Stannous Fluoride Dentifrice with Sodium Hexametaphosphate: Review of Laboratory, Clinical, and Practice-Based Data

By Cynthia Sensenbaugh, RDH, BS; Mary Elizabeth Sagel, BS, MA

Abstract
Dentifrice was originally used to promote oral hygiene by cleaning teeth. However, with advances in product formulation, it has become a valuable vehicle for the delivery of agents offering health and cosmetic benefits. Stannous fluoride, introduced in 1955 in dentifrice, is one of the longest-established of such agents. The well-known anti-caries efficacy of stannous fluoride is based on its impact on the tooth surfaces and on its antibacterial activity. More recently, the demand for tooth whitening products has increased and sodium hexametaphosphate has been shown to be helpful in whitening surface stains and in controlling calculus. A dentifrice formulation which combines the benefits of stannous fluoride with those of sodium hexametaphosphate is now available. A review of the evidence shows that in addition to effective anti-caries action, this formulation is effective in fighting plaque, gingivitis, and gingival bleeding while inhibiting calculus and extrinsic stain.

A practice-based evaluation including data from over 1,200 dental professionals and 1,000 patients demonstrates the product's benefits and excellent acceptability. Collectively, the research shows this stannous fluoride/sodium hexametaphosphate dentifrice provides multiple benefits to meet the oral health and cosmetic needs of patients.

Key Words: stannous fluoride, dentifrice, gingivitis, caries, sensitivity, calculus

Introduction
Patients today represent one of the most heterogeneous groups in history in terms of age, health status, oral hygiene habits and other factors. While certain oral health conditions are more prevalent among specific patient groups, such as periodontal disease among diabetic patients, many oral health conditions affect the broad population. According to U.S. surveys, virtually all adult patients have had dental caries, more than half experience gingivitis, and roughly one in three suffer from dental sensitivity. Fortunately, home care products are available to help prevent and treat many common oral health conditions in conjunction with routine professional care. Dentifrice is one important example. Many years ago, the benefits of dentifrice were limited to fighting disease and the prevention of tooth decay. It was common for professionals to tell patients to “use any dentifrice with fluoride and the ADA Seal.” However, formulators today can design dentifrices to provide numerous other benefits, both for health and cosmetic purposes.

In 2005, a stannous fluoride sodium hexametaphosphate (SFSH) formulation was introduced offering protection against a broad range of health and cosmetic conditions commonly experienced by patients. The present report reviews the laboratory, clinical and practice-based assessments evaluating the efficacy of this dentifrice formulation.

Stannous fluoride is its effect on inflammatory Action
Stannous fluoride and sodium hexametaphosphate formulation
The SFSH formula combines the therapeutic benefits of 0.455% stabilized stannous fluoride with the calculus and stain-control characteristics of sodium hexametaphosphate in a low-water formulation dentifrice. Stannous fluoride, which unlike sodium fluoride can be used in combination with calcium-based abrasives, has been incorporated in dentifrices since the 1950s to provide protection against caries, pathogenic bacteria, gingivitis, hypersensitivity, and the development of plaque. There is considerable evidence for its efficacy as a therapeutic agent with a wide spectrum of beneficial properties. However, its clinical usage was limited because of astringent taste and in some patients its use resulted in extrinsic staining of the teeth. Stannous fluoride was also somewhat unstable in aqueous solution. The latter problem was resolved with the introduction of stabilized stannous fluoride in the 1960s which rendered more available stannous fluoride and resulted in a renewed interest in the wide range of benefits offered by stannous fluoride in dentifrices.

Sodium hexametaphosphate was first introduced in a dentifrice in 2000. It is a chemical whitening agent in the same class as pyrophosphate, which has long been used to inhibit calculus and the molecule is about 10 times longer than that of pyrophosphate. Sodium hexametaphosphate therefore provides better coverage and retention on the tooth surface, thus increasing its ability to inhibit both calculus and stain formation on the enamel surface. Stability of the dentifrice can be an issue with the inclusion of polyphosphates if ingredients are not properly balanced. Like other polyphosphates, sodium hexametaphosphate does not usually show good long-term stability in aqueous dentifrices. However, the novel single-phase SFSH formula, which uses a low-water system in a silica-based formulation, significantly reduces the hydrolysis of sodium hexametaphosphate and helps to maintain effective levels of whitening activity.

The resulting dentifrice has improved esthetic qualities over the original stannous fluoride formulation, and delivers a broad range of therapeutic and cosmetic benefits (Figure 1). The remainder of this paper provides a summary review of research on stannous fluoride, sodium hexametaphosphate dentifrice, and especially, the unique SFSH formulation.

Figure 1. Benefits of stannous fluoride and sodium hexametaphosphate

- Antibacterial activity against species associated with plaque, gingivitis, cavities and malodor
- Reduces plaque
- Reduces gingival inflammation and bleeding
- Protects against hypersensitivity
- Remineralizes enamel and protects against demineralization

Figure 2. Bactericidal activity assessment 16 hours after exposure. Left; water control. Right; stannous fluoride/sodium hexametaphosphate dentifrice. Green-stained cells are live microbial cells; red-stained cells are dead cells (from Ramji et al10).

Like X-Floss, just thinner! NEW

Benefits:
Firm threader is easy to use Flexible bulky floss for excellent cleaning
Easy implant, bridge & ortho floss!

