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A Review of Contemporary Dentifrices

A Peer-Reviewed Publication

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Abstract

Toothpaste, also called dentifrice, is essential to proper daily oral hygiene. Dentifrices are pastes, gels or powders that help remove plaque, a film of bacteria that forms on teeth and gums every day. Toothpaste improves the mechanical brushing and cleaning power of a toothbrush. It may seem like toothpaste is a recent advancement in oral hygiene, but substances to assist in cleaning teeth have been used in various forms for centuries.

Modern dentifrices have evolved to become smooth, good tasting toothpastes which can contain anticaries, antigingivitis, antisensitivity ingredients, or breath fresheners while providing greater cosmetic and therapeutic benefits than those of prior generations, if utilized correctly.

Educational Objectives:

At the conclusion of this educational activity participants will be able to:

1. Describe the difference between active and inactive ingredients
2. List the different therapeutic properties of SnF₂, NaF, and MFP
3. Compare the fluoride concentrations of OTC, Rx, and professional use dental products
4. Describe the RDA value of toothpaste

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Author Disclosures

Dr. Croll has no commercial ties with the sponsors or the providers of the unrestricted educational grant for this course. Dr. DiMarino serves as the Director of Clinical Affairs for Premier Dental Products Co., Plymouth Meeting, PA.

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Abstract

Toothpaste, also called dentifrice, is essential to proper daily oral hygiene. Dentifrices are pastes, gels or powders that help remove plaque, a film of bacteria that forms on teeth and gums every day. Toothpaste improves the mechanical brushing and cleaning power of a toothbrush. It may seem like toothpaste is a recent advancement in oral hygiene, but substances to assist in cleaning teeth have been used in various forms for centuries.

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Introduction

Consumers and dental professionals are flooded with commercials and marketing material declaring product superiority and promising almost everything we could want: protection against cavities, strong teeth, healthy gums, no sensitivity, white teeth, etc. Dental professionals may desire a better understanding of the technology associated with current advances in dentifrices to help them recommend toothpaste that is most appropriate for their patients.

Toothpaste (Dentifrice)

Toothpaste is a necessary, integral part of an effective home care routine. Dentifrices are available in several different forms including gels, pastes and powders. They help with the removal of biofilm from the teeth and gums and add flavor to make brushing more pleasant. Dentifrices can contain both active and inactive ingredients. Active ingredients offer specific therapeutic benefits that are regulated by the U.S. Food and Drug Administration (FDA). Inactive ingredients are those responsible for the structure of the dentifrice and for sensory appeal.

Manufacturers are constantly searching for the ideal toothpaste by combining various active and inactive ingredients. Different combinations create different products which can be marketed for their FDA approved claims as over the counter (OTC), prescription (Rx) strength dentifrices or FDA clearance as a medical device.

Dentifrices and the Food and Drug Administration (FDA)

The FDA's evidence-based system of drug and medical device approval plays an essential role in ensuring that dentifrices are both safe and effective before they are released to consumers. Toothpaste manufacturers are held to strict standards by the FDA to make sure that their manufacturing and marketing efforts reliably produce and promote products of expected identity, strength, quality and purity.

Dentifrice Approval – FDA OTC Drug

Toothpastes that provide a therapeutic benefit (fight caries, relieve sensitivity, reduce gingivitis, etc.) are considered drugs and must be reviewed by the FDA. FDA Over the counter (OTC) drugs are defined as drugs that are safe and effective for use by the general public without seeking treatment by a health professional.¹

Rx Drug

Prescription drug products require a doctor's authorization to purchase, are intended to be used by one person and are to be dispensed or prescribed only on the order of a dentist.²

Medical Device

Medical devices range from simple tongue depressors and bedpans to complex programmable pacemakers. An example of a medical device in dentistry is MI Paste Plus™ which is FDA cleared for sensitivity relief.

Consumers and dental professionals can access FDA resources which can provide a valuable summary of information, examples of which are shown in Figure 1.

ACTIVE INGREDIENTS - DENTIFRICE FDA CLAIMS

Toothpastes may receive FDA approval for one, two or more claims as long as the product meets the specific requirements for each claim.

