jCD
vol. 26 issue 4
Journal of Cosmetic Dentistry

A BETTER LIFE—
A BETTER SMILE

Current Remineralization Strategies
Drs. André V. Ritter, Michael W. Roberts, J. Timothy Wright

Direct Resin Methods Revealed (Part 2)
Dr. Newton Fahl, Jr.

20 Key Points in Managing Caries
Dr. V. Kim Kutsch

Winter 2011
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Journal of Cosmetic Dentistry

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The mission of the Journal of Cosmetic Dentistry is to educate AACD members, as well as other professionals in the field, on the art and science of cosmetic dentistry. We will endeavor to do this by publishing well-researched, peer-reviewed articles accompanied by high-quality, comprehensive clinical imagery. The objective is to enhance readers' knowledge and skills while showcasing the latest cosmetic techniques and procedures. The Journal of Cosmetic Dentistry will strive to help readers become better clinicians, so they can offer their patients the best—and most responsible—treatment possible.

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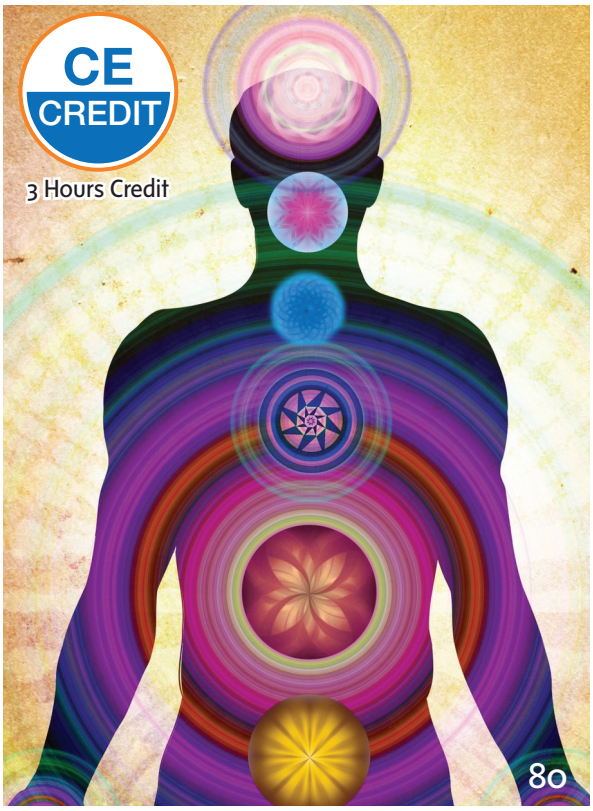
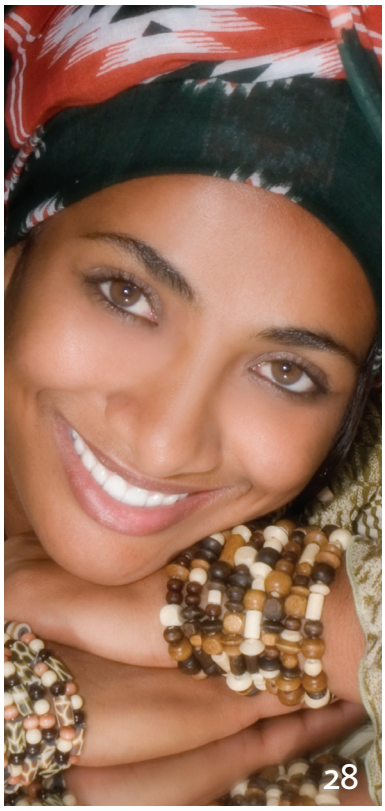
Features





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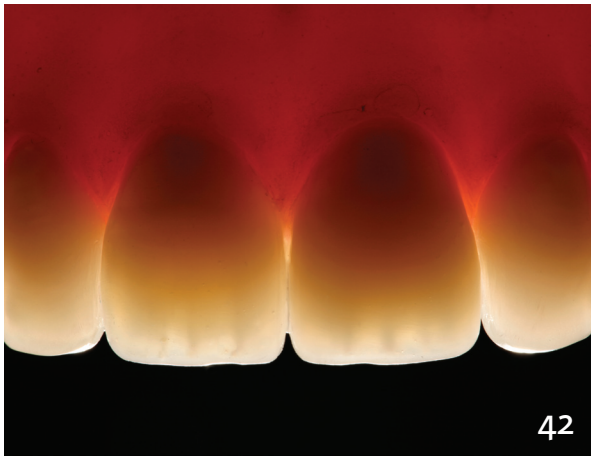
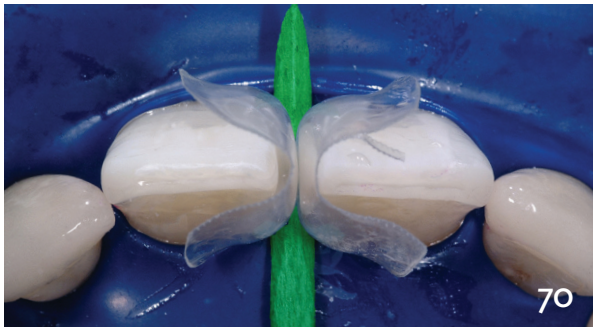


Columns



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The *Journal of Cosmetic Dentistry* maintains signed patient release forms for all articles featuring clinical or other patient photography.

New Beginnings

Edward Lowe, DMD, AAACD

The cover of this issue of the *jCD* features a brave young woman who endured a life of great deprivation and hardship in her native country, Tanzania, before a new beginning in the United States. Her moving story is told in Behind the Smile, and her case, by Dr. Sam Sadati, is recounted in the Clinical Cover Story.

Also in this issue, Dr. Robert Winter shares his thoughts on treatment planning; this critical topic is further addressed in an article by renowned clinician Dr. John Kois.

Cosmetic dentists, by not only improving form and function, but also by creating beauty do, in truth, give their patients a "new beginning."

The AACD's credo of Responsible Esthetics is highlighted in Drs. André Ritter, Michael Roberts, and Timothy Wright's study on remineralization of smooth surface incipient enamel lesions; and Dr. V. Kim Kutsch offers valuable tips on caries management through risk assessment.

Do not miss the interview with distinguished educator Dr. Harald Heymann, who offers his insights on the history of tooth whitening, and on self-etch adhesives.

Dr. Newton Fahl concludes his two-part series on composite artistry and Dr. David Clark shares a case report on closing a diastema.

Readers who are contemplating beginning Accreditation will find the sample written exam questions in the Accreditation Essentials section to be of great value.

This *jCD* Winter issue is full of "beginnings" and, in that spirit, I welcome our new editorial board members. I am honored to have you join us in helping the *jCD* grow.

A Matter of Perception

As I thought about the theme of this issue, the foundations of dentistry, I recalled the many times over the years that I have been surprised by the number of dentists who are not familiar with the AACD; we are surrounded by exceptional dentists who are not members of our organization. Surveys from the American Dental Association and the Canadian Dental Association indicate that only about 2.5% of dentists in North America are AACD members (sources: *2008 Distribution of Dentists in the U.S. by Region and State* and *2006 CDA Membership Survey*).

Sadly, many mistake "cosmetic" dentistry for "frivolous" dentistry. Yet to develop the skills needed to be a good cosmetic dentist requires mastery of virtually every discipline of dentistry and countless hours of postgraduate training.

Cosmetic dentists may place slightly more emphasis on the esthetics of their dentistry, but not at the expense of form and function. Esthetics may be a matter of perception; however, it often is the catalyst that motivates patients—many of whom desire a new beginning in life—to seek treatment. Form and function must complete the case, for if patients cannot chew or are in discomfort postoperatively, they are not going to care how attractive their new smile is.

Cosmetic dentists, by not only improving form and function, but also by creating beauty do, in truth, give their patients a "new beginning."

Edward Lowe

You Asked, We Listened! Be sure to turn to page 94 for a new column, "Member's Exchange"—quick tips from members for members. Send your submission to publications@aacd.com. We are continuing to enhance the jCD with your input!

PATIENT NEWS

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PROUD TO SUPPORT *Give Back A Smile!*

Patient News donated a "double your donation" marketing campaign at the AACD Annual Meeting in Texas 2010. Thank you to Guy Lewis, DDS for bidding $6000 to GBAS! In exchange, PNP produced a $12,000 marketing campaign.