> Page 2B

Dental Tribune Middle East & Africa Edition | March-April 2015 Hygiene Tribune 1B
Table 1. Long-term clinical trials examining the effect of stabilized stannous fluoride on reduction of plaque, gingivitis and gingival bleeding.

<table>
<thead>
<tr>
<th>Reference</th>
<th>No. of Subjects</th>
<th>% St.</th>
<th>Mode of Delivery</th>
<th>Treatment (dose)</th>
<th>Length of Trial</th>
<th>Plaque Reduction</th>
<th>% Reduction Gingival Bleeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archila et al.</td>
<td>186 adults</td>
<td>0.45 Dentifrice</td>
<td>Twice daily</td>
<td>6 months</td>
<td>ND</td>
<td>25.8% ≤ 27.4%</td>
<td>ND</td>
</tr>
<tr>
<td>Archila et al.</td>
<td>38 adults (male vs. female)</td>
<td>0.45 Dentifrice</td>
<td>Twice daily</td>
<td>12 weeks</td>
<td>50% ≤ 55%</td>
<td>50% ≤ 55%</td>
<td></td>
</tr>
<tr>
<td>Boyd et al.</td>
<td>83 adolescent girls</td>
<td>0.4 Brush-on gel</td>
<td>Twice daily</td>
<td>18 months</td>
<td>3% ≤ 31%</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Balawender et al.</td>
<td>45 adults</td>
<td>0.4 Dentifrice</td>
<td>Twice daily</td>
<td>6 months</td>
<td>ND</td>
<td>25% ≤ 29%</td>
<td>ND</td>
</tr>
<tr>
<td>Claridge et al.</td>
<td>28 adults</td>
<td>0.1 Mouth rinse</td>
<td>Twice daily</td>
<td>3 weeks</td>
<td>≥ 83%</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Chitkewell et al.</td>
<td>26 handicapped children</td>
<td>0.2 Spray</td>
<td>Twice daily</td>
<td>3 weeks</td>
<td>48% ≤ 52%</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Mallett et al.</td>
<td>128 adults</td>
<td>0.45 Dentifrice</td>
<td>Twice daily</td>
<td>6 months</td>
<td>8% ≤ 17%</td>
<td>41% ≤ 51%</td>
<td></td>
</tr>
<tr>
<td>Mankodi et al.</td>
<td>104 adults</td>
<td>0.45 Dentifrice</td>
<td>Twice daily</td>
<td>6 months</td>
<td>20% ≤ 21%</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Haras et al.</td>
<td>330 adults</td>
<td>0.45 Dentifrice</td>
<td>Twice daily</td>
<td>6 months</td>
<td>5% ≤ 22%</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Perlman et al.</td>
<td>154 adults</td>
<td>0.45 Dentifrice</td>
<td>Twice daily</td>
<td>6 months</td>
<td>3% ≤ 31%</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Finamore et al.</td>
<td>31 adults, partial oral hygiene</td>
<td>0.4 Brush</td>
<td>Twice daily</td>
<td>3 months</td>
<td>55% ≤ 48%</td>
<td>69% ≤ 75%</td>
<td></td>
</tr>
<tr>
<td>Williams et al.</td>
<td>112 adults</td>
<td>0.45 Dentifrice</td>
<td>Twice daily</td>
<td>6 months</td>
<td>33% ≤ 25%</td>
<td>ND</td>
<td></td>
</tr>
</tbody>
</table>

All reductions are versus control except for Archila and Chitkewell which are relative to baseline values.

*Significant difference for abundance level
| % p ≤ 0.05 | p ≤ 0.01 | ND-no data

< Page 1B

Figure 1. Plaque imaging system

Dentifrice mirror those investi- gating earlier stannous fluoride dentifrices; the recent formulation also shows benefits in the context of normal dental disease where it is significantly more ef- ficacious than sodium fluoride based dentifrices.

Dental Hypersensitivity
Recent studies have demonstrated the anti-inflammatory effects of this SFSH dentifrice, supporting its antiplaque and antigingivitis ef- ficiency.

Figure 4. Left: Scanning electron microscope images showing open tubuli after treatment with a sodium fluoride toothpaste (left) and closed tubuli after treatment with a SFSH dentifrice (right). From Baug and He!.

At 8 weeks, the SFSH showed improvements of 71% and 44% versus the negative control for tactile and thermal measurements, re- spectively.

These studies support that the SFSH dentifrice shares the anti-inflammatory characteristics of previous stannous fluoride formul- ations.

Anti-caries Effects
The anticaries effects of stannous fluoride have been recog- nized for many years. Before the introduction of this car- esion effects, stannous fluoride has been shown to react with dental hydroxyapatite to form a protective phos- phate complex which coats and protects the surface of the enamel. Other effects of stannous fluoride, which was discussed above, provides further protection by suppres- sion of bacteria, particularly Streptococcus mutans, which are one of the primary pathogens associated with dental caries.

The anti-caries benefits of stannous fluoride are therefore due to both its physical chemical and its bacterioidal effects.

Before the introduction of this SFSH dentifrice, a large num- ber of clinical trials had been conducted that demonstrated the efficacy of stannous fluoride in the control of dental caries.

In a 2-year study, Beveridge et al. conducted a large-scale clinical trial with 955 subjects compar- ing the anticaries efficacy of a dual-phase early prototype SFSH dentifrice with a positive control standard sodium fluoride dentifrice, and also a high-dose (2800 ppm F) and a low-dose (300 ppm F) sodium fluoride dentifrice.