1. Anti-caries: Claim

Dental caries is an infectious, multifactorial disease afflicting most persons in industrialized countries and some developing countries⁴. Worldwide, dental caries is an endemic infection and a major public health problem affecting children and adults.⁵

a. Anti-caries agent: Fluoride

Fluoride dentifrice efficacy in the reduction of caries in primary and permanent dentition has been demonstrated worldwide.⁶⁻⁹ When used appropriately, fluoride is a safe and effective agent used to help prevent and control dental caries. Fluoride's primary action is to be incorporated into the tooth substrate (enamel and dentin) rendering the tooth more resistant to acid

Figure 1.

FDA		OTC Drug	Prescription Drugs	Medical Device
		SnF ₂ Gel Delivering ACP	NaF Paste Delivering TCP	NaF Paste
ppm Fluoride		970	5000	900
FDA Approval or Clearance	Anti-Caries	✓	✓	
	Sensitivity Relief	✓		✓
	Anti-Gingivitis	✓		
Requires Doctor's Prescription		No	Yes	Sometimes
Purchase Options		Over The Counter	Only be sold to or on the order of a dentist.	
Use		Safe and effective for use by the general public without seeking treatment by a health professional.	Prescribed for and intended to be used by one person.	
Affects the structure or any function of the body		Yes		Yes, But NOT through chemical action or metabolism
Regulated by FDA		OTC Drug monographs	New Drug Application (NDA)	Pre-market approval/510(k)

Drugs are products intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease.

Medical devices are products intended for use in the diagnosis of disease or other condition, or in the cure, mitigation, treatment, or prevention of disease.

attack associated with cariogenic bacteria and diet. Fluoride can be delivered systemically or topically. Fluoride toothpastes can contain; stannous fluoride (SnF₂), sodium fluoride (NaF) or sodium monofluorophosphate (MFP), which provide benefits as shown in Figure 2.

Figure 2.

Fluoride Source Benefits for OTC Toothpaste			
	Stannous Fluoride	Sodium Fluoride	Sodium Monofluorophosphate
Anti Caries	✓	✓	✓
Sensitivity Relief	✓		
Anti Gingivitis	✓		

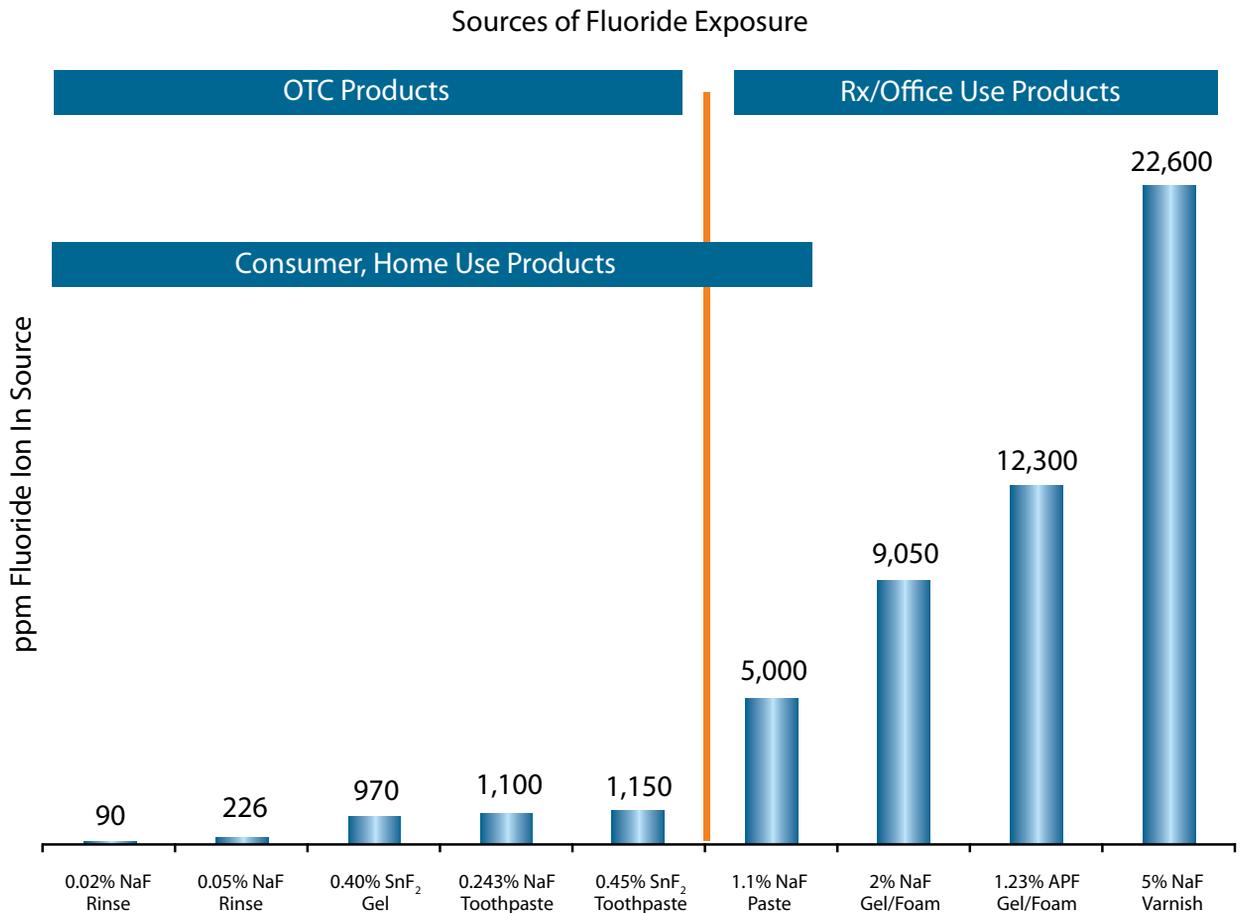
SnF₂ in toothpaste provides sensitivity relief and anti-gingivitis activity in OTC dentifrice concentrations. NaF and MFP do not have these properties.