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Dr. Guy Lewis (in blue) with President Karen Galley & Drs. Jerry Woolf & Dennis Wells at the AACD in Texas

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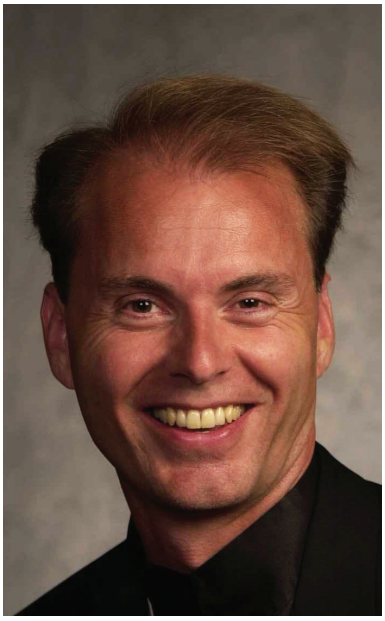

Robert R. Winter, DDS

Performing a comprehensive oral-facial assessment and analysis is an integral part of the treatment-planning process. First, dentists gather subjective information during patient interviews. This information, based on the patient's perception of his or her problem, requires the practitioner to ask specific clarifying questions to determine concerns the patient may be unable to verbalize, and helps to determine the patient's desired treatment outcome. Objective facts are unbiased by personal opinion, and are obtained by performing a thorough clinical examination that includes facial, skeletal, occlusal, and oral components. It incorporates radiographs, photographs, and diagnostic casts, and may require articulation and a diagnostic wax-up. Biologic, structural, functional, and esthetic issues must be identified and addressed. Without addressing all these elements in a sequential, logical, and consistent manner, the treatment plan developed may be ineffective or inappropriate.

Without addressing all these elements in a sequential, logical, and consistent manner, the treatment plan developed may be ineffective or inappropriate.

Once the assessment is completed, all gathered information should be thoroughly reviewed, after which a "problem list" identifying the underlying etiology should be developed and prioritized. Potential treatment options and goals for each problem should be formulated based on a visualization of the biologic and esthetic outcomes that best meet the patient's needs. For the patient to provide truly informed consent, the ideal or optimal comprehensive treatment plan and possible treatment options should be listed first and presented in writing to the patient, with the least invasive procedures to accomplish the desired outcome. Alternatives to the optimal plan should be listed next, noting any potential limitations or compromises to the ideal outcome. These, along with potential complications, should be carefully explained to the patient. The sequencing of treatment and a description of services other specialists may need to provide should be included. For cases requiring a team approach, it is imperative that the team be formed during the planning phase and all necessary team member consultations, assessments, and ideas be incorporated into the plan before any treatment begins. The individual providing the definitive treatment should coordinate the overall plan and sequencing of care to be delivered.

A comprehensive oral-facial analysis using an interdisciplinary approach will enable members of the clinical team to develop a treatment plan to be successfully executed with a highly esthetic, biologically acceptable, and functionally enduring result.

UP FRONT provides a guest editorial forum for influential educational leaders to share their opinions. In this issue, we welcome Dr. Robert R. Winter. Dr. Winter is a member of the graduate prosthodontics faculty at the University of Washington and the University of Southern California; he also is a faculty member at Case Western Reserve University School of Dental Medicine. Dr. Winter will be presenting at AACD's Annual Scientific Session in Boston on May 18, 2011. ***Disclosure:*** *The author did not report any disclosures.*

MEET Rocksand Grogan

During her 15 years in dentistry, Rocksand has been privileged to have worked side by side with some of the most demanding dentists in the country. Her ability to consistently meet her client's needs sets her at the top of her field. She is a proud member of the AACD, a certified dental technician in PTC educational training, and has a keen eye for detail. Her training as a ceramist began at LVI, where she successfully completed multiple LVI Advanced ceramic courses, orthotic, full mouth case design and fabrication, as well as posterior indirect resin courses with Dr. Ron Jackson. Ms. Grogan has also served as a ceramist and participant at the Aesthetic Advantage Continuum with Dr. Larry Rosenthal in New York, creating all ceramic cases for the live-patient aesthetic series.

"I love the personal, one-on-one philosophy at LK Dental Studio - it's where I feel I can give the best to the dentists I work with! In my opinion, the key to success lies in our communication. From the model work and mounting, to the completed restorations, every detail counts. I know our clients need us to deliver for their patients, and that is always my goal." Rocksand

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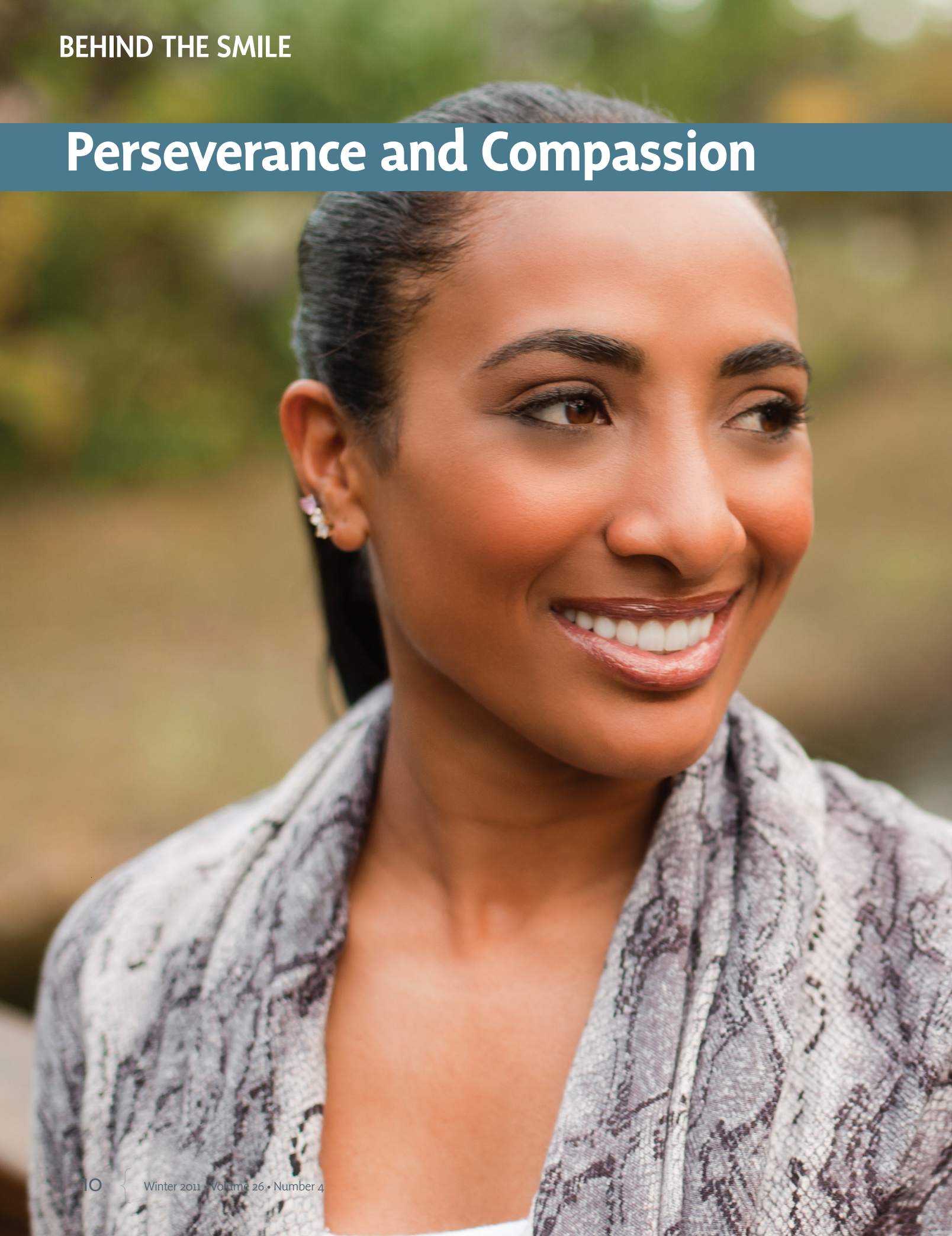
Perseverance and Compassion



I met Aneth through her husband, my long-time patient Mark McCarthy. He had met Aneth during one of his trips to Tanzania, Africa. When they first met, Mark had noticed brown spots on Aneth's teeth and later asked if I could help her. I told Mark I would need to see Aneth to evaluate her case.

Initially, when Aneth arrived in the U.S., we experienced communication difficulties, but I soon realized that charm, kindness, warmth, and sincerity are expressed the same way in any language. Having experienced similar hurdles as an immigrant from Iran, I empathized and wanted to help restore Aneth's smile.

After a full examination and evaluation, it was determined that Aneth had enamel hypoplasia throughout all her dentition, likely due to a combination of the environment, genetics, and inadequate nutrition. It was further noted that her teeth were very small with excessive gingival display.

Aneth had a big smile despite her defective teeth but, after her new restorations, she seemed to smile unconsciously and I could only imagine how happy and grateful she was.

Aneth recently returned to Tanzania for the first time since arriving in the U.S. Her entire village had gathered to welcome her back. The villagers had seen a picture of Aneth with her new teeth and were anxious to know if they could have the same smile. Imagine being able to give a beautiful new smile—and renewed hope—to people who need it, whether in Africa, America, or anywhere else. How rewarding that would be!

For information on the clinical aspects of this case, please turn to page 28.

Restorative dentistry and clinical images by Sam S. Sadati, DDS, FAACD (Wellington, FL). Periodontal hard and soft recontouring by Stuart Feldman, DDS (West Palm Beach, FL). Ceramic artistry by master ceramist Ms. Hakjoo Savercool (Frontier Dental Laboratory, El Dorado Hills, CA). Cover photography by Gary D. James (Gary James Photography, Miami, FL). Cover photos shot with a Canon EOS-IDs Mark 11.