Visual-tactile examination was supplemented with a radio- graphic examination at baseline, after 12 months and at the end of the trial at 24 months. Both exam- iners found that there was significantly less caries in the SFSH (17% and 25%) and high dose (300 ppm F) sodium fluoride dentifrice compared with the sodium fluoride/sodium hexa- metaphosphate dentifrice (1% and 3%). This sup- ports the sustained antimicrobial effects reported by Ramji et al.13

Results of multiple, independ- ent clinical trials using the SFSH dentifrice

Figure 4. Left: Scanning electron microscope images showing open tubuli after treatment with a sodium fluoride toothpaste (left) and closed tubuli after treatment with a SFSH dentifrice (right). From Baug and He!.

< Page 4B

6 B J H Y G E N E T R I B U N E

DENTAL TRIBUNE Middle East & Africa Edition | March-April 2015

Dental Tribune Middle East & Africa Edition | March-April 2015

Dental Tribune Middle East & Africa Edition | March-April 2015

6 B J H Y G E N E T R I B U N E

DENTAL TRIBUNE Middle East & Africa Edition | March-April 2015

Dental Tribune Middle East & Africa Edition | March-April 2015

6 B J H Y G E N E T R I B U N E

DENTAL TRIBUNE Middle East & Africa Edition | March-April 2015

Dental Tribune Middle East & Africa Edition | March-April 2015

6 B J H Y G E N E T R I B U N E

DENTAL TRIBUNE Middle East & Africa Edition | March-April 2015

Dental Tribune Middle East & Africa Edition | March-April 2015

6 B J H Y G E N E T R I B U N E

DENTAL TRIBUNE Middle East & Africa Edition | March-April 2015

Dental Tribune Middle East & Africa Edition | March-April 2015

6 B J H Y G E N E T R I B U N E

DENTAL TRIBUNE Middle East & Africa Edition | March-April 2015

Dental Tribune Middle East & Africa Edition | March-April 2015

6 B J H Y G E N E T R I B U N E
HEALTHIER & STRONGER TEETH* STARTING FROM DAY 1

WITH CONTINUED USE

*ON ENAMEL PLAQUE AND ENAMEL EROSION VS ORDINARY TOOTHPASTE

Toothpaste from the No.1 toothbrush brand used by dentists themselves worldwide
Results from a large practice-based control of calculus and extrinsic plaque also suggests the effectiveness of these dentifrice practice-based assessment with the home care product, and then use sodium fluoride/sodium hexametaphosphate provided almost complete protection against lesion initiation and progression; it was preferred over the conventionally clinically proven dentifrices.

These studies indicate that this SFSH dentifrice is as effective as clinically proven fluoride dentifrices both in its mode of action and in its clinical acceptability.

Anticaries Effects Dental calculus results from the mineralization of bacterial plaque formed on the surfaces of teeth. Agents that inhibit calculus growth, particularly condensed phosphates, have been found to be effective in the prevention of calculus development. In this class of phosphates, sodium hexametaphosphate has been shown to be particularly effective.

In vitro studies by White et al. have shown that sodium hexametaphosphate either in aqueous solution or in a dentifrice. The effects were significantly greater than for a conventional anti-tartar dentifrice containing a polymeric agent. This finding has been supported by four 6-month clinical trials in which sodium hexametaphosphate produced significant reductions in calculus formation – whether contaminated by caries or by plaque formation. These reductions were obtained in a patient's oral cavity in five months of use of a sodium hexametaphosphate dentifrice.

Efficacy was assayed using a standard clinical method (Volpe-Mazur et al., 1992). The use of supragingival calculus coverages on the lingual surfaces of the 6 anterior teeth. In 2 studies evaluating SFSH formulations, calculus reductions of 55% and 46% were observed in the sensitive control group. Efficacy data was compiled by the Manager of Clinical Research at Procter & Gamble in Mason, OH, USA. This includes managing clinical and technical communications at Procter & Gamble.

The authors thank Jane Mitchell (MWS Ltd, Staffordshire, UK) for assistance developing the manuscript.

References
1. Dental Tribune Middle East & Africa Edition | March-April 2015
3. Dental calculus results from the three-way street. Sci Am. 2006;Spec Iss 18-22.
5. A total of 1078 questionnaires were returned by practicing professionals. Of these, 88 reported positive assessments of the SFSH dentifrice (Excellent/Very Good/Good) and two-thirds of all patients stated that they intended to continue to use the SFSH dentifrice; this percentage rose to 77% when patients reported noticeable improvements in their oral health.
6. In terms of rating specific effects, roughly 9 out of 10 patients rated the product positively for “keeping mouth healthy”, “cleaning teeth thoroughly”, being “a non-irritating”, “making gums healthier” and “freshening breath” (Figure 6). Eighty-three percent of patients were positively for reducing surface stains and 77% for reducing gingival bleeding.
7. Dentists and hygienists across the USA participated in the study, and samples of the SFSH formulation were offered to patients to provide a small group of their patients for 5 months. A total of 91 patients completed a questionnaire at the end of the trial by the dental professional. The major outcome is that it provides evidence of excellent professional acceptance and an equal level of acceptance among patients, expressions of professional acceptance and an equal level of acceptance among patients.
8. Conclusions Extensive laboratory and clinical research add to the body of research supporting the value of stannous fluoride as a multi-benefit dental ingredient. Stannous fluoride reduces bacterial growth, bacterial activity, and inflammatory markers as well as prevents against plaque, gingivitis and gingival bleeding. Sensitivity and caries. Research also suggests the effects of sodium hexametaphosphate in the control of calculus and extrinsic staining.
9. Seventeen published clinical and laboratory papers demonstrate the efficacy of these dentifrice ingredients when they are combined in the SFSH dentifrice formulation, which is therefore able to deliver a wide combination of health and cosmetic benefits.
10. Results from a large practice-based assessment involving over 1,200 dental professionals and in 1,000 patients further support the product is widely acceptable and beneficial for improving oral health.
The Ultimate Sonicare Power Toothbrush

New Philips Sonicare DiamondClean—the ultimate clean for ultimate results.