Dental Fluorosis

Concurrent with the decline in caries, an increase in the prevalence of mild dysmineralization, known as dental fluorosis, has been recognized.¹⁰ Dental fluorosis is defined as a chronic, fluoride-induced condition, in which enamel development is disrupted and the enamel is hypomineralized.¹¹ Only children whose tooth enamel is still maturing develop dental fluorosis.¹² Oral health care providers should discuss with caregivers the risk of developing fluorosis versus the benefit of reducing the risk for developing dental caries when providing oral health education.¹³

It is important to know that the tooth coloration changes associated with enamel dysmineralization from excess fluoride consumption in the first 8 years of childhood are remedied using a procedure called enamel microabrasion. This method was developed in the 1980s.¹⁴ Properly performed microabrasion reduces an insignificant amount of superficial enamel, leaving a glass-like lustrous tooth surface.¹⁵⁻¹⁷ In most cases, enamel microabrasion can be supplemented with dental bleaching for patient-pleasing long term results.^{18, 19}

Figure 3.



Fluoride Concentration in Dental Products

There is a wide range of fluoride containing products as shown in Figure 3. The orange line at 1,500 ppm denotes the maximum amount of fluoride permitted in an OTC product. Dental professionals can prescribe 5000 ppm fluoride toothpaste for home or office use.

While dental professionals rely on their patients to properly use fluoride products, certain products pose a significant risk to those who misuse them. That is why fluoride rinses and 5000 ppm fluoride toothpastes are not recommended for children under the age of six.

Fluoride therapy should take into account a patient's dental and behavioral needs and compliance in order to include the most effective fluoride products with the least amount of fluoride exposure, to reduce the probability of fluorosis.

Current Recommendations for Fluoride Containing Products (JADA, 2014)²⁰

< 3 years:

Caregivers should brush children's teeth as soon as they begin to erupt into the mouth using OTC fluoride toothpaste in an amount no more than a smear (0.125 grams) or the size of a grain of rice (Figure 4).

3 to 6 years of age:

Caregivers should dispense no more than a pea-sized dose (0.25 grams) of OTC fluoride toothpaste. (Figure 5)

Figure 4.



Figure 5.