Preoperative

Postoperative

33 Years Later

Interview with Dr. Harald Heymann

Gary M. Radz, DDS

Harald Heymann, DDS, MEd, Professor of Operative Dentistry at the University of North Carolina School of Dentistry, is a distinguished and well-respected educator. He is a past president of the American Academy of Esthetic Dentistry. In Part 1 of this interview he talks with one of his former students, PEC Co-Chair Dr. Gary Radz, about the history of tooth whitening, his opinions about the AACD, and his thoughts on self-etch adhesives.

Dr. Heymann will be presenting at the 27th Annual AACD Scientific Session in Boston, Massachusetts, May 18, 2011. Register today at www.AACD.com.

GR: Dr. Heymann, for years you have been a strong influence and source of information in esthetic dentistry—your research work and articles have added to our knowledge and have guided us in our clinical procedures in a very important way. When did you become interested in this area of dentistry? And what were your influences as you started to pursue this direction in your career?

HH: Actually, I had planned to go into private practice but during my senior year Dr. Clifford Sturdevant, Chair of Operative Dentistry at the University of North Carolina (UNC) School of Dentistry, asked me stay on and teach. I was involved in clinical research under the mentorship of Dr. Karl F. Leinfelder, who got me interested in clinical trials with esthetic restorative materials. At that time, there were some very new and innovative materials such as micro-filled resins. We also were, to my knowledge, the first dental institution in the world to conduct clinical trials with posterior composites, and this was part of the springboard to my interest in esthetic restorative materials. I also learned from Dr. Lee Sockwell, an expert in esthetic dentistry at that time at UNC; between his influence and that of Dr. Leinfelder I became interested in this entire field and I've been very blessed to be part of this program for the past 33 years.

Dr. Harold Heymann with Dr. Van Haywood.

GR: I think readers would be interested in hearing about your role in bringing vital tooth bleaching to the awareness of the profession and the public. How did you become involved with tooth bleaching?

HH: It was almost by accident. Dr. Van Haywood was in the Department of Operative Dentistry with me and he had heard about a technique that we called "nightguard vital bleaching," in which carbamide peroxide gel was placed into a custom-made tray for the purpose of whitening teeth. Obviously at that time we didn't have commercially available whitening products; this technique originated through the use of FDA-approved oral antiseptics like Glyoxide, Proxigel, and Peroxyl. Dr. Haywood and I started using Proxigel because, being a gel, it stayed in the tray a little better, and we began conducting some clinical trials. That work ultimately precipitated an article that we

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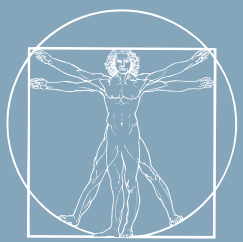

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In the area of tray bleaching (nightguard bleaching) I think the biggest advances have occurred in the compositions of the whitening agents.

The degree of whitening attainable with a nightguard vital bleaching (preoperative shade is represented by the shade tab.

published in *Quintessence International* in 1989, which introduced this technique to the literature.[1]

GR: It is fascinating to see how tooth whitening has grown over the years. What do you see in the future for tray bleaching and over-the-counter (OTC) whitening products?

HH: In the area of tray bleaching (nightguard bleaching) I think the most significant advances have occurred in the compositions of the whitening agents. And by that I mean the incorporation of materials like fluoride and potassium nitrate based on some very good clinical studies.[2] These materials have proved to provide a significant reduction in sensitivity associated with tooth whitening—that is a major advance. Other studies have shown the incorporation of amorphous calcium phosphate may have similar effects in reducing sensitivity.[3] So I think we've seen significant advances with regard to compositional changes. I don't anticipate any major changes in the dentist-supervised version of this technique.

Some people still have concerns about the use of OTC products because they largely are administered in an unsupervised manner. But some of these products have had over 100 clinical trials that document their safety and efficacy.[4,5] Of course, there still are what I'd call "fly-by-night" companies that have products that I'm a little concerned about, particularly when you get into the realm of much higher concentrations of whitening agents used in a manner unsupervised by dentists. So I certainly recommend that if OTC products are going to be used, that the products be from reputable companies that have done their "homework" to document the products' safety and efficacy.

GR: For many years you have been very active in the American Academy of Esthetic Dentistry (AAED). Can you share your impressions about the AAED and about the American Academy of Cosmetic Dentistry (AACD)?

HH: The AAED certainly has been a very positive influence on my practice of dentistry and on my philosophies. Many of the early members, such as Dr. Ron Goldstein and Dr. Gordon Christensen and others, were at the forefront of esthetic and cosmetic dentistry and I hold them in very high regard. However, the AAED is a relatively small organization, whose membership has been very limited. The advent of the AACD, in my opinion, filled a significant need that allowed more practitioners to be involved in an organized way in cosmetic dentistry. I greatly applaud the AACD's credentialing process, which I believe helps to ensure a higher standard of care in the realm of esthetic and cosmetic dentistry. When I was president of the AAED I established a liaison committee between the two organizations. As a result, our organizations now meet regularly and try to identify areas of common interest and to, for example, co-sponsor programs like the IFED meeting, promote ethics in esthetic and cosmetic dentistry, and share speakers. I think this has been a very fruitful venture and I'm really pleased to see that our two organizations are working hand-in-hand for a common good.

I greatly applaud the AACD's credentialing process, which I believe helps to ensure a higher standard of care in the realm of esthetic and cosmetic dentistry.

GR: As we're discussing AAED and AACD, there is a common question that dentists debate amongst themselves and patients ask us: What do you feel is the difference between the meanings of *esthetic* and *cosmetic*, or do you see any differentiation at all?

HH: In my opinion, there is not a big difference. *Esthetic* means "beautiful"; *cosmetic* means "intended to beautify." So "cosmetic" may be the intention and "esthetic" may be the result but I really don't see a great difference between the terms; to me, they both connote improvement in physical appearance.

GR: I'd like to get your opinion on a few broad subjects, especially considering your clinical research background. What do you think about the current state of the art of self-etching adhesives?

HH: That's a very good question. Based on what I have been told by manufacturers, recent surveys indicate that more than 50% of dentists now are using self-etch adhesives. However, I believe self-etch adhesives are a classic example of the "tail wagging the dog." Why are they so popular? First of all, they're extremely user-friendly. Second, self-etch adhesives categorically result in lower sensitivity, or at least it's easier to achieve low sensitivity with self-etch adhesives, because the dentinal tubules largely remain occluded, even after application of the self-etch adhesive. This result occurs because self-etch adhesives employ much less aggressive acids that do not typically open the dentinal tubules like phosphoric acid does. In my opinion that's probably the biggest reason they sell so well—if you can prevent patients from having problems with postoperative sensitivity, that sells! So these are clearly big advantages of self-etch adhesives.

But here's the problem: The most important substrate to which we bond when we do clinical procedures is enamel, not dentin. Bonds to enamel are essential; bonds to dentin are "gravy." And yet the bonds to enamel with self-etch materials are less than optimal. So the problem is self-etch materials bond incredibly well to dentin, only modestly well to enamel, and in some cases not very well at all if you're talking about uncut enamel where the bond strengths can be quite mediocre. Therein lies the problem, since the most important substrate that we can bond to is enamel—that is the key to success long term. Even the best bonds to dentin deteriorate over time, yet bonds to enamel are more predictable and very durable.[6-8]

And all you have to do is look at an example like porcelain veneers—if you have intra-enamel preparations you largely reduce the associated problems such as de-bonding and sensitivity, and even reduce staining and leakage around the margins. Clinical results are excellent when veneer preps are largely positioned in enamel.[9,10] Why? Because bonds to enamel are incredibly predictable and very durable as I noted earlier, as opposed to bonds to dentin, which inherently degrade over time even with the best bonding agents. Admittedly, self-etch materials excel in bonding to dentin, which is great—but the bond to enamel with self-etch adhesives is not nearly as good as that which we can achieve with etch-and-rinse (total etch) systems that use phosphoric acid as the conditioning (etching) agent. So total etch materials clearly are still the superior adhesive materials from a standpoint of long-term clinical longevity, and long-term studies emphatically underscore this claim.

We recently had a study published in the *Journal of the American Dental Association*—a 12-year study with OptiBond that revealed approximately 90% retention overall when evaluated in the restoration of non-carious cervical lesions.[11] By comparison, there are some self-etch materials that don't render 90% retention at three years let alone 12 years. So it's like most things in dentistry—the first versions of new materials, in this case self-etch materials, may not be as good but usually there's a progression that results in much improved versions over time. I believe that is the case with self-etch adhesives.

