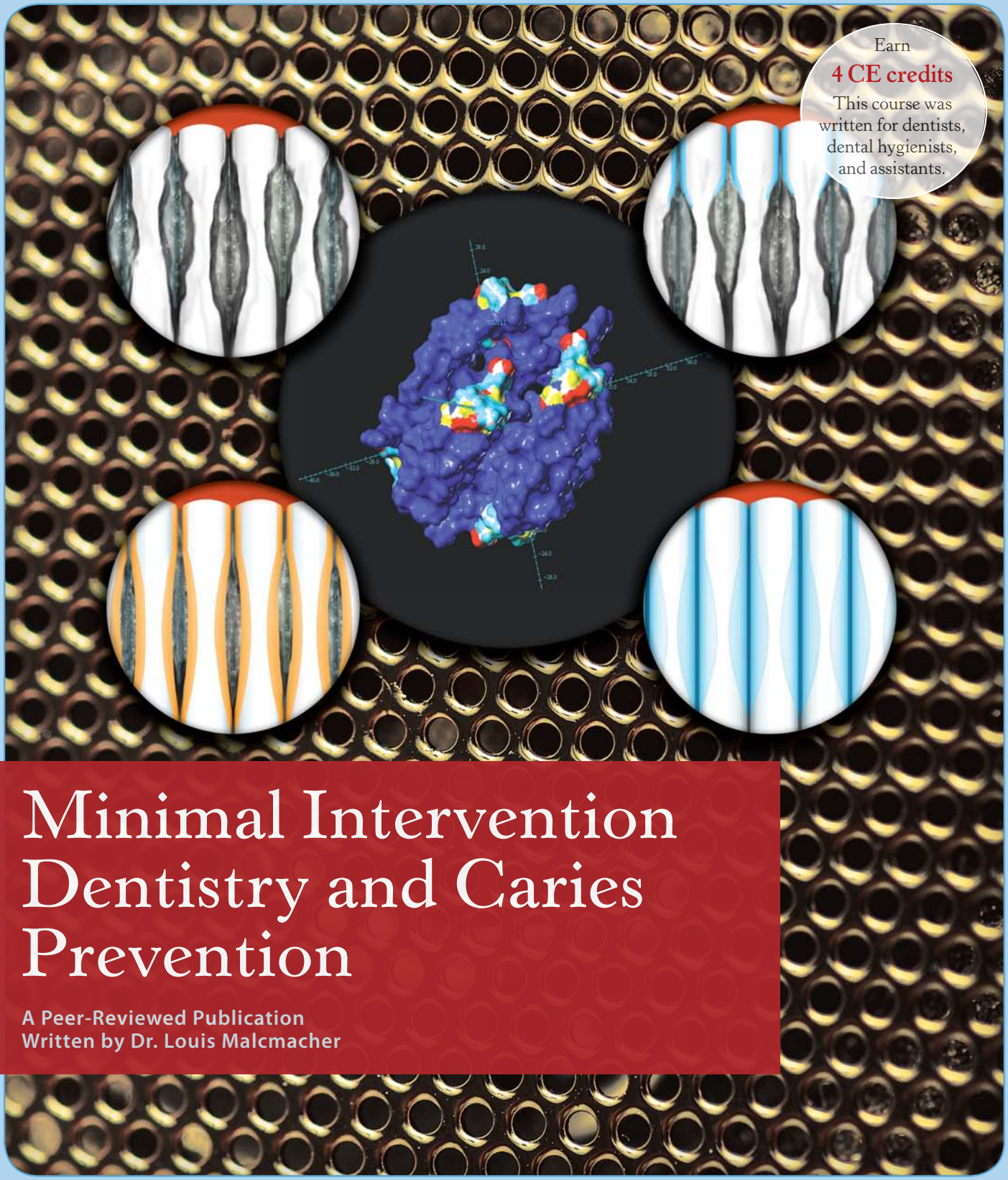

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Minimal Intervention Dentistry and Caries Prevention

A Peer-Reviewed Publication
Written by Dr. Louis Malcmacher

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Educational Objectives

Overall goal: The purpose of this article is to provide dental professionals with information on risk assessment, preventive and treatment options that will further the practice of a medical model and minimal intervention dentistry.