- Supervise children’s brushing to ensure that they use the appropriate amount of toothpaste and encourage the child to spit out the toothpaste rather than swallowing it.
- Encourage the use of a small dispensing orifice in order to better control the dispensing of a smear or pea-sized volume of fluoride toothpaste. (Figure 6)

Figure 6.



b. Non-Fluoride Anti-Caries Agents – Calcium Phosphate Products

The overall intent of these technologies is to increase the amount of available calcium and phosphate typically together with fluoride.^{21,22} Indications for products incorporating these technologies are caries control and sensitivity reduction, depending on the product.²³⁻²⁵

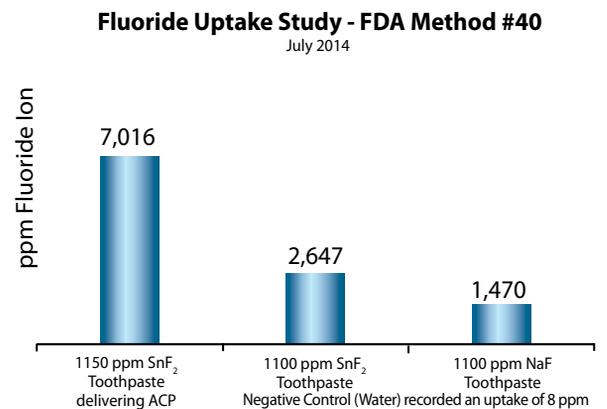
- Amorphous Calcium Phosphate (ACP)
 - Very high solubility in saliva and rapidly transforms into stable apatite.²⁶
 - The first non-fluoride therapy to remineralize enamel and dentin.²⁷
 - The calcium and phosphate ions precipitate and recrystallize as apatite to repair early lesions.²⁸
 - Strengthens teeth by acting as an enhanced fluoride delivery system to deliver more fluoride than products without ACP.²⁹
- Calcium Sodium Phosphosilicate (CSP) is a bioactive glass which assists in sustained release of calcium & phosphate while neutralizing the pH.
- Tri-Calcium Phosphate (TCP). Saliva activates the calcium compound degrading the protective coating, releasing calcium at the tooth surface

Research- Enamel Fluoride Uptake Study – FDA Method #40

OTC Dentifrices

Since a fluoride containing toothpaste is a drug that must satisfy the FDA OTC monograph for FDA approval, a review of the FDA testing requirements comparing fluoride dentifrices may assist dental professionals in determining how well products perform. Recently, an enamel fluoride uptake study was conducted following the FDA guidelines comparing OTC fluoride dentifrices. (Figure 7)

Figure 7.



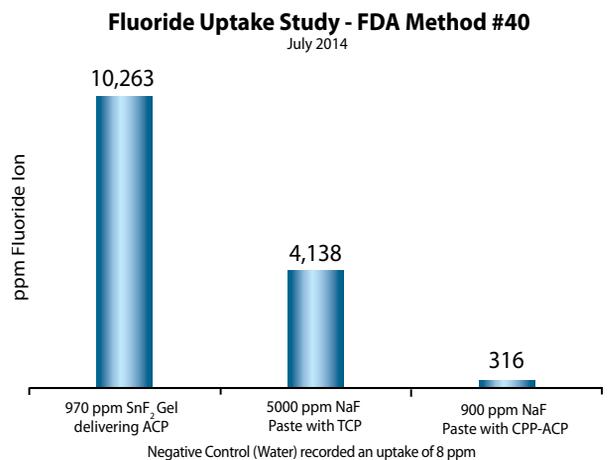
Source: Schemehorn BR, DiMarino JC, Movahed N. Comparison of the incipient lesion enamel fluoride uptake from various prescription and OTC fluoride toothpastes and gels. J Clin Dent 2014;25:57-60.

A 1,150 ppm, OTC, SnF₂ dentifrice delivering ACP toothpaste provides 2 – 4 times more fluoride uptake into lesioned enamel than similar OTC fluoride products on the market with similar fluoride ion concentrations.

OTC and Rx Dentifrices

Next, an OTC dentifrice delivering ACP was compared to two Rx products. The results are displayed in Figure 8.

Figure 8.



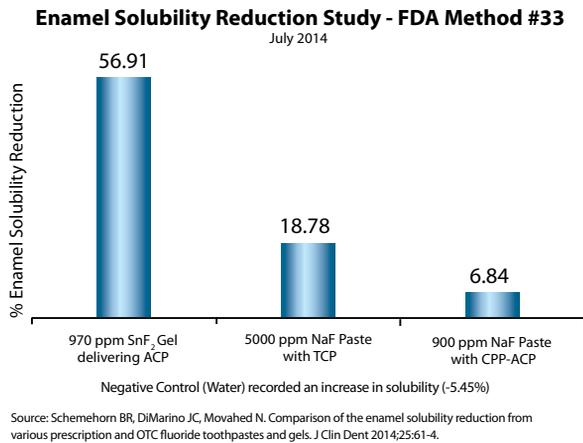
Source: Schemehorn BR, DiMarino JC, Movahed N. Comparison of the incipient lesion enamel fluoride uptake from various prescription and OTC fluoride toothpastes and gels. J Clin Dent 2014;25:57-60.