So take heart; there are significant improvements being made in the realm of self-etch materials. There are products out there that I believe show significant promise in addressing some of the major concerns that exist with current versions of self-etch materials. These concerns include the fact that self-etch adhesives are inherently very hydrophilic, and being hydrophilic it means they're more subject to degradation in a fluid environment. There are newer self-etch adhesives that I believe


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Self-etch adhesives employ much less aggressive acids that do not typically open the dentinal tubules like phosphoric acid does.

are addressing this concern by incorporating, for example, a hydrophobic overcoat to improve the durability of the bonds. There are also new self-etch adhesive systems that I believe are lower in pH so that you do get a more predictable bond to enamel. So don't throw out self-etch adhesives. I'm not saying that they don't show promise, because newer versions do. But the bottom line on dentinal adhesives to date is that the best adhesives based on clinical research are still etch-and-rinse (total etch) systems such as the original multi-bottle systems. These include products like Scotch Bond Multi-Purpose, All Bond II, Optibond, and Optibond FL. These types of materials just flat-out work. Single-bottle etch-and-rinse systems also are time-proven adhesives. Examples include Optibond Solo Plus, Prime and Bond (which was the top-selling adhesive material for many years), One Step Plus, Singlebond, and many others. In fact, many of these single-bottle materials have been our "workhorse" materials for many years, and consequently that's why we still teach at our dental school the use of etch-and-rinse systems. Now, many people say if you use etch-and-rinse systems you're going to get sensitivity. But the truth is after etching and before placing these materials you can interject a Gluma-type desensitizer, and greatly reduce sensitivity. And it does so very simply because it occludes the tubules, it kills the bacteria, and coincidentally it also improves collagen bonding.[12-16]

In summary, even though I think self-etch materials are improving, to date clinical performance is still going to be best with the etch-and-rinse (total etch) systems.

GR: Do you have any comments about the self-etching materials that are now showing up on the market?

HH: I think they show promise because most of these self-etching restoratives are intended as bases and liners; and, of course if you're talking about bonding to dentin alone where enamel is not involved, these materials are superb. Studies show that if you have well-etched, well-bonded enamel margins, that is one of the keys to the durability of any type of adhesive material that is bonded to dentin.[17] The peripheral seal created by a good enamel bond is key. So I think most of these new flowable self-etch bases and liners will do OK and will survive well if you have well-etched and bonded enamel margins. But that usually requires a supplemental etch of these enamel margins with phosphoric acid. Self-etch flowables also are excellent materials as the first increments in a posterior composite procedure, because of their favorable elastic moduli. They are capable of significant flexure, and that ability to act as a stress-breaking liner greatly improves the ability to maintain the bond to the dentinal substrate. That quality also helps in reducing postoperative sensitivity by maintaining the bond to the underlying dentinal substrate. So if you're talking about bonding to dentin, these materials excel if they are well sealed with well-etched enamel margins.

Part 2 of the interview with Dr. Heymann, which will appear in the Spring 2011 issue of the jCD, *will address topics including no-prep veneers, interdisciplinary collaboration, and the metal-free practice.*

References

1. Haywood VB, Heymann HO. Nightguard vital bleaching. Quintessence Int. 1989;20(3):173-6.
2. Tam L. Effect of potassium nitrate and fluoride on carbamide peroxide bleaching, Quintessence Int. 2001;32:766-70.
3. Giniger M, MacDonald J, Ziemba S, Felix H. The clinical performance of professionally dispensed bleaching gel with added amorphous calcium phosphate. J Am Dent Assoc. 2005;136(3):383-92.
4. Munro IC, Williams GA, Heymann HO, Kroes R. Use of hydrogen peroxide-based tooth whitening products and the relationship to oral cancer. J Esthet Rest Dent. 2006;18(3):119-25.
5. Munro IC, Williams GA, Heymann HO, Kroes R. Tooth whitening products and the risk of oral cancer. Food Chem Toxicol. 2006;44(3):301-15.
6. Meiers JC, Young D. Two-year composite/dentin durability. Amer J Dent. 2001;14(3):141-4.
7. Hashimoto M, Ohno H, Kaga M, Endo K, Sano H, Oguchi H. Resin-tooth interfaces after long-term function. Amer J Dent. 2001;14(4):211-5.
8. Okuda M, Pereira PN, Nakajima M, Tagami J, Pashley DH. Long-term durability of resin dentin interface: nanoleakage vs. microtensile bond strength. Oper Dent. 2002;27:289-96.

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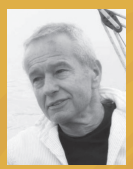

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9. Friedman MJ. A 15-year review of porcelain veneer failure: a clinician's observation. Compend Cont Ed Dent. 1998;19:625-36.

10. Dumfahrt H, Schaffer H. Porcelain laminate veneers: a retrospective evaluation after 1-10 years of service. Int J Prosthodont. 2000;13(1):9-18.

11. Wilder AD, Swift EJ, Heymann HO, Ritter AV, Sturdevant JR, Bayne SC. A 12-year clinical evaluation of a three-step dentin adhesive in noncarious cervical lesions. J Am Dent Assoc. 2009;140:526-35.

12. Shupbach P, Lutz F, Finger WJ. Closing of dentinal tubules by Gluma desensitizer. Eur J Oral Sci. 1997;105:414-21.

13. Bergenholz G, Jontell M, Tuttle A. Inhibition of serum albumin flux across exposed dentin following conditioning with Gluma primer, glutaraldehyde or potassium oxalates. J Dent. 1993;21:220-7.

14. Dall Orologio DG, Malferrari S. Desensitizing effects of Gluma and Gluma 2000 on hypersensitive dentin. Am J Dent. 1993;6:283-6.

15. Dijkman G, Jongebloed WL, DeVries J, Ogaard B, Arneds J. Closing the dentinal tubules by glutaraldehyde treatment, a scanning electron microscopy study. Scand J Dent Res. 1994;102:144-50.

16. Qin C, Xu J, Zhang Y. Spectroscopic investigation of 2-hydroxyethylmethacrylate/glutaraldehyde solution as a dentin desensitizer. Eur J Oral Sci. 2006 Jul;114(4):354-359.

17. De Munck J, Van Meerbeek B, Yoshida Y, Inoue S, Vargas M, Suzuki K, Lambrechts P, Vanherle G. Four-year water degradation of total-etch adhesives bonded to dentin. J Dent Res. 2003;82:136–40. **jCD**

Old Well, University of North Carolina (UNC).

Bonds to enamel are essential; bonds to dentin are "gravy." And yet the bonds to enamel with self-etch materials are less than optimal.

Dr. Heymann is a Professor of Operative Dentistry at the University of North Carolina.

Dr. Radz is an Associate Clinical Professor at the University of Colorado School of Dentistry. He has a private practice in Denver.

Disclosure: The authors did not report any disclosures.

Five Years After Treatment, Life is "Sweet" for Candy

GBAS Beneficiary Smiles in Front of—and Behind—the Camera

Allison DiMatteo, MPS

The AACD Charitable Foundation's Give Back a Smile™ (GBAS) program restores the smiles of domestic violence survivors at no cost. In response to crucial volunteer feedback, the GBAS guidelines have been updated to move away from full-mouth reconstruction cases and focus on injuries incurred to the smile zone.

This section shares the triumphs of the GBAS program. Please visit www.givebackasmile.com for more information on how you can help restore a smile.

As a child, Candy witnessed domestic violence against her mother and siblings, and experienced it herself.

In the Spring 2007 issue of the *Journal of Cosmetic Dentistry*, Douglas C. Jungman, DDS, shared the details involved in treating Candy, a single mother of four whose smile he had restored through the AACD Charitable Foundation's Give Back a Smile™ (GBAS) program. GBAS restores the smiles of domestic violence survivors at no cost. Like the other more than 1,000 domestic violence survivors whose lives the program has changed, Candy was able to move from devastation to rejuvenation.

"It's hard to put into words how much this opportunity has changed my life. Even after completion of my new smile, it took time to realize that I no longer needed to place my hand in front of my mouth when speaking or laughing," Candy recalls. *"In addition to healing physically, the wounds that were most difficult to heal came from enduring so many years of emotional abuse. Getting back my smile forced me to face and overcome many of my demons."*

As a child, Candy witnessed domestic violence against her mother and siblings, and experienced it herself. Not once did anyone tell her that it was wrong.

"If someone had told me it was wrong, it could have made a big difference in how I lived my own life," Candy says. *"In some ways, the smile makeover process was embarrassing. My 'before' images were featured in many articles and on national television. People close to me had no idea how severe my problem really was until the photographs became public. I guess I became very good at keeping it hidden."*

The years of physical abuse damaged not only Candy's smile, but also her self-esteem. A gut-wrenching encounter with an unsympathetic dentist who yelled at her and called her a drug addict when she sought treatment for a painful abscessed tooth contributed to an understandable phobia about dentistry. She avoided having photographs taken, didn't wear lipstick to avoid attracting attention to her teeth, and heeded directions from employers to avoid customer contact to prevent scaring them away because of her teeth.

It was a letter from Candy's then 14-year-old daughter, Kate, to the "Dr. Phil" show requesting a Mother's Day surprise that ultimately brought Candy and Dr. Jungman together. Kate's heart-warming letter conveyed how her "Supermom"—who was working three jobs to make ends meet—suffered broken teeth from the beatings

The years of physical abuse damaged not only Candy's smile, but also her self-esteem.

Kate's father inflicted upon Candy **(Fig 1)**. She wanted her mother to have beautiful teeth so that she could smile again. Dr. Phil, who was aware of the GBAS program, arranged for Kate, Candy, and Dr. Jungman to appear on the show, and Candy's smile makeover began soon thereafter.