Upon completion of this course, the dental professional should be able to do the following:

1. List the differences between a medical model and a surgical model and applications of each model to dentistry.
2. List the factors involved in the caries process and describe the dynamics involved.
3. List the factors involved in risk assessment and how to determine which risk category an individual patient falls under.
4. Describe technology available containing calcium and phosphate ions and the role this technology plays in furthering a medical model and minimal intervention dentistry.

Abstract

Historically, dentistry has been focused on treating dental disease through the excision of diseased tissue and restoration of the defect. The medical model and minimal intervention dentistry involve prevention and the preservation of tooth structure. These require a risk assessment for individual patients and the tailoring of care based on the level of risk, which requires an understanding of the caries process and its influencers. Demineralization begins in the enamel below pH 5.5, which the acid attacks and infiltrates. This results in the loss of calcium and phosphate ions from the tooth. The progress of caries depends upon many factors, including the presence of ions that would aid remineralization as well as acid balance.

Calcium, phosphate and fluoride have all been shown to aid remineralization. The key is to embrace this knowledge and put it into practice in the real world – to perform risk assessment, inhibit caries formation and progression, enhance the natural repair process and perform minimal intervention dentistry. The success of clinical cases is not measured just on the day of dental treatment but also on the results five to ten years later. Using the medical model and minimal intervention dentistry enhances patient care.

Introduction

There is no question that we live in an amazing era for dentistry. Historically, dentistry has been focused on the treatment of dental disease through the excision of diseased tissue and, where possible, subsequent restoration of the defect. This is a surgical model. Furthermore, while significant improvements in materials used to replace tooth structure have occurred, whether by direct and/or indirect restorative materials or by implants, all are artificial. Today these materials do not meet the ideal biological and mechanical requirements for replacement of elements of the dentition, although stem cell research may result in natural biological replacements being available for soft and hard tissue in the future.

Optimally, diseases should be prevented and if present treated at an early stage to minimize their impact and severity in the least invasive and most effective way. This applies as much to dentistry as it does to medicine. The medical model and minimal intervention dentistry can be applied to both dental caries and periodontal disease – for the purposes of this article, we will discuss the paradigm shift to the medical model as it pertains to caries. The medical model and minimal intervention approach to dentistry (MID) have been enabled and gained ground as new materials and products have been developed and introduced and conservative procedures have become possible. This approach has influenced periodontology, as well as other disciplines, and especially preventive and restorative care. Adhesive resin materials and techniques have been a significant accomplishment for us to be able to conserve tooth structure. No longer is it necessary to create preparations for direct restorations that adhere to mechanical retention principles dating back to G.V. Black's classification system or indirect restorations requiring a specific length and taper. Instead, minimal tooth structure can be removed and retention provided chemically as well as, or instead of, mechanically.

Figure 1. The Paradigm Shift

	Old Model	New Model
Dental Caries	Drilling and filling Mechanical retention Extraction	Risk assessment Preventive care Adhesive dentistry Minimal intervention dentistry

At its core, the medical model requires a risk assessment for individual patients and the tailoring of care based on the level of risk. Risk assessment and preventive care presuppose an understanding of the caries process and its influencers. Any "curative" treatment provided should be minimally invasive, preferably completely nonsurgical and conserve tooth structure as much as possible.

The Caries Process

Caries is a multifactorial bacterial infection involving a process of demineralization and remineralization – predominantly as a result of colonization and acid production by Streptococcus mutans and Lactobacilli that are contained in dental plaque. Dental plaque adheres to the pellicle that starts reforming rapidly following its removal by brushing or prophylaxis. Cariogenic bacteria colonize dental plaque within two to six hours of its formation, and these continue to be present while the proportions of gram-positive and gram-negative bacteria change during plaque maturation.[1,2] Demineralization occurs when cariogenic bacteria