A 970 ppm, OTC, SnF₂ dentifrice delivering ACP provided over twice as much fluoride uptake than a prescription strength 5000 ppm fluoride ion toothpaste with five times the amount of fluoride ion.

Research- Enamel Solubility Reduction Study - FDA Method #33

Additionally, an enamel solubility reduction study was conducted following FDA guidelines comparing an OTC dentifrice with two Rx products. The results are displayed in Figure 9.

Figure 9.



A 970 ppm, OTC, SnF₂ dentifrice delivering ACP provided three times more resistance to demineralization than a prescription strength 5000 ppm fluoride ion toothpaste with five times the amount of fluoride ion.

Significance of the Research

While the above results are not conclusive to prove superior performance of products in preventing caries in vivo, it is surprising and encouraging to observe that an OTC product containing 80% less fluoride significantly outperformed a prescription strength 5000 ppm fluoride toothpaste with five times the amount of fluoride ion in both of the FDA OTC monograph required in vivo tests.

Protection against erosion

Dental erosion can be caused by exposure to intrinsic acid (gastric acid from gastro-esophageal reflux disease (GERD), bulimia, etc.) or extrinsic acids such as soft drinks or acidic foods. Dental erosion results in gradual loss of enamel, eventually exposing and opening dentinal tubules which can cause tooth sensitivity. Dental erosion is generally believed to be irreversible. Mechanical abrasion is also more rapid once dentin has been softened by erosion which is why a low abrasive toothpaste is beneficial.

Research suggests that combining a SnF₂ toothpaste with ACP delivering technology could result in a build-up of tin-containing deposits on tooth surfaces.^{31, 32} These deposits are resistant to acids and have the ability to cover open dentinal tubules preventing sensitivity. In addition, by stimulating remineralization of tooth structure, the effects of erosion can be reduced or eliminated.³⁴⁻³⁶

Consider recommending low abrasive toothpaste delivering ACP and SnF₂ and use of a soft bristled toothbrushes to help minimize mechanical abrasion for patients experiencing or concerned about dental erosion.

2. Reduction in Tooth Sensitivity

Dental hypersensitivity may be defined as transient tooth pain resulting from thermal, tactile or osmotic stimuli, af-

fecting teeth with exposed dentinal tubules. Such sensitivity can also be associated with malformed teeth as seen in patients with enamel hypoplasia, enamel hypocalcification or certain types of amelogenesis imperfecta. Dental professionals should make sure that the sensitivity is not generally associated with dental caries, cracked teeth, pulpal abscess, occlusal trauma, etc.³⁷

Products Designed to Reduce Tooth Sensitivity

1. Potassium Salts – Nerve Depolarization

One solution to tooth sensitivity is a toothpaste that includes potassium salts which reduces sensitivity by depolarizing the nerve. Such formulations have shown some benefit in various dentifrices.³⁸⁻⁴¹

When potassium salt products are effective, the relief tends to last only as long as the product is used.

2. SnF₂ – Tubular Occlusion

SnF₂ products are successful desensitizers by precipitating the stannous (tin) ion to occlude the dentinal tubules. SnF₂ toothpastes and gels are proven to effectively relieve dentinal hypersensitivity⁴²⁻⁴⁴ and can be used long term.^{45, 46} NaF and MFP have been shown to be poor desensitizers in OTC level dentifrices.^{47,48}

3. Amorphous calcium Phosphate (ACP)

- Toothpaste designed to deliver calcium and phosphate salts provided relief from sensitivity greater than the control product without ACP.⁴⁹
- ACP and fluoride provide semi-permanent occlusion with fluorapatite.⁵⁰

4. Casein phosphopeptide (CPP)/ACP formulations have been cleared by the FDA as a medical devices for relief of sensitivity.