Help your patients experience the difference of Sonicare technology. It will be love at first brush.
• Our newest power toothbrush removes 45% more plaque than Sonicare FlexCare+ with ProResults brush head.
• Powerful yet gentle dynamic cleaning action helps improve gum health in just 2 weeks.
• Clinically proven to whiten teeth in just 1 week.

Extrinsic tooth discoloration, an updated review

By Dr. Kassim Cynthia DDS, DESCO, DUDRE, Director of Esthetic and Restorative Dentistry – Saint Joseph University – Dental Polyclinic, Lebanon

Abstract

The appearance of the tooth structure and a large number of people seeking dental treatment and the color of the tooth discoloration has become an esthetic concern. Discolored teeth are frequently seen in the dental office and present a major challenge to dentists. The causes of tooth discoloration are complex and numerous. Basically, there are two types of tooth discolorations: those caused by extrinsic factors and those caused by intrinsic congenital or systemic influence. The major causes of extrinsic discoloration areنتيجة

Introduction

Ever since the ancient times, mankind has been seeking for beauty through the perfection of his body. In today’s society, for example, used urine and goat milk in an attempt to whiten their teeth. There has been a recent increase in interest in the treatment of tooth staining and discoloration as shown by the large number of tooth whitening agents appearing on the market.

Teeth discolorations are associated with many clinical and esthetic challenges. They can have an impact on a person’s self-esteem and overall confidence in today’s society, where most people place tooth color high. This increase in awareness of the cause of discoloration is important as it has a profound effect on treatment outcomes.

Normal enamel is colorless and transparent. The tooth dentin is mainly responsible for the color of the tooth. The dental pulp is of grey color where it consists of thick layers and where the enamel layer is thin (cervical margins).

A variety of colors can typically be seen in tooth discoloration from the gingival margin to the incisal edge of the tooth a gradation of the color can be seen. Any changes of tooth structure is likely to cause an alteration in outward appearance of the tooth caused by changes of light transmitting and reflecting properties.

Some discolorations are located on the outer surface of the tooth structure, others are caused by intrinsic factors and those are caused by intrinsic congenital or systemic influence. The major causes of extrinsic discoloration are tobacco use, nicotine exposure and oral use of tobacco products. Tobacco smoke contains carbon monoxide, thiocyanate, herbicides, fungicide and pesticide residues, tars, and many other substances which impair collagen and elastin fibers and impair the body’s defense mechanism and functions. Tobacco use in general is associated with periodontal diseases and infections. Tobacco is considered a healthful beverage due to the biological activity of polyphenols of the C. sinensis plant. The difference between the various teas lies in their processing. Green tea is prepared from unfermented leaves, oolong tea leaves are partially fermented, and black tea is fully fermented.

Tea, the commonly consumed beverage, is gaining increased attention in promoting overall health. In specific, green tea is considered a healthful beverage due to its biological activity of polyphenols of the C. sinensis plant. The difference between the various teas lies in their processing. Green tea is prepared from unfermented leaves, oolong tea leaves are partially fermented, and black tea is fully fermented.

Extrinsic tooth discoloration lies on the tooth surface in or in the acquired pellicle. The majority of tooth discolorations are extrinsic in nature and appear as brown pigments. Extrinsic staining of a single tooth is unusual. The distribution is usually generalized, and those stains are found on surfaces with poor tooth brush accessibility. Smoking, tea or coffee consumption and increasing age are promoting factors and such discolorations are frequently seen in connection with oral use of antibacterial plaque-inhibiting mouthrinses. Chemical alteration of the acquired pellicle appears to be the major reason for these brown stainings.

The causes of extrinsic staining can be divided into two categories; those compounds which are incorporated into the pellicle and produce a stain as a result of their basic color 2 or those which lead to staining caused by chemical interaction at the tooth surface.

Direct staining has a multi-fatorial etiology with chromogens derived from dietary sources or substances habitually placed in the mouth. The original color of chromogens are taken up by the pellicle and the color imparted is determined by the nature of the colorant of the chromogen. The origin of the stain may be metallic or non-metallic.

The aim of this review is to systematically search the literature for data concerning extrinsic tooth discoloration etiologies in order to establish the right treatment remark.