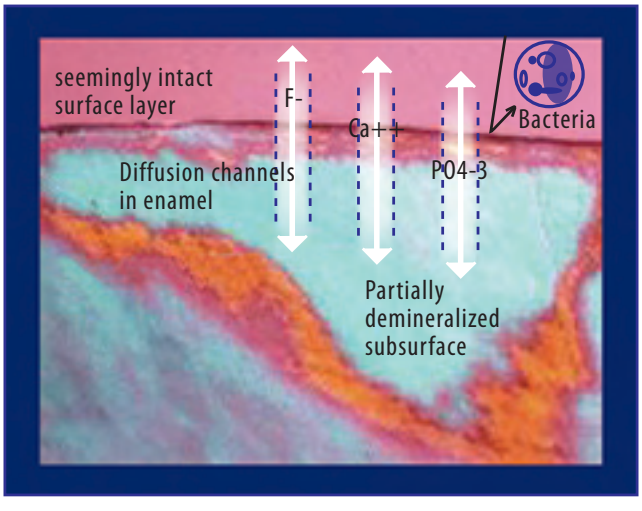
produce acid that attacks the teeth, resulting in the loss of minerals. Fermentable carbohydrates are metabolized to produce the acids that lower the pH and start the demineralization. Its progress depends upon many factors, including the presence of saliva and ions that would aid remineralization.

Initially, given the coronal tooth structure, demineralization begins in the enamel, which the acid attacks and infiltrates. This results in the loss of calcium and phosphate ions from the tooth. If this process occurs repeatedly over a period of time without remineralization reversing the process, a carious lesion that may be visible as a white spot lesion will develop.

The progress of caries depends on the balance of demineralization and remineralization

White spot lesions are areas of decalcification (demineralization) with subsurface dissolution. Caries develops initially with subsurface lesions and a relatively intact non-cavitated surface layer.[3] It is also believed that small amounts of fluoride and proteins from saliva are adsorbed onto the enamel crystalline surface and help inhibit surface dissolution.[4] White spots are particularly common in teenagers undergoing orthodontic treatment with fixed appliances, due both to the difficulty of maintaining a plaque-free environment around bands and the difficulties of patient compliance in this age group.[5,6] Often, white spots will feel rough if you gently drag an explorer over the area (while taking care not to invade the already compromised surface). It is very important to note that not all carious lesions present as white spots, and neither are all lesions visible without radiographs and other caries detection devices.

Figure 2. Demineralization



Over time the lesion can cavitate – a cavity will develop that must then be treated.

Natural Reversal of Demineralization

Demineralization is reversed by saliva, which contains calcium and phosphate ions as well as buffering agents, fluoride and other substances. Saliva has a pH of around 6.8 to 7 in healthy patients.[7] Saliva naturally buffers decreases in pH at the tooth surface. The higher the level of acid and the longer it is present at the tooth surface, the more difficult it is for saliva to buffer the area and for remineralization to succeed. When the balance shifts toward demineralization, a lesion develops. When remineralization is possible in the early stages of lesion development, no visible change may be apparent, and in the case of white spot lesions, they can evolve to a frosty-looking enamel that is hard and smooth to the touch of an explorer. Remineralization occurs when the pH rises and calcium and phosphate from the saliva, and fluoride, enter and repair the subsurface lesion. The resulting layer is more resistant to dissolution than the original content.[8]

A lesions develops when the caries balance shifts toward demineralization

Figure 3. Caries Balance

The key to improved dental health is to embrace this knowledge and put it into practice in the real world – to perform risk assessment, inhibit caries formation and progression, enhance the natural repair process and perform minimally invasive dentistry.

Caries Risk Assessment

There are several models for caries risk assessment. All involve assessing dietary, salivary, oral hygiene, destructive and protective influencers that may or may not be present in the individual patient.[9,10] Poor quality saliva or poor/no salivary flow (xerostomia) places a patient at risk due to the lack of buffering by saliva and lack of salivary ions (calcium and phosphate). Poor oral hygiene and a carbohydrate-rich diet result in a high bacterial load and plentiful fuel for bacterial acid production, increasing risk. The presence of sealants and use of products containing fluoride and products containing calcium and phosphate, as

well as use of antimicrobials, all decrease risk. A family's oral health and a patient's genetic factors, dental defects, and ability and willingness to perform oral hygiene are additional considerations.[11] It is the combination of all these that will determine risk and influence disease presence and progression.

Of course, reducing the bacteria present would help prevent caries. Reductions in acidogenic bacteria occur with use of chemotherapeutics (0.12% chlorhexidine gluconate rinse, other chemotherapeutic rinses, triclosan-containing oral care products and xylitol). Eliminating damaging bacteria completely would be even better. Probiotic therapy holds promise, with the potential to deliver "good" bacteria at the expense of "bad" bacteria.[12] Recent studies have found that lactobacilli-derived probiotics reduce the levels of Streptococcus mutans when delivered as a lozenge.[13]

Remineralization and the prevention of demineralization can be advanced. Driving mineralizing ions into initial carious lesions quickly and directly, and optimizing exposure to them, is important.