5. Calcium sodium phosphosilicate has been shown to desensitize exposed dentin.^{51,52}

Stannous fluoride and ACP occlude open tubules providing long lasting sensitivity relief.

3. Anti-gingivitis: Gingivitis Reduction

One of the simplest ways of using an anti-gingivitis agent is by incorporating it into toothpastes and gels used during brushing, with no extra step involved for the user.

Products designed to treat gingivitis

SnF₂ is known to exert a substantive antibacterial effect when used as a topical agent, is effective as a bactericidal agent against biofilms⁵³ and is more effective than NaF dentifrice in reducing gingivitis.⁵⁴

Triclosan/copolymer is an anti-gingivitis therapeutic additive to toothpastes^{55, 56} which is not currently known to be hazardous to humans; however, several scientific studies have come out since the last time FDA reviewed this ingredient that merit further review.⁵⁷

Patients using SnF₂ toothpaste can benefit from the anti-gingivitis, bacteriostatic and bactericidal activity of the SnF₂

ion in addition to gaining its unique anticaries and sensitivity relief benefits.

DENTIFRICE - Inactive Ingredients

1. Surfactants

Surfactants are foaming agents that work with abrasives in the removal of dental plaque by loosening it from the tooth surface. The plaque is then removed physically during brushing.⁵⁸ An example of a surfactant is sodium lauryl sulfate (SLS).

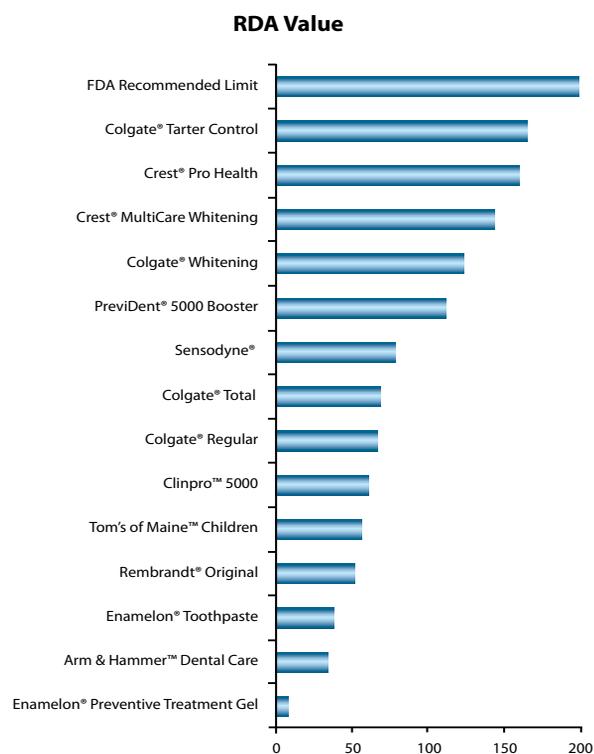
If a patient experiences recurrent aphthous ulcers suspected of being associated with SLS sensitivity,⁵⁹ consider recommending a low SLS or SLS-free dentifrice.

2. Dentifrices and Abrasives

Dentifrice inactive ingredients may include mild abrasives to remove debris and residual surface stains. Dentifrice abrasiveness is measured by its Relative Dentin Abrasivity (RDA). Figure 10 shows the RDA value of some common toothpastes. Lower numbers reflect less enamel and dentin wear. The higher the number, the better extrinsic stain removal is achieved; however, more enamel and dentin could get worn away.

Consider the lowest RDA dentifrice to minimize enamel/dentin loss.

Figure 10.



DENTIFRICE – Clinical Considerations

1. **Orthodontic patients** are at greater risk of gingivitis, demineralization and caries around bonded orthodontic brackets associated with poor oral hygiene.

Dental professionals should consider recommending a dentifrice that has the following properties: cavity protection (providing the best protection with the least amount of fluoride ion), resistance to demineralization, reduction in gingivitis and products with substantivity that can be safely used daily.

2. **Periodontal patients** may experience gingivitis, gingival recession, root caries and tooth sensitivity. Following treatment, patients require lifelong preventative periodontal maintenance visits several times a year.

A safe, daily use dentifrice for periodontal patients may include: anti-gingivitis properties, cavity protection, resistance to demineralization, reduction in sensitivity, saliva stimulation and one that provides substantivity for long lasting benefits.