1. Tobacco

Tobacco smoking and chewing (chewing of betel nut, betel leaf, nutmeg, pepper betel, Pan) has been known to cause staining. Smoking leads to not only tobacco and nicotine leaching but also it leads to gum disease and oral cancer.2 There are all kinds of tobacco cigarettes, including tobacco, nicotine and tar that can harm tissue and oral health. Tobacco cigarettes can cause changes of periodontal diseases and infections. This is true of cigarettes, tobacco chewing, waterpipe and cigars to varying degrees, all will cause bad breath, crippled teeth and ugly brownish-yellowish stains. Tobacco smoking is rich with nicotine14 which is named after the tobacco plant Nicotiana tabacum. It is an inherently colorless substance that turns yellowish-brown when processed with oxygen. When cigarette smoke is inhaled, the inside of the mouth will affect not only with tar from the tobacco smoke but with nicotine. Nicotine permeates through the mucosa and crevices of the teeth leading to tooth stains. Tobacco smoke contains carbon monoxide, thiocyanate, herbicides, fungicide and pesticide residues, tars, and many other substances which impair collagen and elastin fibers and impair the body’s defense mechanism and functions. Tobacco use in general is associated with periodontal diseases and infections. Tobacco is considered a healthful beverage due to the biological activity of polyphenols of the C. sinensis plant. The difference between the various teas lies in their processing. Green tea is prepared from unfermented leaves, oolong tea leaves are partially fermented, and black tea is fully fermented.

Tobacco smoke was the most staining agent.

The aim of an in vitro study done by Young N et al.18 showed that tobacco is likely to cause staining.

2. Black Cofee

From black coffee to red wine, fruits, and vegetables, there are many examples. It is important to understand what staining is in order to minimize the stain causing agents. Coffee, tea and fruits are considered to not only tobacco and nicotine leaching but also it leads to gum disease and oral cancer.2 There are all kinds of tobacco cigarettes, including tobacco, nicotine and tar that can harm tissue and oral health. Tobacco cigarettes can cause changes of periodontal diseases and infections. This is true of cigarettes, tobacco chewing, waterpipe and cigars to varying degrees, all will cause bad breath, crippled teeth and ugly brownish-yellowish stains. Tobacco smoking is rich with nicotine14 which is named after the tobacco plant Nicotiana tabacum. It is an inherently colorless substance that turns yellowish-brown when processed with oxygen. When cigarette smoke is inhaled, the inside of the mouth will affect not only with tar from the tobacco smoke but with nicotine. Nicotine permeates through the mucosa and crevices of the teeth leading to tooth stains. Tobacco smoke contains carbon monoxide, thiocyanate, herbicides, fungicide and pesticide residues, tars, and many other substances which impair collagen and elastin fibers and impair the body’s defense mechanism and functions. Tobacco use in general is associated with periodontal diseases and infections. Tobacco is considered a healthful beverage due to the biological activity of polyphenols of the C. sinensis plant. The difference between the various teas lies in their processing. Green tea is prepared from unfermented leaves, oolong tea leaves are partially fermented, and black tea is fully fermented.

Black coffee contains polyphenols21-23 which cause staining.

3. Red Wine

Red wine is packed with polyphenols21-23 which help prevent plaque formation by inhibiting the growth of the gums and bone around teeth.21 Nevertheless red and white wine can cause staining. In addition, the alcohol content is very acidic and wears away tooth enamel.

A research aimed to investigate bleached enamel susceptibility to coffee and red wine staining at different time periods after bleaching. No differences were observed between the exposure times of 30 and 150 min after bleaching for both beverages (p > 0.05). Although coffee did not stain the surface, red wine significantly darkened the enamel in the previously bleached enamel.14

Atia et al have quantified the change in color of human and bovine teeth exposed to a coffee solution containing high polyphenol content (16% CP) and a red wine solution.19 When the teeth were exposed to a coffee solution during home bleaching, no staining effect was observed to be less stable (P < 0.05).

Bovine and human enamel substrates behaved similarly in terms of staining and bleaching effects, although they presented inherent differences in color.

A study has examined the surface staining mechanism of a photo-polymerized composite by coffee, oolong tea, and red wine.20 Dental composite was subjected to an experimental 24-hour staining cycle: 17-hour immersion in artificial saliva solution followed by 2-hour immersion periods of 30 min followed by 7-hour immersion in coffee, tea, or wine. Wine caused the most severe staining, followed by tea and coffee. Chlorohexidine increased the staining effect of tea and coffee when compared to the control specimens. Common drinks stained the dental composite, but each in a specific mechanism that depended on external conditions such as the presence of chlorohexidine.

Cortes et al have evaluated the influence of coffee and red wine staining on tooth color during and after bleaching. Blocks obtained from human molars were divided into 11 groups in accordance with the bleaching treatment- peroxide carbamide 10%, 15% and 35% for both bleaching with the stain-therapy coffee, wine or without stain (control).32 A photodensitometry evaluation of the enamel with artificial saliva and the subse-

As for all colored beverages, in order to minimize the staining effect, coffee and red wine can be drunk through a straw.

To conclude, the causes of staining are multifactorial and the contribution of smoking is significant, with tobacco smoke containing carbon monoxide, thiocyanate, herbicides, fungicide and pesticide residues, tars, and many other substances which impair collagen and elastin fibers and impair the body’s defense mechanism and functions. Tobacco use in general is associated with periodontal diseases and infections. Tobacco is considered a healthful beverage due to the biological activity of polyphenols of the C. sinensis plant. The difference between the various teas lies in their processing. Green tea is prepared from unfermented leaves, oolong tea leaves are partially fermented, and black tea is fully fermented.