Aided Remineralization

The strategy for aided remineralization is to have ions directly delivered to where and when they are needed most. A number of mechanisms are available for this. The most well-known is the delivery of topical fluoride, which has proven to be a highly effective caries preventive. More recently, the medical model also utilizes calcium and phosphate ions. Calcium, phosphate and fluoride all aid remineralization through the body of the enamel (Figures 4a-d).

Figure 4a. Demineralized Enamel

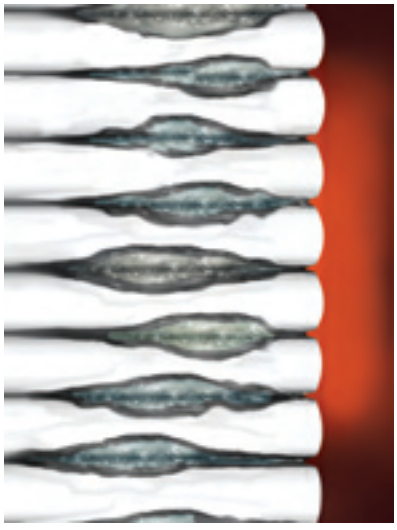


Table 1. Risk Assessment

Age	Risk Level		
	Low	Moderate	High
Younger than 6 years			
No carious lesions* during the last three years and no factors that may increase caries risk	X		
No carious lesions* during the last three years and presence of at least one risk factor		X	
Any carious lesion* during the last three years			X
Presence of multiple risk factors			X
Low socioeconomic status			X
Suboptimal fluoride exposure			X
Xerostomia			X
6 years and older			
No carious lesions* during the last three years and no factors that may increase caries risk	X		
1 or 2 carious lesions* in the last three years		X	
No carious lesions* in the last three years but the presence of at least one risk factor		X	
Three or more carious lesions* in the last three years			X
Presence of multiple risk factors that may increase caries risk			X
Suboptimal fluoride exposure			X
Reduced salivary flow			X
Xerostomia			X

*Incipient or cavitated; primary or secondary

Adapted from: American Dental Association Report. JADA, August 2006;137:1151-9.