3. Children

Children are the most at risk for fluorosis and incorrect use of fluoride products. Dental professionals must consider patients' total exposure to fluoride (systemic and topical) and compliance, while balancing the anticaries benefits of fluoride with the risk of excess fluoride ingestion when recommending fluoride products.

An appropriate dentifrice for the young patient population should have the following properties: cavity protection (providing the best protection with the safest, lowest amount of fluoride recommended for the child's age and weight), resistance to demineralization, substantivity for long lasting relief and encourages compliance by being pleasant to use.

4. Patients suffering from xerostomia

Patients with xerostomia experience a reduction in salivary flow which can cause significant oral complications such as;⁶⁰ dental caries, halitosis, discomfort, candidiasis, etc.

Dental professionals should consider recommending a dentifrice that has the following properties: substantial cavity protection, resistance to demineralization and reduction in sensitivity, saliva stimulation, lubrication of soft tissues and one that provides substantivity for long lasting relief. Ideally, all these properties would be available in one product that was pleasant to use.

Conclusion

With many different types of toothpastes on the market and manufacturers constantly searching for the all-in-one dentifrice, consumers and dental professionals need to know how to find a product that matches their needs. Understanding the active and inactive ingredients, assessing claims and efficacy and considering disease indicators and risk factors all play a major role in deciding which dentifrice can best deliver the desired benefits, safely and effectively.