For all colored beverages, in order to minimize the staining effect, coffee and red wine can be drunk through a straw.
Ultra-low abrasion for your patients who need sensitivity relief and seek gentle whitening

- Clinically proven relief from the pain of sensitivity
- Gently lifts stains and help prevent new stains from forming
- Ultra-low abrasive formulation appropriate for your patients with exposed dentine

Recommend Sensodyne – specialist expertise for patients with dentine hypersensitivity

*With twice-daily brushing

and wine-caused enamel color changes; however, the wine led to greater staining than did cof-
fce.\textsuperscript{8}
d - Cola Drinks

Dark-colored cols not only stain teeth, but also erode tooth enamel and cause tooth decay.\textsuperscript{8,9} although a new article found no significant differences in the frequency of the consumption of foods and beverages and the presence of dental erosion.\textsuperscript{10}

Other articles found greater enamel dissolution occurring in flavored and energy (sports) drinks than in cola drinks.\textsuperscript{11,12}

The influence of coffee, tea, cola, and red wine staining on the color of teeth after home bleaching has been evaluated. A total of 45 samples were obtained from 45 sound maxillary central incisors. The samples were immersed in four staining solutions (coffee, tea, cola, and red wine) or artificial saliva. Following 15 min and 6 h of immer-
sion on the first day and next day of all the staining solutions, the lowest ΔE values were observed with coffee staining versus artifi-
cial saliva (control group), for all time intervals evaluated after whitening. There were statistically significant differences between the red wine, cola, and tea solutions.\textsuperscript{13}

A study assessed the influence of surface sealant on the color sta-

ble. Red wine resulted in the highest level of discoloration. Intermedi-

teresting, the relatively high iron-orange juice, and the cola soft drink.\textsuperscript{14}

e - Cranberry Juice

Some drinks that may be rela-
tively good for health may not be so good for teeth. In terms of staining them, cranberry juice, grape juice and other dark-

colored fruit juices are very good at staining teeth because they contain pigments—and lots of them—that can yellow teeth, probably the same way they stain composite resin.\textsuperscript{15}

Cranberry juice contains po-
tential anticaries agents (high-
molecular-weight polyphenols) that inhibit the production of or-

ganic acids and the formation of biofilms by cariogenic bacteria.\textsuperscript{16}

The polyphenols of cranberries interfere with various activities (including formation of bio-

film and adhesion) of Porphy-

romonas gingivalis, the main etiologic agent in chronic peri-
odontitis.\textsuperscript{17,18}

In order to avoid these stains, straws should be used and mouthwash followed by tooth brushing should be done.

f - Soy Sauce

Soy sauce is a condiment made from a fermented paste of boiled soybeans, roasted grain, brine, and Aspergillus oryzae or Asper-

gillus sojae molds.\textsuperscript{19}

Iron-fortified foods can help prevent iron deficiency so can iron-fortified soy sauce due to the relatively high iron absorp-
tion from soy sauce.\textsuperscript{20} But soy sauce sticks to teeth, and the deep-colored pigment can cause very bad stains. In a study done by Chan KC, the discoloration of enamel caused by food sub-

stances was found to be super-

ficial and ingressive for dentin and cementum. Discoloration of cementum exceeded that of dentin, and dentin stained more than enamel. Coffee and soy sauce stained the calcified den-
tal tissues more than the cola beverage and tea. The longer the staining time, the deeper was the discoloration.\textsuperscript{21}

g - Balsamic Vinegar

Balsamic vinegar is made from grapes and generally consumed in the Mediterranean region. Oxidized low-density lipoprotein (LDL) is believed to contribute to atherosclerosis. Studies results showed that balsamic vinegar contained abundant polyphe-

nols and inhibited LDL oxidation.\textsuperscript{22} Thus, balsamic vinegar reduces lipoprotein, and it has an anti-diabetic effect.\textsuperscript{23} In spite of these health benefits, balsamic vinegar is deeply pig-
m ented causing teeth discoloration.

h - Tomato Sauce

Lycopene is the pigment princi-

pally responsible for the charac-
teristic deep-red color of ripe to-
mato fruits and tomato products. Lycopene is a micronutrient with important health benefits, because it contains natural anti-
obstant compounds like pheno-

lides hydroxystyryl and appears to provide protection against a broad range of epithelial can-

cers.\textsuperscript{24,25} But the tomato sauce is highly acidic and it attaches to the teeth and causes unsightly stains.

i - Blueberries

Berries are a rich source of a wide variety of non-nutritive, nutritive, and bioactive com-

pounds such as flavonoids, phe-

notoxins, anthocyanins, phenolic acids, stilbenes, and tannins, as well as nutritive compounds such as sugars, essential oils, ca-

rotenoids, vitamins, and miner-

als. Bioactive compounds from berries have potent antioxidant, anticancer, antinutagenic, ant-

imicrobial, anti-inflammatory, and antiedgerase properties, both in vitro and in vivo.\textsuperscript{26,27}

Wild blueberries are rich in polyphenols and have several potential health benefits.\textsuperscript{28} For example blueberry extracts may reverse the declines of cogni-

tive and behavioral functioning in the ageing process.\textsuperscript{29} Anthocy-

an- and proanthocyanidin-rich botanical extracts, present in berries, may alleviate neuro-

degeneration in Parkinson’s disease.\textsuperscript{30} Polyphehols found in the wild blueberries help in re-

ducing the expression of pro-in-

flammatory genes in vitro\textsuperscript{31} and current evidences are promising concerning the role of berry (poly) phenols to support cardio-
vascular health.\textsuperscript{32}

Even if the deep berry blue color can cause deep staining, aren’t all the benefits cited above worth staining teeth? 3 - Betel leaf: India, Pakistan