Figure 4b. Remineralized enamel at surface of lesion using fluoride

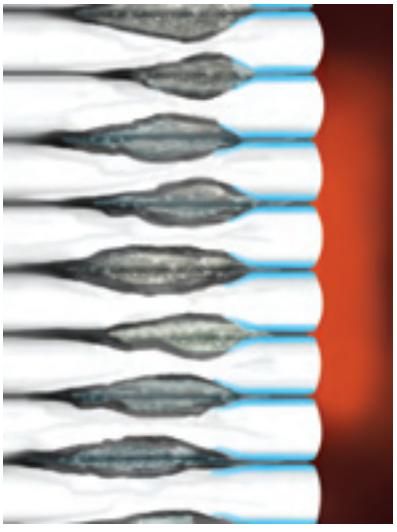


Figure 4c. Body of lesion remineralized with CPP-ACP

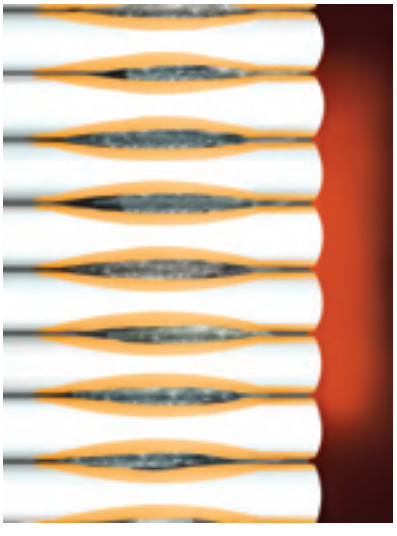


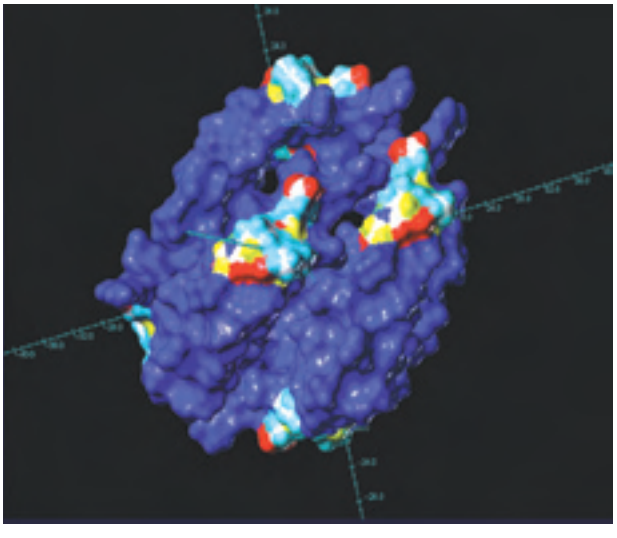
Figure 4d. Remineralized enamel using fluoride and CPP-ACP

CPP-ACP (Recaldent®)

Recaldent® is a combination of casein phosphopeptides (CPP) and amorphous calcium phosphate (ACP). The casein is derived from cow's milk, and is safe for patients who are lactose intolerant. It should not however be used by patients with milk allergies. CPP has been shown to have the capacity to act as a molecular delivery system for ACP and help bind it to the enamel surface in small clusters. CPP has also been found to be incorporated into pellicle and to help inhibit Streptococcus mutans.[14] Effectively, the CPP-ACP is adsorbed onto the surface and available.

Numerous in vitro studies have demonstrated the effectiveness of CPP-ACP in preventing and reversing early carious lesions often seen as white spot lesions and in remineralizing subsurface lesions.[15,16,17] CPP-ACP increases the level of calcium phosphate in plaque and releases calcium and phosphate ions onto the tooth when acid is present, resulting in supersaturation of these ions, which helps prevent demineralization and aids remineralization. (Figure 5) [18]

Figure 5. CPP-ACP Molecule



CPP-ACP has also been added to milk for an increased remineralizing effect.[19] Recaldent® is contained in chewing gum (Trident, Cadbury Adams) for over-the-counter use. In this manner, patients can benefit both from salivary stimulation as a result of chewing the gum and from the CPP-ACP content. Its use in chewing gum has also been found to remineralize enamel subsurface lesions and result in areas that are more resistant to future demineralization.[20] In the future CPP-ACP may also be contained in glass ionomer cements.

CPP-ACP has been found in in vitro studies to help prevent and reverse early carious lesions

CPP-ACP pastes are available for use delivered in a manner similar to topical fluoride in dentifrices. Candidates include patients with evidence of decalcification and erosion. Intermittent vomiting occurs during pregnancy, and the medical model suggests preventing any possible erosion as a result of the stomach acids being regurgitated. Therefore, I also recommend CPP-ACP therapy for expectant mothers. Preventive therapy should be given to those patients at increased risk for caries – such as patients wearing fixed appliances, practicing poor oral hygiene, having a soda pop habit, or suffering from substance abuse or fluorosis. A decreased or absent salivary flow is another reason to institute therapy – whether due to prescription drugs, head and neck radiation, substance abuse or autoimmune conditions. Secondary caries has been found in studies to be the most common reason for the replacement of both direct and indirect restorations.[21,22] Providing patients with preventive therapy that contains calcium, phosphate and fluoride will help reduce the risk of demineralization and therefore eventually the risk of replacing expensive restorations and insulting the tooth further. CPP-ACP containing paste has also been found to help reduce tooth sensitivity.[23]

Table 2. Candidates for Therapy

Patients with evidence of decalcification
Patients with evidence of erosion
Anorexics, bulimics, expectant mothers
Patients with xerostomia
Orthodontic patients with fixed appliances
Other patients at-risk for caries
Patients experiencing dentinal hypersensitivity

MI Paste™ and MI Paste™ Plus (GC America) are water-based, sugar-free creams that are applied topically to the tooth surface, enabling medical treatment of the early carious lesion. MI Paste™ Plus contains 900ppm fluoride, while MI Paste does not contain fluoride. I use the fluoride-free MI Paste™ for patients under 6 years of age (to avoid additional fluoride ingestion) or if a patient prefers not to have (additional) fluoride. For other patients, MI Paste™ Plus enhances protection. These topical treatments can be used to help prevent demineralization and to aid remineralization.

