if the lower second molar was entirely decayed. Examination of many different sections confirmed the observation that the animals on stannous fluoride had lesions that were not so deep and extensive as either those on sodium fluoride or those given no chemical supplement. Three typical sections are shown in Figure 2.


Fig. 1 • Mandibular arches of rats that were on a caries-producing diet for 140 days. During this time, animal A received 10 ppm fluorine as stannous fluoride ad libitum in the drinking water; B received 10 ppm fluorine as sodium fluoride; C received 10 ppm tin as stannous chloride; D received no added supplement. Note the relatively small cavity in the left second molar of A as compared with B and C. These are typical findings.
In addition to the changes in the lower arch, cavities were observed in the upper first and second molars (Fig. 3). The upper first molars were by far the most frequently affected. It is interesting to note that a few cases appeared in which one of the upper first molars was completely decayed. In such cases there was a strong tendency for the opposing lower molar to be without lesions, whereas the adjacent lower teeth in that side of the arch tended to be greatly affected. This finding has been mentioned previously. The foregoing is additional evidence in support of the belief that caries in the rat is initiated by impaction of food particles in the fissures.

Neither the stannous salts nor the sodium fluoride seemed to have any toxic effect in the concentrations used. Some of the animals from each group were mated and all reproduced satisfactorily. There was no impairment of growth (Table 2) or other changes suggestive of any injurious effect.


Fig. 2 - Decalcified sections of mandibular teeth of rats on a modified Hopper-Webber-Canniff diet for 140 days. Animal A received 10 ppm fluoride as stannous fluoride, B received 10 ppm fluoride as sodium fluoride, and C received no added supplement. Soundness of the dentin in A is clearly demonstrated and penetration into the pulp is obvious in B and C. Enamel was removed in the preparation of these sections. The conclusion that less caries occurred in the stannous fluoride animals appears justified because there was little disturbance in the dentin in these animals. These sections are representative of the experimental animals.
Fig. 3. Maxillary teeth of rats on caries-producing diet for 140 days. Note relative freedom from cavitation in A. This is characteristic, although in a small percentage of animals lesions occur as illustrated in B.

It is significant that this in vivo work parallels the findings previously reported by Muhler and Van Huyzen and Muhler, Boyd and Van Huyzen on in vitro studies of enamel solubility. These authors reported that stannous fluoride was by far the most effective agent to decrease the solubility of powdered enamel and dentin, while sodium fluoride had some beneficial effect, although not as much as obtained by the use of stannous fluoride.

On the basis of these findings, and the results from in vitro investigations already published, the effectiveness of stannous fluoride should be compared with sodium fluoride in the control of human dental caries. Perhaps the most useful test would involve topical applications of the two salts, comparing one with the other in effectiveness.

SUMMARY

1. Experimental dental caries was produced in two different strains of rats by a modified Hopper-Webber-Canniff diet.

2. Stannous fluoride in the concentration of ten parts of fluorine per million in the drinking water was greatly superior to sodium fluoride or stannous chloride in any concentration used in this experiment for reducing the incidence and severity of carious lesions in both strains of rats.

3. Stannous chloride did not appear to decrease significantly the incidence of dental caries. Sodium fluoride in the concentrations of 10 ppm of fluorine in the drinking water had some preventive effect on the incidence and severity of the carious lesions.

4. The lower first and second molars had the greatest incidence of decay. The upper first molar was affected in about 10 to 15 per cent of the cases with any lesions and the upper second molar was affected in but 5 to 8 per cent of all animals with any lesions.

5. Neither the stannous salts nor the sodium fluoride had any apparent toxic effects.
Appendix D

FOLDER 6:
Instructions: This folder contains x-rays from Muhler’s research. Glue image 1 on an envelope. Place image 2 in the envelope, cut the x-rays into individual pieces and place them in the envelope.
Appendix E

Folder 7:

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Whereas William H. Nebergall, of Bloomington, Indiana, assignor to Indiana University Foundation, of Bloomington, Indiana, a corporation of Indiana,

Presented to the Commissioner of Patents a petition praying for the grant of Letters Patent for an alleged new and useful invention the title and a description of which are contained in the specification of which a copy is hereunto annexed and made a part hereof, and complied with the various requirements of law in such cases made and provided, and

Whereas upon due examination made the said Claimant is adjudged to be justly entitled to a patent under the law.