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Questions

- The Food and Drug Administration (FDA):**
 - Does clinical testing on all drugs to assure FDA compliance.
 - Assures that cosmetic devices are sold only in pharmacies.
 - Fines dentists and physicians for using products as labelled
 - Develops regulations concerning claims that manufacturers are permitted to make about their products.
- The FDA can classify a dentifrice as a:**
 - Cosmetic
 - Drug
 - Medical device
 - All the above
- Active ingredients for which an FDA therapeutic claim can be granted include all of the following except:**
 - Anti-plaque
 - Anti-caries
 - Sensitivity relief
 - Anti-gingivitis
- Stannous fluoride:**
 - Is an important ion for use in systemic fluoride therapy
 - Cannot be used in topical fluoride therapy due to its erosive effect on enamel crystals.
 - Enhances the ability of superficial enamel to resist acid challenge.
 - Cannot be used topically because of the risk of fluorosis.
- People at risk of acquiring dental fluorosis include:**
 - Teenagers who excessively consume sports drinks which contain high levels of fluoride.
 - Adults with exposed root surfaces using fluoride/ACP rinses at least twice daily.
 - Adolescent orthodontic patients who receive fluoride varnish treatments every two months.
 - A preschooler who receives daily fluoride supplementation by tablet and also swallows excessive amounts of fluoridated dentifrice.
- Mild and moderate fluorosis:**
 - Usually manifests as white or brown enamel discoloration that can be improved with enamel microabrasion with or without dental bleaching.
 - Is a deep dentinal stain that discolors teeth by showing through the translucent enamel layer which can't be helped with dental bleaching.
 - Softens teeth to the degree that the slightest acid insult can result in a carious lesion.
 - Can be diagnosed radiographically by bell-shaped molar crowns and calcified pulp spaces.
- Which of the following should dental practitioners consider when recommending home-use fluoride products?**
 - Patient's weight and age
 - ppm fluoride ion, efficacy and safety of the proposed treatment
 - Patient's risk level
 - All of the above
- The 2011 Health and Human Service recommendation for the amount of fluoride ion in community drinking water is:**
 - 0.70 ppm
 - 0.10 ppm
 - 0.07 ppm
 - 0.01 ppm
- The maximum level of fluoride ion available in an FDA approved, OTC dentifrice for home use is:**
 - 970 ppm
 - 1,100 ppm
 - 1,150 ppm
 - 1,500 ppm
- Prescription strength 1.1% NaF fluoride toothpaste contains how many ppm of fluoride ion?**
 - 970 ppm
 - 1,500 ppm
 - 5,000 ppm
 - 9,050 ppm
- The 2104 recommended dose of an OTC fluoride toothpaste for children less than 3 years old is a:**
 - "Smear" (0.125 grams)
 - "Pea-size" (0.25 grams)
 - "Strip" (0.50 grams)
 - "Nurdle" (0.75 grams)
- The 2104 recommended dose of an OTC fluoride toothpaste for children 3–6 years of age is a:**
 - "Smear" (0.125 grams)
 - "Pea-size" (0.25 grams)
 - "Strip" (0.50 grams)
 - "Nurdle" (0.75 grams)
- Which of the following product(s) are NOT recommended for children under the age of six years old?**
 - Sodium monofluorophosphate
 - OTC fluoride mouth rinse
 - 1.1% NaF, 5000 ppm fluoride toothpaste
 - b and c
- Amorphous calcium phosphate compounds:**
 - Occlude dentinal tubules by forming a calcium phosphate deposit.
 - Are highly soluble in saliva and rapidly transforms into stable apatite
 - Strengthens teeth by acting as an enhanced fluoride delivery system to provide more fluoride than products without ACP.
 - All the above
- Which of the following is a side effect of many drugs?**
 - dysmineralization
 - remineralization
 - xerostomia
 - a and b
- Which fluoride source has been shown to relieve dentinal hypersensitivity in OTC toothpaste?**
 - Sodium fluoride
 - Stannous fluoride
 - Sodium monofluorophosphate
 - a and b
- According to the FDA Enamel Fluoride Uptake Study discussed in this course, how effective was the prescription strength fluoride toothpaste compared to the OTC fluoride dentifrice containing SnF₂ and delivering ACP?**
 - Less effective
 - Equally effective
 - More effective
 - None of the above
- According to the FDA Enamel Solubility Reduction Study discussed in this course, how effective was the prescription strength fluoride toothpaste compared to the OTC fluoride dentifrice containing SnF₂ and delivering ACP?**
 - Less effective
 - Equally effective
 - More effective
 - None of the above
- 1.1% NaF prescription strength fluoride toothpastes contain approximately how much more fluoride ion than a 970 ppm fluoride ion, OTC toothpaste?**
 - Two times
 - Five times
 - Ten times
 - Twenty times
- Potassium salts provide sensitivity relief by:**
 - Tubular occlusion
 - Nerve depolarization
 - Being incorporated into a low RDA toothpaste
 - a and c
- SnF₂ provides sensitivity relief by:**
 - Tubular occlusion
 - Nerve depolarization
 - Being incorporated into a low RDA toothpaste
 - All the above.
- Amorphous calcium phosphate provide sensitivity relief by:**
 - Tubular occlusion
 - Nerve depolarization
 - Being incorporated into a low RDA toothpaste
 - a and c
- Which fluoride source has been proven to be the most effective at providing anticaries benefits in OTC toothpastes?**
 - Stannous fluoride
 - Sodium fluoride
 - Sodium monofluorophosphate
 - All of the above provide the same level of benefit.
- Which fluoride source has been proven to be the most effective at providing sensitivity relief in OTC toothpastes?**
 - Stannous fluoride
 - Sodium fluoride
 - Sodium monofluorophosphate
 - All of the above provide the same level of benefit.
- Which fluoride source has been proven to be the most effective at providing anti-gingivitis benefits in OTC toothpastes?**
 - Stannous fluoride
 - Sodium fluoride
 - Sodium monofluorophosphate
 - All of the above provide the same level of benefit.
- Sodium laurel sulfate:**
 - Is an example of a surfactant used in many OTC and prescription strength dentifrices
 - Used in dentifrices as foaming agents
 - May be associated with causing recurrent aphthous ulcers in patients who use products containing SLS
 - All of the above.
- Many dentifrices contain abrasives which:**
 - Are included as remineralization agents
 - Helps to remove debris and stain but may cause enamel and dentin to wear away
 - Assist fluoride, calcium and phosphate to strengthen enamel through the process of microabrasion
 - All the above
- Orthodontic patients may benefit from dentifrice which contains:**
 - SnF₂ and ACP
 - ACP and RDA
 - SnF₂ and RDA
 - RDA and ACP
- An appropriate dentifrice for children under the age of six would contain:**
 - Less than 1,200 ppm fluoride ion
 - Low RDA value
 - Substantial protection against caries
 - All the above
- An appropriate dentifrice for patients with xerostomia or GERD would contain protection against:**
 - Plaque, caries, fluorosis
 - Caries, sensitivity, erosion
 - Fluorosis, erosion, sensitivity
 - Caries, fluorosis, erosion