Figure 6. Tray Application

Figure 7. Paste Smeared on Teeth

Prolonged exposure can be achieved using a tray application for 3 minutes (Figure 6). The paste can also be used for a final in-office polishing. After in-office treatment, the patient can be given the paste to use at home. The patient can be instructed to use the paste in a tray, to smear on the teeth (Figure 7), or to brush with the paste and not rinse off depending on the patient's needs.

Figure 8. Extensive white spots and discoloration

Courtesy of Dr. Scott Munro

Figure 9. Result following minimal intervention treatment

Courtesy of Dr. Scott Munro

White spot lesions can be treated using a combination of MI Paste™ and in-office bleaching for severe cases. The patient shown in Figures 8 and 9 presented with extensive white spots and discoloration that were able to be treated using a minimal intervention approach. At three successive visits, the teeth were etched for 3 minutes followed by tray application of MI Paste™ for 5 minutes. At the subsequent two visits, the same sequence was carried out and followed by in-office bleaching. This was followed by two more visits during which only the 3 minute etching and 5 minute tray application of MI Paste™ was carried out. The patient's treatment included light micro-abrasion of the cusp tips. In addition to the in-office protocol, the patient wore trays containing MI Paste™ for five minutes twice daily. As shown in Figure 9 above, this minimal intervention approach resulted in improved esthetics.

The cost of using a custom tray system for calcium and phosphate – or fluoride – is easily integrated into the fees of whitening, esthetic procedures and periodontal procedures. It is then possible to subsequently provide MI Paste™ to patients at cost as a service to patients and a commitment to their overall and long-term dental health. MI Paste™ Plus can also be coded as topical fluoride treatment.

Other Calcium and Phosphate Therapy Options

ACP is also available without the CPP complex, in toothpaste and other dental products. ACP has been found in in vitro studies conducted on sodium bicarbonate toothpaste, fluoride varnish and prophy paste delivering ACP to result in remineralization and increased availability of fluoride as well as surface filling of enamel defects.[24,25,26,27] A third option is NovaMin®, a bioactive glass which releases calcium and phosphate ions when exposed to water or saliva. Toothpaste containing NovaMin® has been found to help remineralize and whiten teeth with surface stain.[28,29]

Summary

From both a clinical and practice management perspective, using the medical model and minimal intervention dentistry enhances patient care. The success of clinical cases is not measured just on the day of dental treatment but also on the results five to ten years later. Preventing demineralization, remineralizing early carious lesions and ensuring long-term wellness are all within the realm of today's dental practice. Current research on bacteria holds promise for the future, while in the present the enhanced delivery of fluoride, calcium and phosphate ions to the tooth surface offers our patients' preventive care. Candidates for calcium, phosphate and fluoride therapies include patients at risk for caries and/or presenting with early carious lesions. In addition, such therapies have been found to help relieve dentinal hypersensitivity. It is incumbent upon us to ensure that we provide preventive and minimal intervention dentistry.

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Author Profile

Dr. Louis Malcmacher

Dr. Louis Malcmacher maintains a general and cosmetic private practice in Cleveland, Ohio. He is an internationally known lecturer, author, and dental consultant, known for his comprehensive and entertaining style. Dr. Malcmacher is a frequent contributor to the dental literature, having lectured on and published numerous articles about adhesive resin dentistry, crown and bridge procedures, practice management, periodontics, esthetic dentistry, and halitosis therapy. He has lectured at many major dental meetings and local dental societies throughout the US, Canada, Europe, and the Middle East. Dr. Malcmacher is an evaluator for Clinical Research Associates, a master of the Academy of General Dentistry, a fellow of the International Association of Dental Facial Esthetics, a visiting lecturer at a number of Universities, a spokesperson for the Academy of General Dentistry, and a consultant to the Council on Dental Practice of the American Dental Association. Dr. Malcmacher has also been coaching dentists for nearly thirty years on best practices and how to improve their clinical efficiency and practice management skills.