"During the year it took to complete the dental work, I heard myself constantly referred to as a 'victim' of domestic violence. That helped me realize that I wasn't a victim and neither are those who are able to get out of an abusive relationship," Candy says. *"Rather, we are survivors of domestic violence. The only true victims are those adults and children whose lives are lost due to domestic violence."*

Since Candy's restorative treatment, she has been pursuing her passion for photography, which she says would never have happened without "this gift" of a GBAS smile makeover **(Fig 2)**.

"Appearance, unfortunately, plays a big role in what we do or feel capable of doing. I now use my photography to make a difference," Candy shares. *"Most of my photographs are sold*

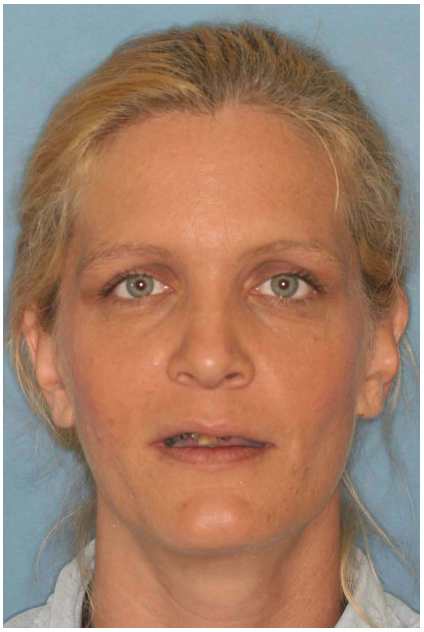

Figure 1: When Candy first presented, she rarely smiled and avoided having her photograph taken.

Figure 2: Candy's GBAS treatment restored her smile and enabled her to regain her self-confidence.

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Figure 3: Today, Candy is all smiles and proud to pose for family portraits with her children.

The treatment process and her renewed self-esteem and awareness have empowered Candy to reach out to other survivors of domestic violence.

only for fund-raising programs to benefit others in need. I now realize that one person can make a difference."

The treatment process and her renewed self-esteem and awareness also have empowered Candy to reach out to other survivors of domestic violence. By sharing her pain and embarrassment, she hopes to help change the lives of others.

"If just one person who read about or heard my story found hope for getting out of an abusive relationship, then all my shame, embarrassment, and pain was worth it," Candy believes.

Candy is working with other survivors to bring domestic violence programs into high schools to educate teenagers about the fact that children who grow up in homes with domestic violence often continue that cycle. She wants today's kids to know what she didn't know and believes that if such a program helps just one young person break the cycle of abuse, it is well worth the effort.

"The most amazing outcome of this whole process for me, and one for which I will be forever grateful, is that for the first time in 12 years, my children and I have had a family photograph taken ***(Fig 3)****. I am so thankful to the "Dr. Phil Show," Dr. Jungman and his entire amazing staff, and the Give Back a Smile program. Not only did these people give me back my smile, but they also gave me back my life,"* Candy expresses with sincere gratitude. *"Thank you! Thank you! Thank you! May life bestow many blessings on all of you who were involved in changing my life and the lives of others."*

Acknowledgment

The AACD thanks Candy for sharing her story. We also are very grateful to members such as Dr. Jungman, who give their time and skill so generously to the Give Back a Smile program. **jCD**

Allison DiMatteo is president of Crème della Crème Copywriting & Communication. Disclosure: The author did not report any disclosures.

10 Questions to Test Your Knowledge

Free AACD Sample Written Exam Questions

Kim Hollenbeck

AACD Accreditation recognizes excellence in cosmetic dentistry. To obtain Accreditation, you must pass a written examination, submit clinical cases, and pass an oral examination. Cases encompass a broad range of treatment. Each case requires pre- and postoperative images and a written report. To pass, cases must meet standards set by the American Board of Cosmetic Dentistry. This section's objective is to support your goal of becoming Accredited.

"it" is the Accreditation Written Examination—the first step in the AACD Accreditation process—but do not be intimidated. Did you know that over 90 percent of those who take the exam pass? The Accreditation Written Examination consists of more than 100 multiple-choice questions that test your foundational knowledge of cosmetic dentistry. This knowledge includes all disciplines of dentistry, with an emphasis on those subjects pertaining to esthetics. The AACD has ensured the validity of all questions and keeps references on file for each one.

The next Accreditation Written Examination will be administered in Boston, May 19, 2011, during the 27th Annual AACD Scientific Session. Pre-registration for the written examination is required. You can register online at www.aacd.com or on site in Boston, at AACD Main Registration prior to the day of the exam. Individuals may take the exam more than once. Study materials include sample exams and, for further assistance, a reference library—both available at www.aacd.com.

Following are some sample questions to test your knowledge.

"The Accreditation Written Examination was a challenging, but a fair test of knowledge that reignited a passion for dentistry that kept growing as the Accreditation process continued."

~ Adamo E. Notarantonio, DDS

...over 90 percent of those who take the exam pass.

1. **What is the most likely reason for chronic inflammation and swelling around the maxillary right central incisor in a patient who had the upper eight anterior teeth restored with indirect restorations two years ago?**
   - A. Plaque accumulation
   - B. Biologic width violation
   - C. An over-contoured restoration
   - D. Patient allergy to the restorative material

2. **When placing a post and core, the risk of using dual-cure cement and a dual-cure adhesive is most accurately described by which of the following?**
   - A. Dual-cure adhesives will not fully polymerize in the canal
   - B. Polymerization expansion may cause root fracture
   - C. Some of the adhesives accelerate the set of the cement, preventing post seating
   - D. Incomplete removal of the etch from the post space may retard complete polymerization

3. **In order to improve the clinical performance of zirconia restorations, research should focus on:**
   - A. improving the toughness of the zirconia core.
   - B. providing more opacity for the core material.
   - C. enhancing the esthetic properties of the materials.
   - D. improving the surface properties of the veneering porcelain.

4. **What method of ceramic restoration fabrication results in the greatest porosity?**
   - A. Powder condensation
   - B. Slip casting
   - C. Hot pressing
   - D. CAD/CAM

5. **Centric relation may be defined as the relationship of the mandible to the maxilla when:**
   - A. maxillary and mandibular teeth are in maximum occlusal contact.
   - B. the condylar disk assemblies are in its most superior position.
   - C. the muscles of mastication are at rest.
   - D. the condylar disk is in its most anterior position.

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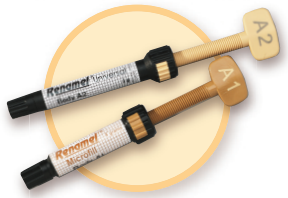

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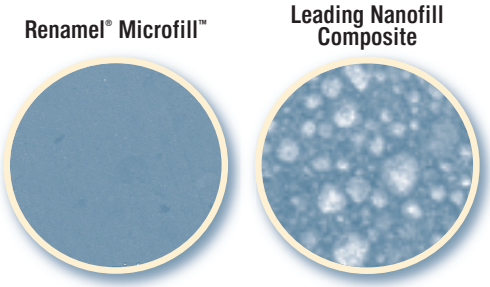

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6. **The general rule for equilibrating working side contacts is:**
   A. BULL (buccal inclines upper, lingual inclines lower).
   B. LUBL (lingual inclines upper, buccal inclines lower).
   C. DUML (distal inclines upper, mesial inclines lower).
   D. MUDL (mesial inclines upper, distal inclines lower).

7. **An increase in chroma induces:**
   A. an increase in hue.
   B. a decrease in hue.
   C. an increase in value.
   D. a decrease in value.

8. **In treatment plan considerations regarding gingival esthetics, the predictably achievable interdental papilla height is SHORTEST between:**
   A. a tooth and an adjacent implant.
   B. a tooth and an adjacent pontic.
   C. an implant and an adjacent implant.
   D. an implant and an adjacent pontic.

9. **What is the recommended preparation for a zirconium full-crown restoration?**
   A. Chamfer type finish lines with rounded surface transitions
   B. Shoulder type finish lines with parallel axial walls
   C. Chamfer type finish lines with parallel axial walls
   D. Shoulder type finish lines to maximize the bio-compatible conditions for long-term function

10. **Application of hydrofluoric acid to the internal surface of silica-based ceramic restorations is used to:**
    A. remove surface contaminants left from try-in.
    B. provide a smoother surface for the subsequent luting agent.
    C. increase surface area for bonding to the luting agent.
    D. increase wettability for the luting agent.

So how did you do?