The betel (Piper betle or Paan) is the leaf of a vine belonging to the Piperaceae family, which includes pepper and kava. Explo-

red for their unique medi-

cal properties, the leaves of Pip-
er betel, an evergreen perennial vine, are a reservoir of phenolics with antimitogenic, antitumor, and antioxidant activities.\textsuperscript{33} It is a compound of natural substances chemically derived from the wild blueberries help in re-

ducing the expression of pro-in-

flammatory genes in vitro\textsuperscript{34} and current evidences are promising concerning the role of berry (poly) phenols to support cardiovascular health.\textsuperscript{35}

Approximately 200 million persons chew betel regularly throughout the western Pacific basin and south Asia. There is copious production of a blood-

red saliva that can stain oral structures. After years of chew-

ing, the teeth may become red-

brown to nearly black.\textsuperscript{36}

4 - Liquorice

It is a uniquely tasting herb de-

veloped to provide protection against a broad range of epithelial can-

cers.\textsuperscript{24,25} But the tomato sauce is highly acidic and it attaches to the teeth and causes unsightly stains.
The symptomatic picture of a TMJ patient does vary significantly and often includes: muscle, joint, and facial pain, difficulty with chewing, joint sounds, headache, and sometimes an open-bite. Recent studies show that more females than males suffer from TMJ symptoms, most of which, are in their childbearing years. The conventional methods used to treat TMJ dysfunction include: Botulinum toxin relaxes specific muscle groups (masseters), or rhodontics (braces, retainers, mouth guards), and in some cases, surgery. There exist options in the field of physical therapy for patients looking for an alternative health approach. Specialized treatment using soft tissue release and joint mobilization, alone, has had a profound affect on the restoring the natural joint position of the TMJ sufferers. Application of intra-oral technique to release the lateral pterygoid myofascial release to the anterior neck component are two examples of treatment goals. Both techniques reduce inflammatory pressures on the jaw caused by hyper-toned muscle groups.

There is a demand placed on oral surgeons and dentists, to offer patients relative compositional solutions, specifically after oral surgery, and dental procedures in which the jaw is open and overstretched (beyond normal range), for a long period of time. A patient may experience trauma from reduced joint mobility, and also causes fatigue and pain to the facial musculature. Lifestyle changes and sleep hygiene is recommended for a reduced inflammatory treatment option. This further benefits the patient with help of pain management and restoration of the natural joint position and functional range of motion of the TMJ.

Current research shows a link between stress and the TMJ. Specific triggers to stressor include intake and smoking for example, have an effect on sleep quality, and therefore, may promote bruxism at night. Bruxism, is a neurologic, sleep movement disorder characterized by grinding or clenching of the teeth in our sleep. This disorder is very damaging to the teeth and the TMJ, and also causes fatigue and pain to the facial musculature. Lifestyle changes and sleep hygiene is recommended for a reduced inflammatory treatment option. This further benefits the patient with help of pain management and restoration of the natural joint position and functional range of motion of the TMJ.

Conservative Care and Treatment of TMJ Dysfunction in Dental Patients

By Shivani Sarthi, Physical Therapist (TMJ Specialist)

E ach year, the number of reported cases of TMJ dysfunction patients increases in our country, brought on by stress, trauma to the jaw, post-dental procedures, or other factors. Symptoms of TMJ sufferers are growing. TMJ dysfunc- tion is defined as a term covering the swelling and discomfort of the muscles of mastication and the temporomandibular joints.

The proportional incidence of a TMJ patient does vary significantly and often includes: muscle, joint, and facial pain, difficulty with chewing, joint sounds, headache, and sometimes an open-bite. Recent studies show that more females than males suffer from TMJ symptoms, most of which, are in their childbearing years. The conventional methods used to treat TMJ dysfunction include: Botulinum toxin relaxes specific muscle groups (masseters), or rhodontics (braces, retainers, mouth guards), and in some cases, surgery.

There exist options in the field of physical therapy for patients looking for an alternative health approach. Specialized treatment using soft tissue release and joint mobilization, alone, has had a profound affect on the restoring the natural joint position of the TMJ sufferers. Application of intra-oral technique to release the lateral pterygoid myofascial release to the anterior neck component are two examples of treatment goals. Both techniques reduce inflammatory pressures on the jaw caused by hyper-toned muscle groups.

There is a demand placed on oral surgeons and dentists, to offer patients relative compositional solutions, specifically after oral surgery, and dental procedures in which the jaw is open and overstretched (beyond normal range), for a long period of time. A patient may experience trauma from reduced joint mobility, and also causes fatigue and pain to the facial muscles. Lifestyle changes and sleep hygiene is recommended for a reduced inflammatory treatment option. This further benefits the patient with help of pain management and restoration of the natural joint position and functional range of motion of the TMJ.

Current research shows a link between stress and the TMJ. Specific triggers to stressor include intake and smoking for example, have an effect on sleep quality, and therefore, may promote bruxism at night. Bruxism, is a neurologic, sleep movement disorder characterized by grinding or clenching of the teeth in our sleep. This disorder is very damaging to the teeth and the TMJ, and also causes fatigue and pain to the facial musculature. Lifestyle changes and sleep hygiene is recommended for a reduced inflammatory treatment option. This further benefits the patient with help of pain management and restoration of the natural joint position and functional range of motion of the TMJ.