Now therefore these Letters Patent are to grant unto the said Indiana University Foundation, its successors or assigns for the term of SEVENTEEN years from the date of this grant right to exclude others from making, using or selling the said invention throughout the United States.

In testimony whereof, I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington the twenty-seventh day of May, in the year of our Lord one thousand nine hundred and fifty-eight, and of the Independence of the United States of America the one hundred and eighty-second.

[Signature]
Attorney, Commissioner of Patents
United States Patent Office

2,836,544

Patented May 27, 1959

STANNOUS CHLOROFUORIDE, METHOD OF PREPARING SAME, AND DENTIFRICE COMPOSITIONS THEREWITH

William E. Neberall, Bloomington, Ind., assignor to Indiana University Foundation, Bloomington, Ind., a corporation of Indiana

Application February 17, 1955, Serial No. 486,385
9 Claims. (Cl. 167—93)

This invention relates to a new composition of matter. More particularly, it relates to the compound tin (II) chlorofluoride (stannous chlorofluoride), having the formula SnClF (SnCl₂(F₂)), in a method for its preparation, and to compositions or compositions containing this compound. It further relates to compositions of matter suitable for application to the teeth.

The tin (II) chloride used in the preparation of the compound may be either anhydrous or in the hydrate form. Also, the hydrogen chloride may be supplied either as a gas or in aqueous solution as hydrochloric acid. The reaction may take place in the absence of water. However, when water is present the total proportion of water and hydrogen chloride is about one-third of the total weight of the reaction mixture.

The tin (II) chloride salt may be supplied to the reaction mixture either in solid form or in solution, as long as the formation is not uniform and does not exceed the limits of the reaction mixture. If solvents other than water are used they should be selected so as to introduce no undesirable reactant or contaminant.

The temperature at which the reaction takes place is not critical except that the application of heat may be desirable to dissolve the tin (II) chloride and thus hasten the reaction. Also, the use of a minimum amount of water in the solution will facilitate crystallization of the tin (II) chlorofluoride.

The tin (II) chloride may be formed in situ in the reaction mixture. For example, tin (II) oxide may be combined with hydrogen chloride. Also, tin may be directly combined with chlorine under proper reaction conditions. It is to be understood that any of the foregoing and other equivalent reactions are to be included in the scope of this invention.

Since stannous salts are easily oxidized it may be desirable to use oxygen-free water in preparing the aqueous solutions to prevent the formation of stannic salts which could form contaminating insoluble compounds. It may also be desirable to protect the reacting materials from the air by keeping them under some inert gas such as nitrogen, argon, etc. However, the contamination would be slight, these precautions will not be necessary where small amounts of impurities can be tolerated.

The following example illustrates the preparation of the compound with greater particularity:

Example 1

112.8 g. (0.5 mole) tin (II) chloride dihydrate were weighed into a 200 ml polyethylene beaker and 15 g. of oxygen-free, boiling water were added to dissolve the salt. The solution was heated to 55° C. on a steam bath, while maintaining an atmosphere of oxygen-free nitrogen above the solution. 22.5 g. (0.55 mole) of 49.6% hydrofluoric acid were slowly added to the solution. The mixture was allowed to cool at room temperature, and colorless crystals formed. The supernatant liquid was decanted, and the crystals were washed three times with 95% ethanol; the alcohol was decanted after each washing. The product was dried in an unvented desiccator until...
Appendix E

3

Analysis—Calc'd. for SnClF: Sn, 68.53%; F, 10.97%.
Found: Sn, 68.7%, 68.3%, 68.5%; F, 10.7%, 10.7%, 10.8%.

Tin (II) chlorofluoride in aqueous solution is an excellent material for topical application to the teeth. The following example illustrates the efficacy of an aqueous solution in clinical testing.

Example II

An aqueous solution of 4% tin (II) chlorofluoride solution was prepared using oxygen-free water. This solution was applied to newly erupted teeth of nearly 400 children. As a comparison, a comparable group was treated with a 1% solution of sodium fluoride (this furnished an equivalent amount of fluoride).