Answer key:
1. B, 2.C, 3.C, 4.A, 5.B, 6.B, 7.D, 8.C, 9.A, 10.C

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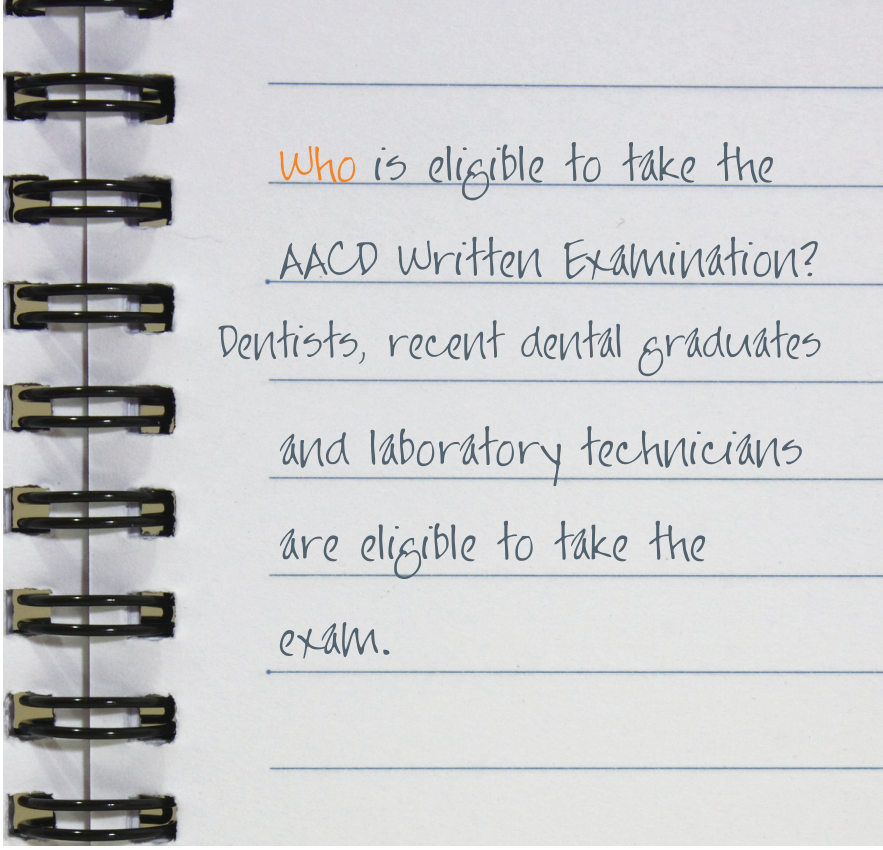

"The AACD's Accreditation Written Examination is challenging, yet it allowed me to honestly evaluate my understanding of cosmetic dentistry from all aspects. The best way to get started was to take the sample tests that are available on AACD's Web site. Once I found out in which areas my understanding was lacking, it was easy to find help through many lecturers from the AACD's Annual Scientific Session. It is the start of an exciting and fulfilling journey."

~ Jerome Y. Cha, DDS

Kim Hollenbeck is the AACD Credentialing Manager and manages the Accreditation Written Examination. She can be reached at credentialing@aacd.com.

From Africa to America

Correcting Enamel Hypoplasia and Breaking Cultural Barriers

Sam S. Sadati, DDS, FAGD, FAACD

Abstract

Amelogenesis imperfecta, a hereditary disorder causing developmental alterations of enamel, is considered a major cause of enamel hypoplasia. Although affecting only the enamel, enamel hypoplasia can lead to staining, discoloration, and secondary decay, as well as psychological issues, including lack of self-confidence, for patients. Although treatment is challenging, teeth can be restored to proper function and esthetics through focused evaluation, diagnosis, and a comprehensive multidisciplinary treatment plan. This article discusses the successful restoration of a patient's hypoplastic enamel and gingival display through the use of full- and partial-coverage lithium disilicate and leucite-reinforced all-ceramic restorations.

Photo credit: Randy Hribko (Studio Palm Beach; Palm Beach, FL).

Aneth's husband, Mark, says:

When I met her, Aneth lived in the village of Esso in Arusha, Tanzania. Her home was a mud shack with a corrugated tin roof and dirt floor. There was one electric light bulb. There was no running water. She had never slept in a real bed, had three meals a day, a medical or dental checkup, or even taken a hot bath or shower. All the things we take for granted, she never had.

Aneth's teeth had suffered from the lack of care and nutrition. Her diet consisted mainly of soft foods. I asked her why and she explained that her teeth were too weak for her to eat many solid foods.

Upon returning with Aneth to the U.S., we visited Dr. Sadati's office for an evaluation and learned she was in need of many dental treatments. The first to be done was a root canal. Later that day when Dr. Sadati called to see how she was feeling, she told him that it was the first time in five years she was able to chew food on the right side of her mouth. Imagine going five years with a toothache because you had no means of paying for treatment. We are very grateful to Dr. Sadati for his help.

Figure 1: Preoperative full-face image.

Introduction

Dentition are considered specialized structural components of the craniofacial skeleton and can be susceptible to genetic defects.[1] Whether alone or in combination with the oral environment or nutrition, genetic defects can detrimentally affect the development, function, and esthetics of oral structures.[1]

Enamel Hypoplasia

Patients with this disorder often have normal roots, normal pulp chambers, and the root canals are typically present.[2] Although damage is limited to the enamel, it is significantly affected, developing as amorphous and granular, instead of smooth.[2] It is rare with this condition for enamel prisms to follow the usual course, and teeth often demonstrate pseudo-isotropic regions and lamellae.[2] The enamel also tends to be softer, demonstrating a dentin-like density.[3]

Amelogenesis imperfecta is a hereditary disorder causing developmental alterations or defects in the enamel structure.

Amelogenesis imperfecta is a hereditary disorder causing developmental alterations or defects in the enamel structure. It affects primary and permanent dentition.[2,3] One of the most prevalent of these disorders, enamel hypoplasia, is characterized by brown spotting or overall browning of tooth surfaces.[2] Unlike conditions affecting the entire tooth structure, enamel hypoplasia is contained within enamel.[2]

The primary clinical problems of amelogenesis imperfecta include sensitivity issues, loss of occlusal vertical dimension, and dysfunction, in addition to the patient's esthetic concerns.[3] Patients with enamel hypoplasia also demonstrate increased susceptibility to secondary decay, a direct result of malformed enamel.[3]

Restoring the dentition solves functional problems associated with this developmental defect and has a positive impact on the patient's psychological status, which is significantly important.[3] To develop the best treatment plan, dentists and technicians must consider the patient's age, socio-economic status, type and severity of the disorder, and intraoral condition.[3] A multidisciplinary approach that includes evaluation; diagnosis; and a combination of periodontal, prosthodontic, and restorative treatment often is required.[3]

Case Study

The patient, a 23-year-old woman born in Tanzania, South Africa, had recently arrived in the U.S. to begin her new life. Although her English was limited, her husband knew some Swahili and served as the main interpreter throughout the case. The patient was concerned with the brown spots on her teeth and desired to improve her smile **(Fig 1)**.

Since everything she was seeing and experiencing was new, unfamiliar, and strange, the dental team ensured that her office visit was very comfortable and welcoming. During the consultation, where patient and doctor typically sit alone to discuss concerns and goals, two female team members also were present. After the initial conversation, the patient was informed that more data were needed before beginning the smile makeover process.

Diagnostic Information

During the first appointment, diagnostic information, including full-mouth, panoramic, and temporomandibular joint radiographs to evaluate the joints for disorders and disease, was gathered, and gingival tissues were checked.[4] To increase predictability, study models of the maxillary and mandibular arches were created from the impressions ob-

Figure 2: Preoperative retracted front view showing enamel defects on the dentition.

Figure 3: Preoperative maxillary occlusal view showing the extent of the defects on most surfaces of the teeth.

Figure 4: Image of the mandibular occlusal demonstrating the unusual shape and size of the canines.

tained and helped determine the anatomic alterations required during treatment.[5,6]

A facebow transfer (Protar 5, KaVo Dental; Charlotte, NC) recorded and transferred the spatial relationship of the maxillary arch to the selected anterior reference point and the articulator.[7,8] A centric relation (CR) record then was taken to determine the relationship of the maxilla to the mandible, with the mandible in CR.[9] Full intraoral and extraoral digital photographs (Canon 10D, Canon USA; Lake Success, NY) were taken to communicate proper shading and characteristics to the technician for use when fabricating the definitive restorations.[10] Periodontal charting enabled recording of furcation involvement, mobility, pocket depths, bleeding sites, and other gingival abnormalities.[11]

Following an oral cancer screening, a comprehensive esthetic evaluation of the patient's gingival and dental condition was performed.[12] The patient had light to moderate (mostly supragingival) calculus, with isolated areas of inflammation. She was in good overall health, but complained of pain in the area of tooth #3. To resolve the pain radiating from #3 and provide a temporary restoration until a definitive treatment plan was developed, endodontic therapy and a buildup were completed during the initial appointment.

The patient was scheduled to return the following week to allow sufficient time for development of a proper treatment plan.

The primary clinical problems of amelogenesis imperfecta include sensitivity issues, loss of occlusal vertical dimension, and dysfunction.

Diagnosis

After review of the radiographs and an in-depth visual examination, the patient was diagnosed with hypoplasia throughout her dentition. The causes, although not definitively known, were most likely environment, genetics, nutrition, or any combination of these **(Figs 2-4).** Aside from being unesthetic, the spotted enamel decalcification made the teeth prone to staining and secondary decay.

A portion of the dentin in #3 had been lost due to lack of treatment, which ultimately led to irreversible pulpitis and chronic pain over the previous five years. The patient's teeth were very small, in part because of an excessive gingival display. The anatomy, size, and morphology of the lower canines, crowns, and roots deviated from normal anatomical form. Teeth ##1, 5, 12, 17, and 32 were congenitally missing.