Conservative Care and Treatment of TMJ Dysfunction in Dental Patients

By Shivani Sarthi, Physical Therapist (TMJ Specialist)

E ach year, the number of reported cases of TMJ dysfunction patients increases in our country, brought on by stress, trauma to the jaw, post-dental procedures, or other factors. Symptoms of TMJ sufferers are growing. TMJ dysfunc- tion is defined as a term covering the swelling and discomfort of the muscles of mastication and the temporomandibular joints.

The proportional incidence of a TMJ patient does vary significantly and often includes: muscle, joint, and facial pain, difficulty with chewing, joint sounds, headache, and sometimes an open-bite. Recent studies show that more females than males suffer from TMJ symptoms, most of which, are in their childbearing years. The conventional methods used to treat TMJ dysfunction include: Botulinum toxin relaxes specific muscle groups (masseters), or rhodontics (braces, retainers, mouth guards), and in some cases, surgery.

There exist options in the field of physical therapy for patients looking for an alternative health approach. Specialized treatment using soft tissue release and joint mobilization, alone, has had a profound affect on the restoring the natural joint position of the TMJ sufferers. Application of intra-oral technique to release the lateral pterygoid myofascial release to the anterior neck component are two examples of treatment goals. Both techniques reduce inflammatory pressures on the jaw caused by hyper-toned muscle groups.

There is a demand placed on oral surgeons and dentists, to offer patients relative compositional solutions, specifically after oral surgery, and dental procedures in which the jaw is open and overstretched (beyond normal range), for a long period of time. A patient may experience trauma from reduced joint mobility, and also causes fatigue and pain to the facial muscles. Lifestyle changes and sleep hygiene is recommended for a reduced inflammatory treatment option. This further benefits the patient with help of pain management and restoration of the natural joint position and functional range of motion of the TMJ.

Current research shows a link between stress and the TMJ. Specific triggers to stressor include intake and smoking for example, have an effect on sleep quality, and therefore, may promote bruxism at night. Bruxism, is a neurologic, sleep movement disorder characterized by grinding or clenching of the teeth in our sleep. This disorder is very damaging to the teeth and the TMJ, and also causes fatigue and pain to the facial muscles. Lifestyle changes and sleep hygiene is recommended for a reduced inflammatory treatment option. This further benefits the patient with help of pain management and restoration of the natural joint position and functional range of motion of the TMJ.

Conservative Care and Treatment of TMJ Dysfunction in Dental Patients

By Shivani Sarthi, Physical Therapist (TMJ Specialist)

E ach year, the number of reported cases of TMJ dysfunction patients increases in our country, brought on by stress, trauma to the jaw, post-dental procedures, or other factors. Symptoms of TMJ sufferers are growing. TMJ dysfunc- tion is defined as a term covering the swelling and discomfort of the muscles of mastication and the temporomandibular joints.

The proportional incidence of a TMJ patient does vary significantly and often includes: muscle, joint, and facial pain, difficulty with chewing, joint sounds, headache, and sometimes an open-bite. Recent studies show that more females than males suffer from TMJ symptoms, most of which, are in their childbearing years. The conventional methods used to treat TMJ dysfunction include: Botulinum toxin relaxes specific muscle groups (masseters), or rhodontics (braces, retainers, mouth guards), and in some cases, surgery.

There exist options in the field of physical therapy for patients looking for an alternative health approach. Specialized treatment using soft tissue release and joint mobilization, alone, has had a profound affect on the restoring the natural joint position of the TMJ sufferers. Application of intra-oral technique to release the lateral pterygoid myofascial release to the anterior neck component are two examples of treatment goals. Both techniques reduce inflammatory pressures on the jaw caused by hyper-toned muscle groups.

There is a demand placed on oral surgeons and dentists, to offer patients relative compositional solutions, specifically after oral surgery, and dental procedures in which the jaw is open and overstretched (beyond normal range), for a long period of time. A patient may experience trauma from reduced joint mobility, and also causes fatigue and pain to the facial muscles. Lifestyle changes and sleep hygiene is recommended for a reduced inflammatory treatment option. This further benefits the patient with help of pain management and restoration of the natural joint position and functional range of motion of the TMJ.

Current research shows a link between stress and the TMJ. Specific triggers to stressor include intake and smoking for example, have an effect on sleep quality, and therefore, may promote bruxism at night. Bruxism, is a neurologic, sleep movement disorder characterized by grinding or clenching of the teeth in our sleep. This disorder is very damaging to the teeth and the TMJ, and also causes fatigue and pain to the facial muscles. Lifestyle changes and sleep hygiene is recommended for a reduced inflammatory treatment option. This further benefits the patient with help of pain management and restoration of the natural joint position and functional range of motion of the TMJ.
cantly increased compared to the other 3 rinses. The anti-
hesite/chlorhexidine rinse pro-
duced the greatest reduction of the anti-
H. pomatia and Aspergillus species.
Phytotherapy and fungi such as Penicil-
nia and Aspergillus species.

The quality of the consumed drinking water may also affect oral health. For example, the presence of fluoride in drinking water can promote the formation of dental biofilms of black tooth stains and can be used as a means to control dental plaque.

A study was done in vitro to de-
temine if toothpaste influenced the biofilm of CHX and CPC as a predictor of action in vivo. Little staining was seen with a wash-and-rinse toothpaste (TP) and wa-
sed toothpaste (WTP) as a control.

in vitro. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo. Little staining was seen with toothpastes containing CPC as a predictor of action in vivo.