The aqueous solutions were applied to the teeth by cotton applicators as described by J. W. Kautner, J. Amer. Dent. Assn., 36-37 (1948). This consisted of a thorough dental prophylaxis followed immediately by the first fluoride application. Within a period not exceeding 10 days, three additional treatments were given although only the first was preceded by a prophylaxis. The treatment consisted of keeping all surfaces of the teeth moist throughout each four minute treatment series. Approximately one year after the initial fluoride application the children were reexamined by the same dentist. The following table shows the dental caries experience in the erupted permanent teeth at the time of the first examination:

<table>
<thead>
<tr>
<th>Solution</th>
<th>Number of Children</th>
<th>Non-Carious Teeth</th>
<th>Destroyed, Missing or Filled Surfaces</th>
<th>New Decayed, Missing or Filled Teeth</th>
<th>New Decayed, Missing or Filled Surfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>NaF......</td>
<td>307</td>
<td>5,969</td>
<td>1,893</td>
<td>265</td>
<td>265</td>
</tr>
<tr>
<td>SnClF......</td>
<td>394</td>
<td>5,409</td>
<td>1,866</td>
<td>252</td>
<td>261</td>
</tr>
</tbody>
</table>

*Compared to initial non-carious teeth.

As can be seen, the use of aqueous solutions of SnClF results in a very great reduction in caries formation as compared to aqueous solutions of NaF.

Very satisfactory results can be obtained using a concentration of about 0.0091% SnClF up to saturation. However, aqueous solutions for topical application containing too large an amount of fluoride may be toxic if swallowed and must be used with care.

As has been heretofore pointed out, tin (II) chlorofluoride can be incorporated in a dentifrice composition, and will produce very good results in reduction of caries formation when applied to the teeth in this type of medium.

One of the most commonly used dentifrice forms is toothpaste, and tin (II) chlorofluoride can be conveniently included as an active material in a toothpaste.

Example III

Toothpaste, containing 4000 p. p. m. of F— was prepared having the following composition:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carboxymethyl cellulose</td>
<td>1.60</td>
</tr>
<tr>
<td>Calcium pyrophosphate</td>
<td>40.82</td>
</tr>
<tr>
<td>Tin (II) chlorofluoride</td>
<td>5.54</td>
</tr>
<tr>
<td>Glycerine</td>
<td>25.00</td>
</tr>
<tr>
<td>Sodium coconut monoglyceride sulfate</td>
<td>1.00</td>
</tr>
<tr>
<td>Lauryl alcohol sulfate</td>
<td>0.38</td>
</tr>
<tr>
<td>Flavor and sweetening</td>
<td>0.4</td>
</tr>
<tr>
<td>Water</td>
<td>Balance</td>
</tr>
</tbody>
</table>

A toothpaste containing 1000 p. p. m. of F— was prepared having the following formula:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carboxymethyl cellulose</td>
<td>1.10</td>
</tr>
<tr>
<td>Magnesium-aluminum silicate</td>
<td>0.40</td>
</tr>
<tr>
<td>Humectants</td>
<td>30.00</td>
</tr>
<tr>
<td>Calcium pyrophosphate</td>
<td>40.00</td>
</tr>
<tr>
<td>Tin (II) chlorofluoride</td>
<td>0.91</td>
</tr>
<tr>
<td>Sodium coconut monoglyceride sulfate</td>
<td>0.81</td>
</tr>
<tr>
<td>Lauryl alcohol sulfate</td>
<td>0.70</td>
</tr>
<tr>
<td>Flavor and sweetening</td>
<td>0.2</td>
</tr>
<tr>
<td>Water</td>
<td>Balance</td>
</tr>
</tbody>
</table>

Although specific formulations have been given in the preceding examples for toothpastes, other equivalent materials may be used. For example, alumina is another very satisfactory abrasive. Other abrasives which will form satisfactory toothpastes, but which are less effective, include dicalcium phosphate, both hydrated and anhydrous, calcium carbonate, etc.

The preferred binder is one of the cellulose other type such as sodium carboxymethyl cellulose, etc., but other known and acceptable binders may be used.

Any of the sudoing agents commonly used will be satisfactory for the toothpaste formulation. Examples of these include alkyl sulfates, monoglyceride sulfonates, alkyl sulfa-acetates, succinylates, soaps, etc.

Other components of pastes such as humectants, such as glycerine, sorbitol, etc., flavorings such as oils of spearmint, peppermint or wintergreen, and sweetening agents will suggest themselves to those skilled in the art.

The compound of this invention may also be included in dentifrices which may be dispensed from a pressurized container in the form of foam.

In dentifrice compositions it is preferred to use from 0.0091% to 3.64% of SnClF, while especially good results are obtained with a dentifrice containing from 0.22% to 0.31%.

While specific examples of dentifrice materials have been set forth it is to be understood that they are illustrative only and that the invention is not to be limited thereto.