Treatment Plan

The patient's face was studied carefully during planning to ensure that her final smile design would match her radiant and positive personality. It was decided that the patient would need a wider, brighter, yet still feminine smile.

After studying the mounted casts, radiographs, periodontal chart, and digital photographs, it was obvious that the patient required soft and hard tissue lengthening in order for her teeth to demon-

Figure 5: Excessive gingival display.

Figure 6: The right lateral smile view showing the patient's shortened dentition.

Figure 7: Preoperative left lateral smile view displaying stained teeth that were detrimental to the smile.

strate the correct size, fit the frame of her lips to complement her smile, and be harmonious with her facial anatomy **(Figs 5-7)**.[13]

Discussions about whether the proposed treatment was periodontally responsible were held with Dr. Stuart Feldman, chairman of the Department of Periodontics at the Atlantic Coast Dental Research Clinic. After examining the patient, Dr. Feldman determined she was a good candidate for the procedure and offered to donate his services. Surgical guides were requested to demonstrate how much tissue should be removed.

Additionally, full- and partial-coverage leucite-glass ceramic restorations were planned for the anterior teeth and full-coverage lithium disilicate restorations for the posterior dentition. Due to the condition of the patient's enamel and the fact that all her teeth were prone to severe decay, any treatment other than full-coverage restorations for most of the teeth would have been irresponsible esthetic treatment.

Prior to the patient's next appointment, a computer-generated image of the proposed smile makeover was created to demonstrate how her smile would appear after treatment. This step was crucial, as the patient was from a different part of the world, and what looks good to the dentist may not always look good to the patient, especially if they have different perceptions of what is esthetically pleasing. The digital image also helped to overcome verbal communication barriers.

During the treatment plan presentation, the findings and ideal treatment, and advantages and disadvantages, were discussed with the patient and her husband. Both were very excited and grateful. The patient was shown the computer-generated image of the final restorations, at which point she became extremely emotional and began to cry. This was enough confirmation that the restorations would satisfy her desires and that she was ready to undergo treatment.

Treatment

Composite Mock-up

The patient underwent a complete oral hygiene regimen to stabilize her gingival health, with home care instructions provided. Although it was obvious that her teeth needed to be longer, further examination was required to determine whether length would be added toward the gingival margin only; or, as in reversed smile cases, to the incisal edge, or both.[14] For this determination, a quick and temporary composite mock-up was done on her six anterior teeth. After considering lip position and testing all phonetic sounds, the patient was asked to speak. While she counted numbers, she was observed and photographs (frontal, lateral) were taken at different magnifications (1:1, 1:2), which helped the technician determine the required tooth length and create the wax-up to visualize the patient's lip and incisal edge position.

Prior to removing the composite mock-up, alginate impressions of the maxillary arch were taken, making it possible to determine and mark with a red pencil on the preoperative casts how far api-

Figure 8: Four months postoperative, the patient exhibited longer and more proportional teeth, in comparison to the original amount of gingival display.

cally the gingival margins needed to be on each individual tooth. The zenith on each tooth was marked facially and buccally on the casts.

All marks were connected according to the ideal gingival margin pattern. Using a sharp #3(1/2) Hollenback carver (GC America; Alsip, IL), the red lines were followed and indented while trays were created with a vacuumed thermoforming machine using 1.0-mm thick plastic sheets. By trimming the edges of the trays at the indented lines, the surgical guides required by the periodontist for the maxillary and mandibular arches were formed.[13]

Gingival and Osseous Tissue Surgery

The patient then underwent the full-mouth osseous and gingival crown-lengthening procedures with Dr. Feldman. The surgical guides facilitated determination of the desired final position of the gingival margin once the healing period was completed. The procedure did not extend to the lingual side of any teeth. The guides were periodically placed on the patient's surgical site during the surgical procedure to evaluate the correct amount of reduction and, as importantly, the correct gingival margin shape.

It is imperative that patients who undergo this type of surgical procedure allow ample time for complete healing and stabilization of the gingival margins prior to any restorative procedure. Otherwise, irritation from the restorations could cause hypertrophy, inflammation, poor gingival health, and restoration failure. It was initially believed that the patient could wait three months to begin the restorative phase. However, four months were allowed for proper healing before beginning the restorative phase **(Figs 8 & 9)**. The patient was seen by Dr. Feldman on a routine basis during this time.

Six weeks after crown lengthening, the patient returned to the restorative dental office to determine if any areas needed further reduction or modification. The surgical guides were placed intraorally by the restorative dentist, and the gingival margins were compared to the surgical guide margins, which observation found to have been followed precisely. The zenith and curvature of the arch of the gingival margin on each individual tooth, the symmetry of the gingival height between the right and left sides, and the overall appearance were evaluated and determined to be precise and exactly as originally planned.

Laboratory Communication

A full series of digital photographs, study casts, and a facebow transfer were completed again to properly communicate the case to the laboratory.[8] These new records, cast of the composite mock-up, photographs of the desired mold and anatomy of the six maxillary anterior restorations, and detailed prescription were sent to the technician, along with a request for further discussions between the technician and clinician. Following a telephone discussion, the wax-up was completed and returned to the clinician's office within 10 days.[15,16]

It is imperative that patients who undergo this type of surgical procedure allow ample time for complete healing and stabilization of the gingival margins prior to any restorative procedure.

Preparation

Since the patient's appointment required between three and five hours, no other appointments were scheduled that day to limit interruptions. The patient was administered Carbocaine 3% (Cook-Waite, Novocal Pharmacy; Ontario, Canada) and Marcaine 0.3% (Cook-Waite) to fully anesthetize her left side and her right side slightly. All left teeth were prepared to match the guides provided by the laboratory, taking into consideration the amount of


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Figure 9: The patient's retracted smile, four months after the full-mouth osseous and gingival crown-lengthening procedure.

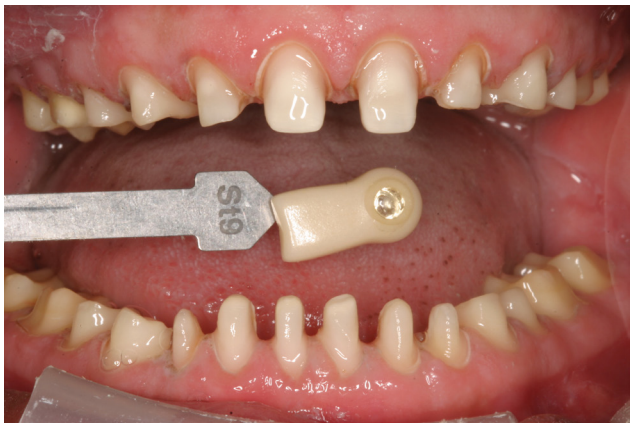

Figure 10: After preparation of the teeth, the shade of the underlying prepared teeth was compared to the stump shade tab.

...because of the stains and decay present, the preparations needed to extend beyond the normal requirements for this specific restorative material.

staining and decay present on each tooth.[15,17,18]

Tooth reduction was required for laboratory fabrication of the desired restorations because the patient's teeth were already small and the case was additive rather than reductive. Preparation began by removing and excavating all affected areas on each tooth. However, because of the stains and decay present, the preparations needed to extend beyond the normal requirements for this specific restorative material.

Due to the stains, decay, and hypoplasia effect deep in her tooth structure, all teeth except the four maxillary and four mandibular anterior teeth were prepared with full-coverage, 360° 1-mm shoulders to eliminate any defects under the ceramic restorations. Three-quarter crown preparations with a 1-mm shoulder were placed for the eight anterior teeth. The 1-mm shoulders were created to strengthen the marginal integrity of the planned ceramic restorations.

Prior to completing the left side preparations, the patient was administered anesthetic (Marcaine 0.3%) on her right side to allow sufficient time for efficacy before beginning those preparations. Once preparation had been completed on the left side, two separate centric occlusion (CO) bite registrations were taken using a super-rigid polyvinyl silane material (Mega Bite, Discus Dental; Culver City, CA), with the patient sitting up in the operatory chair.[15] Her right side was then completely prepared, and CO bite registrations were taken (Mega Bite), with the left side occluding on the first bite registration.

Multiple digital photographs of the preparations were taken, with and without the stump shade guide, along with a horizontal and vertical stick bite registration **(Fig 10)**. Retraction cords (Ultradent; South Jordan, UT) were placed on all teeth, and impressions of both arches were taken (Mega Bite). After evaluating the impressions, the preparations were thoroughly rinsed with ample amounts of water.

The provisional restorations were fabricated immediately using a B1 shade temporary material (Luxatemp, DMG America; Englewood, NJ), which was placed into a prefabricated putty stent (Sil-Tech, Ivoclar Vivadent; Amhert, NY) made from the patient's waxed-up models. The loaded stent was placed on her maxillary arch first and, when set, the stent and temporaries were removed from the teeth. The same process was performed for the mandibular provisional restorations.

All excess material was removed and the margins trimmed. At the time this case was completed, the provisional cementation method involved a 50/50 by volume mixture of adhesive (Optibond Solo Plus, Kerr; Orange, CA) and flowable composite (Tetric flow, Ivoclar Vivadent) placed into each tooth in the provisional, after which the provisionals were placed on the teeth. Excess material was cleaned using a cotton pellet and gentle air flow, and each tooth was light-cured (Sapphire, Dent-Mat; Santa Maria, CA) for three seconds each from the facial, lingual, and occlusal aspects.