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Notes

Questions

1. Historically, dentistry has been focused on the treatment of dental disease using a surgical model.
   a. True
   b. False
2. The medical model and minimal intervention dentistry can be applied only to dental caries.
   a. True
   b. False
3. The medical model requires _____.
   a. a collective risk assessment for patients
   b. a risk assessment for individual patients
   c. tailoring of care based on the level of risk
   d. b and c
4. Caries is predominantly a result of lack of knowledge.
   a. True
   b. False
5. Cariogenic bacteria colonize dental plaque within _____ of its formation.
   a. one to two hours
   b. two to four hours
   c. two to six hours
   d. none of the above
6. Demineralization has been found to occur when _____.
   a. bacteria produce alkali that attacks the teeth
   b. bacteria produce acid that results in the accretion of minerals
   c. bacteria produce acid that results in the loss of minerals
   d. a and c
7. White spot lesions are areas of _____.
   a. recalcification
   b. decalcification (demineralization) with only surface dissolution
   c. decalcification with subsurface dissolution
   d. none of the above
8. White spots often feel smooth if you place an explorer over the area.
   a. True
   b. False
9. All carious lesions present as white spots.
   a. True
   b. False
10. Even if remineralization is possible in the early stages of lesion development, a visible change is always apparent.
    a. True
    b. False
11. Remineralization occurs when _____.
    a. the pH falls and ions leave the surface lesion
    b. the pH falls and ions leave the subsurface lesion
    c. the pH rises and ions repair the subsurface lesion
    d. none of the above
12. Caries risk assessment models involve assessing dietary, salivary, oral hygiene, destructive and protective influencers.
    a. True
    b. False
13. Oral hygiene and carbohydrate intake have little effect on a patient's level of risk for caries.
    a. True
    b. False
14. As long as a patient under 6 years of age has no carious lesions, he or she has a low risk for caries.
    a. True
    b. False
15. A patient older than 6 years of age is at high risk for caries only if he or she has experienced multiple carious lesions in the previous three years.
    a. True
    b. False
16. Recent studies have found that typhus bacilli–derived probiotics increase the levels of Streptococcus mutans when delivered as a chewing gum.
    a. True
    b. False
17. Calcium, phosphate and fluoride all aid _____.
    a. remineralization
    b. collectivization
    c. enamel mutation
    d. all of the above
18. Topical fluoride has proven to be _____.
    a. a slightly effective caries preventive
    b. a highly effective caries preventive
    c. ineffective
    d. none of the above
19. Casein phosphopeptide contains a derivative of _____.
    a. beer
    b. water
    c. cow's milk
    d. all of the above
20. In vitro studies have demonstrated the effectiveness of CPP-ACP in preventing and reversing early carious lesions.
    a. True
    b. False
21. Remineralizing subsurface lesions must include the use of zinc.
    a. True
    b. False
22. Supersaturating the area adjacent to teeth with calcium and phosphate _____.
    a. helps prevent demineralization and aids remineralization
    b. has no impact on the caries process
    c. aids demineralization and helps prevent remineralization
    d. none of the above
23. Adding CPP-ACP to milk makes no difference in its effect on teeth.
    a. True
    b. False
24. CPP-ACP is available only in pastes containing fluoride.
    a. True
    b. False
25. Intermittent vomiting can occur during pregnancy, making these patients _____.
    a. candidates for therapy with calcium and phosphate products
    b. sensitive and not candidates for calcium and phosphate pastes
    c. susceptible to erosion
    d. b and c
26. Providing patients with preventive therapy that contains calcium, phosphate and fluoride will help reduce the risk of demineralization.
    a. True
    b. False
27. ACP is also available without the CPP complex, in toothpaste and other dental products that have been found to offer benefits.
    a. True
    b. False
28. ACP has been found in in vitro studies to result in remineralization and increased availability of fluoride.
    a. True
    b. False
29. Preventing demineralization, remineralizing early carious lesions and ensuring long-term wellness are all within the realm of today's dental practice.
    a. True
    b. False
30. Prolonged exposure to CPP-ACP is achieved through _____; if patients are noncompliant, they should _____.
    a. use of a tray application ; brush with the paste rather than not use it at all
    b. use of a toothbrush; do nothing
    c. use of a tray application ; do nothing
    d. none of the above

ANSWER SHEET

Minimal Intervention Dentistry and Caries Prevention

Name: Title: Specialty:

Address: E-mail:

City: State: ZIP:

Telephone: Home ( ) Office ( )

Requirements for successful completion of the course and to obtain dental continuing education credits: 1) Read the entire course. 2) Complete all information above. 3) Complete answer sheets in either pen or pencil. 4) Mark only one answer for each question. 5) A score of 70% on this test will earn you 4 CE credits. 6) Complete the Course Evaluation below. 7) Make check payable to PennWell Corp.