What is claimed is:

1. Stannous chlorofluoride.
2. The method of making stannous chlorofluoride which comprises mixing SnClF₂, H₂O, and HF in proportions substantially defined by the area A B C D of the figure, and forming stannous chlorofluoride from said mixture by crystallization.
Appendix E

3. The method of making a composition of matter containing stannous chlorofluoride which comprises mixing SnCl₂, H₂O and HF in proportions substantially defined by the area AEFGA of the figure and forming a mixture of crystals of stannous chlorofluoride and distannous monochlorofluoride from said mixture by crystallization.

4. The method of making stannous chlorofluoride which comprises mixing SnCl₂, H₂O, and HF, in proportions substantially defined by the area AEFGA of the figure, forming a mixture of crystals of stannous chlorofluoride and distannous monochlorofluoride from said mixture by crystallization and separating out stannous chlorofluoride.


6. A dentifrice containing stannous chlorofluoride.

7. A composition of matter useful in the treatment of teeth comprising an aqueous solution containing from 0.0091% to saturation of stannous chlorofluoride.

8. A toothpaste containing stannous chlorofluoride.

9. A toothpaste containing from 0.0091% to 3.64% stannous chlorofluoride.

References Cited in the file of this patent

UNITED STATES PATENTS

1,943,856 Cross .......................... Jan. 16, 1934
2,689,170 King .......................... Sept. 14, 1954
2,694,616 Wiener ......................... Nov. 16, 1954
2,717,197 Brown .......................... Sept. 6, 1955

OTHER REFERENCES

Appendix F

FOLDER 8:

At last! Freedom from Tooth Decay!

MAGIC OF FLUORIDE
NOW CAPTURED IN AMAZING NEW “SUPER” TOOTH PASTE!

This wonder-working fluoride formula PREVENTS CAVITIES better than any dentifrice could ever do before!

“SUPER” AMM-i-DENT GIVES YOU “SUPER” PROTECTION AGAINST DECAY!

The brand new paste... with the grand new taste ...in the new red carton!

“SUPER” Amm-i-dent with fluoride is a completely new formula... totally different from other tooth pastes.... your dentist says you may have tried something different from my Amm-i-dent you may have tried before! It is the only formula with “super” protection against decay...

...to unique combination of ingredients that promotes a healthy new set of teeth and your children will love.

Everything about “Super” Amm-i-dent is new—even the package! Look for the new red cartons at all stores!

Revolutionary new “Super” Amm-i-dent with fluoride works its magic by strengthening tooth enamel... making it so strong that cavities can't even get started!

Newspapers, magazines, dental journals...it's the biggest news story since tooth paste! This wonder-working fluoride...for every family, every person, can enjoy the decay-fighting benefits of this wonder-working formula!

Yeast Stores everywhere now have amazing new “Super” Amm-i-dent containing fluoride! It's a “super” tooth paste that offers “super” protection against decay for adults and children...and ever. It reduces caries in a way no dentifrice could ever do before... “Super” Amm-i-dent!

Endorsed by Health Authorities Everywhere Revolutionary new “Super” Amm-i-dent contains the same magical fluoride endoreded by dentists, doctors and health authorities everywhere. They know it makes a triumph over tooth decay!

What's more, “Super” Amm-i-dent is the world's first and only tooth paste that gives you all three of these amazing benefits: (1) Fluoride; (2) Ammoniated; (3) Anti-enzyme (SLS). All three of these decay fighters are now combined in this one great new tooth paste!

No other tooth paste...no other offers you this wonderful triple protection against decay!

And... while preventing cavities so remarkably, “Super” Amm-i-dent with fluoride also cleans teeth and removes odor and restores the natural beauty and brightness of your teeth.

How “Super” Amm-i-dent with Fluoride Works
New “Super” Amm-i-dent with fluoride works its magic by strengthening permanently your teeth—inside and out! It makes your teeth so much stronger, more resistant to decay, that cavities couldn't even get started in years after years tested by dentists.

This remarkable strengthening action begins the first time you brush your teeth with “Super” Amm-i-dent. What's more, each brushing with this amazing new fluoride tooth paste makes your teeth even stronger. Truly, you never dreamed your teeth could be so free of decay!

To give yourself and your family the “super” protection against decay, get “Super” Amm-i-dent with magical fluoride. It's the brand new paste...the new red cartons...with the grand new taste...in the new red cartons!