Educational Objectives

1. List the differences between a medical model and a surgical model and applications of each model to dentistry.
2. List the factors involved in the caries process and describe the dynamics involved.
3. List the factors involved in risk assessment and how to determine which risk category an individual patient falls under.
4. Describe technology available containing calcium and phosphate ions and the role this technology plays in furthering a medical model and minimal intervention dentistry.

Course Evaluation

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

1. Were the individual course objectives met?	Objective #1:	Yes	No	Objective #3:	Yes	No	
	Objective #2:	Yes	No	Objective #4:	Yes	No	
2. To what extent were the course objectives accomplished overall?	5	4	3	2	1	0	
3. Please rate your personal mastery of the course objectives.	5	4	3	2	1	0	
4. How would you rate the objectives and educational methods?	5	4	3	2	1	0	
5. How do you rate the author's grasp of the topic?	5	4	3	2	1	0	
6. Please rate the instructor's effectiveness.	5	4	3	2	1	0	
7. Was the overall administration of the course effective?	5	4	3	2	1	0	
8. Do you feel that the references were adequate?		Yes		No			
9. Would you participate in a similar program on a different topic?		Yes		No			

10. If any of the continuing education questions were unclear or ambiguous, please list them.

_____

11. Was there any subject matter you found confusing? Please describe.

_____

_____

12. What additional continuing dental education topics would you like to see?

_____

_____

Mail completed answer sheet to

Academy of Dental Therapeutics and Stomatology,
A Division of PennWell Corp.
P.O. Box 116, Chesterland, OH 44026
or fax to: (440) 845-3447

For IMMEDIATE results, go to www.ineedce.com and click on the button "Take Tests Online." Answer sheets can be faxed with credit card payment to (440) 845-3447, (216) 398-7922, or (216) 255-6619.

☐ Payment of $59.00 is enclosed.
(Checks and credit cards are accepted.)

If paying by credit card, please complete the following: ☐ MC ☐ Visa ☐ AmEx ☐ Discover

Acct. Number: _____

Exp. Date: _____

Charges on your statement will show up as PennWell

1.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	16.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
2.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	17.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
3.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	18.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
4.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	19.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
5.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	20.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
6.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	21.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
7.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	22.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
8.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	23.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
9.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	24.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
10.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	25.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
11.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	26.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
12.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	27.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
13.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	28.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
14.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	29.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
15.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	30.	Ⓐ	Ⓑ	Ⓒ	Ⓓ

AGD Code 258, 780

PLEASE PHOTOCOPY ANSWER SHEET FOR ADDITIONAL PARTICIPANTS.

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COURSE EVALUATION and PARTICIPANT FEEDBACK
We encourage participant feedback pertaining to all courses. Please be sure to complete the survey included with the course. Please e-mail all questions to: macheleg@pennwell.com.

INSTRUCTIONS
All questions should have only one answer. Grading of this examination is done manually. Participants will receive confirmation of passing by receipt of a verification form. Verification forms will be mailed within two weeks after taking an examination.

EDUCATIONAL DISCLAIMER
The opinions of efficacy or perceived value of any products or companies mentioned in this course and expressed herein are those of the author(s) of the course and do not necessarily reflect those of PennWell.

Completing a single continuing education course does not provide enough information to give the participant the feeling that s/he is an expert in the field related to the course topic. It is a combination of many educational courses and clinical experience that allows the participant to develop skills and expertise.

COURSE CREDITS/COST
All participants scoring at least 70% (answering 21 or more questions correctly) on the examination will receive a verification form verifying 4 CE credits. The formal continuing education program of this sponsor is accepted by the AGD for Fellowship/Mastership credit. Please contact PennWell for current term of acceptance. Participants are urged to contact their state dental boards for continuing education requirements. PennWell is a California Provider. The California Provider number is 3274. The cost for courses ranges from $49.00 to $110.00.

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RECORD KEEPING
PennWell maintains records of your successful completion of any exam. Please contact our offices for a copy of your continuing education credits report. This report, which will list all credits earned to date, will be generated and mailed to you within five business days of receipt.

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