FIRST and ONLY
tooth paste with all 3:
1 FLUORIDE
2 AMMONIATED
3 ANTI-ENZYMES (SLS)
All 3 of the most effective... “deacy fighters” known... now in this one new “Super” tooth paste!
Appendix F

FOLDER 9:

INDIANA UNIVERSITY
INTER-DPARTMENTAL COMMUNICATION

TO: President Herman B Wells
DEPT: Administration Building

FROM: Joseph C. Muller, B.D.S., Ph.D.
DEPT: Chemistry
DATE: February 15, 1955

Yesterday I sent you one of the first tubes of the new Indiana University dentifrice. Today sales begin with this product in Portland, Oregon, Columbus, Ohio, and Rochester, New York. These three cities have been chosen for test market trial, and the product will not go into national distribution until a later date. This date is determined by one factor. This is based upon the fact that my most recent clinical data has not been as satisfactory, as the first data reported in the Journal of Dental Research. (I am enclosing a reprint of this for you.) However, this situation has been corrected and I am starting tomorrow, February 21st a new clinical test with a dentifrice that the laboratory and analysis data gives indications of being several times as effective as the data published in the first report. However, it will take at least two years, I believe, to state definitely if we have available as equally effective or more effective product. I would like to give you a full report on the progress of this research later on, but due to an enormous amount of work on my desk at this time I would like to defer this until later in the year. I will continue to keep you posted on the most important facet of this work.

I am enclosing a booklet of information which you may like to examine. This material is being distributed to all the dentists in the test market areas.

I am not very wise regarding money matters as you may know, but I would like to get together with the Foundation to ascertain if Proctor and Gamble are going to pay royalties to the Foundation on the sales of Crest in the test market areas. I would welcome any suggestions or procedures regarding this that you would care to make.

Regarding further commitments from Proctor and Gamble to the University, I would like to invite your thought to the fact that although our contract with Proctor and Gamble is limited to royalties for only three years, I have sufficient evidence to feel moderately encouraged that in a short time we will have available more effective fluorides than stannous fluoride. Obviously, when these are added to a new dentifrice and tested here on the campus I would hope that you would support me in asking that a new contract be drawn up to cover this product and that new royalties would begin when the new product was distributed. As you see, if I keep on my toes and if we can keep abreast with new developments, I see no reason why the University cannot receive royalties for many years to come from such research.

If you have further questions regarding this or any of the related problems I would be most anxious to answer them for you.

With my best personal regards,

Joe Muller
Many thanks for your memorandum of February 15 and enclosures. I am glad to have the publication addressed to the dentists on Crest, and the sample which you sent. I am taking the paste home and will try it out myself. Hearty congratulations to you on the state which this project has now reached.

Concerning the royalties and other matters in regard to Proctor and Gamble, I suggest that you talk to Mr. Neighway of the Foundation who is best informed. I share your hope that new contracts can be drawn up when warranted by new scientific developments.
Appendix G

COLLECTION PROCESSING SHEET

Collection Number:
Location:
Creator:
Title:
Span Date:
Bulk Date:
Processed by:
Finding Aid Completed:
Extent of Collection:
Container Description:
Primary language/s of collection:
Abstract:

Arrangement:

Biographical Note:

Folder List:
Series:
EXPERIMENT SHEET: STANNOUS FLUORIDE EFFECTS ON EGGSHELLS

1. How much does each shell weight before conducting the experiment?
   Eggshell 1:  
   Eggshell 2:  
   Eggshell 3:  
   Eggshell 4:  

2. How much does eggshell 1 and 2 weigh after soaking them in the Stannous Fluoride 0.63% - Dental Rinse?
   Eggshell 1:  
   Eggshell 2:  

3. Do eggshells 1 and 2 have any noted reactions to the vinegar? If so, note it.

4. Do eggshells 3 and 4 have any noted reactions to the vinegar? If so, note it.

5. How much does shell 1 and 2 weigh after soaking them in the vinegar?
   Eggshell 1:  
   Eggshell 2:  

6. How much does shell 3 and 4 weigh after soaking them in the vinegar?
   Eggshell 3:  
   Eggshell 4:  

7. What is the difference of weight between eggshells 1-2 and eggshells 3-4?

8. After dying the eggshells in food color, what are visible effects of the vinegar on each eggshell?
   Eggshell 1:  
   Eggshell 2:  
   Eggshell 3:  
   Eggshell 4:  

9. What did you learn from this experiment about the effects of Stannous Fluoride on eggshells?