The difficulty with this provisional cementation method occurs at the time of removal, when the final restorations are planned for delivery. Although the natural teeth were not etched for provisionalization, some bonding agent and/or flowable composite remained attached to the preparations after removing the temporaries, particularly on the margins where gingival tissue is delicate. Removing such flash irritated the gingival margins and promoted bleed-

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ing. Stopping the bleeding and cleansing off any fluid prior to cementation of the final restorations is very tedious and time-consuming, with a high potential risk for contamination.

Therefore, the author's current provisional cementation method involves setting the liquid provisional material directly to the teeth after placement in the stent and seating in the mouth. This is accomplished by leaving the stent in the mouth approximately one additional minute beyond the recommended setting time to ensure the provisional material is set and sufficiently hard to lock itself in and not dislodge off the preparations. Then, upon stent removal, all excess material is carefully cut off and the margins trimmed and polished to a fine finish.

In this case, once both maxillary and mandibular provisionals were in place using the original method, all preliminary occlusal adjustments were made.[12,19]

The patient was dismissed, rescheduled for two days later, and instructed to notify the office if she needed to be seen sooner. When she returned, the patient underwent additional occlusal adjustments and selected a final shade for the definitive restorations. She was also asked to elaborate on the performance of the provisional restorations, and stated that she was very comfortable and happy with their appearance and did not have any difficulty speaking. Her speech pattern, facial harmony, and smile symmetry were evaluated, and several digital photographs were taken.

Material Selection/Fabrication

Impressions, bite registrations, stick bite registrations, models, a compact disc with the patient's photographs, and a detailed prescription were sent to the laboratory.[16] Based on discussions with the laboratory, the strength of the materials and restorations and esthetics required of the case would be achieved by restoring the molars with lithium disilicate (IPS e.max Press, Ivoclar Vivadent) pressed into a coping and layered with a low-fusing, leucite-reinforced glass-ceramic (IPS Eris, Ivoclar Vivadent), which would provide the necessary translucency and internal effects.[20,21]

Lithium disilicate was suitable for the posterior region because it demonstrates a high monolithic strength (400 MPa) and the edge strength necessary for the molars to resist masticatory forces during function.[20,21] The material strength enables restorations to be finished thinner, without concern for chipping yet allowing a more natural emergence profile.[20,21]

The restorations were evaluated for any errors, none of which were found, and the patient was scheduled for another three-to-four-hour appointment.

For the anterior restorations, an all-ceramic, leucite-reinforced glass ceramic system (IPS Empress Esthetic, Ivoclar Vivadent) was chosen. Initially, EO2 ingots would be used to match the opacity of the patient's dentition. Ultimately, the final desired shade was bleach shade OM3. Showing a low clinical failure rate in the anterior, leucite-reinforced glass ceramic crowns also demonstrate excellent esthetics, with the literature showing long-term stability beyond 11 years.[22,23] With greater strength than conventional feldspathic porcelains and other metal-free alternatives, leucite-reinforced materials provide improved strength and superior optical properties.[22,23]

Three weeks after receiving the case information, the restorations were completed by the laboratory and delivered to the restorative dentist. The restorations were evaluated for any errors, none of which were found, and the patient was scheduled for another three-to-four-hour appointment.

Try in and Final Seating

Anesthetic was administered to both arches, the provisionals removed, and the preparations cleaned with a chlorhexidine antibacterial scrub (Consepsis, Ultradent). The definitive restorations were tried in with water to verify fit.[24] After evaluating the restorations, the patient was asked to view them in a mirror with the lip retractor in place and lightly clenching her teeth to keep them in place. Final cementation began after patient approval.

For this specific case, isolation was achieved with a lip retractor.[25] Although rubber dams are typically considered the "gold standard" for isolation, when teeth are prepared at or slightly subgingival, 360° around, rubber dams are not practical. In this type of procedure, moisture is caused by crevicular fluid seeping from the crevicular sulcus, which rubber dams would not prevent. Additionally, when all teeth, including the most distal, are prepared at or below the gingival margin, clamp placement would damage the gingiva, ultimately promote bleeding, and lead to more contamination of the prepared tooth. Successful isolation of the full-coverage prepared teeth was achieved in this case using an automatic lip retractor with cotton rolls and thin, absorbent, cellulose triangles (Dri-Angle, Dental Health Products; Niagara Falls, NY).[25]

Following isolation, a gentle blast of air from the air syringe and high-volume suction for one second on each tooth removed excess water and moisture. All maxillary preparations were etched with a semi-viscous, 35% phosphoric acid solution (Ultra-Etch,

Figure 11: The postoperative smile displayed the proper incisal line, which followed the lower lip line.

Figure 12: Right lateral smile view of the restored teeth, demonstrating proper length and size.

Figure 13: Left lateral smile view showed the proper amount of gingival tissue display.

Ultradent), one sextant at a time for 15 seconds each.[25] The etchant was then rinsed away with water.

A single-component adhesive (OptiBond Solo Plus) designed for direct and indirect bonding was placed and agitated on all teeth. When bonding was complete, high-volume suction removed excess adhesive. A crucial step in the restorative process, it is necessary to understand how much adhesive must remain on the teeth. If too much remains and is cured, the restoration will not fit over the preparation, especially when using more viscous materials. If excessive amounts of adhesive are removed, bond strength is compromised and the possibility of postoperative sensitivity increases.

To avoid these issues, the preparations were initially coated with the adhesive (OptiBond Solo Plus) and agitated very well on all surfaces for between 10 and 30 seconds. To remove the excess, a high-volume suction tip was held first on the lingual, then the buccal area of each tooth, close to the gingival margin. This was done until no pull of adhesive into the suction tip from the surface of the tooth was visible.[25]

Utilizing a plasma arc light (Sapphire, Dent-Mat), each tooth was light-cured individually for five seconds each on the buccal, lingual, and occlusal surfaces. An additional layer of adhesive was placed on the cured layer on the preparations and left uncured. The inner surfaces of the restorations were then rinsed, cleaned, and conditioned with a two-part silane bond enhancer (Mirage Prolong, Chameleon Dental Products; Kansas City, KS).

The restorations were filled with a clear luting resin (Rely-X, 3M ESPE; St. Paul, MN). Teeth #8 and #9 were filled first and placed on the preparations, which already had one cured and one uncured layer of adhesive placed on their surfaces. Steady, gentle finger pressure was exerted on both restorations to extrude excess uncured adhesive material and luting cement. The center of the facial aspect of the restorations was cured with a 2-mm diameter curing tip for one second to secure them while placing the other restorations.

Restorations for teeth #7 through #2 and #10 through #16, in that sequence, were placed using the aforementioned technique. A regular diameter curing tip was used for one second to cure the buccal and lingual surfaces of the cemented restorations. This allowed excess cement to polymerize sufficiently for gentle removal.

After gross cleanup, each tooth was light-cured for an additional five seconds from all three buccal, lingual and occlusal/incisal directions. The same procedure was performed on the mandibular teeth. The incisors were cemented first, followed by teeth #28 through #31, and then #21 through #18, in that order.[13,26]

Care was taken to ensure that all restorations and interproximal areas were cleaned of residual cement and adhesive materials. Since the patient's entire mouth was anesthetized, her occlusion and bite were checked and adjusted grossly at this appointment.

Finishing and Polishing

The patient was scheduled for a post-delivery appointment two days later, during which the occlusion was evaluated and the patient's bite adjusted. The adjusted surfaces were polished with a diamond ceramic polisher (CeramiPro Dialite, Brasseler USA; Savannah, GA).[4]

Upper and lower alginate impressions, with a bite registration, were taken to fabricate an occlusal guard for nighttime wear to protect her ceramic restorations. The patient was scheduled for a recall after three weeks for delivery and adjustment of the occlusal guard and final clinical photographs **(Figs 11-17)**.

Conclusion

Although the patient always had a big smile prior to treatment, regardless of the tooth defects, the new restorations made her less self-conscious and improved her overall quality of life. She was overwhelmingly happy with the appearance and function of the new restorations and was very grateful for all of the help and care she received. Photographs were printed and given to her, which she sent to her mother, who still lives in Africa.

When the proper materials and techniques are utilized and all necessary information is communicated to the laboratory and patient, even difficult-to-treat cases of enamel hypoplasia can be restored to a natural appearance.[5] By placing proper restorations and utilizing a comprehensive and multidisciplinary treatment plan, the dental team in this case provided the best in function, esthetics, and quality of care while meeting the patient's expectations.[3]

Acknowledgments

The author thanks Dr. Stuart Feldman (West Palm Beach, FL) for his expertise and generosity in donating his services for this case; and Ms. Hakjoo Savercool (Frontier Dental Laboratory; El Dorado Hills, CA) for her artistic skills and beautiful ceramic work. He also thanks his family, instructors, mentors, and all the individuals throughout his life who have made a difference and given him opportunities, which have helped him to be in a position to now make a difference in others' lives.

References

1. Bailleul-Forestier I, Berdal A, Vinckier F, de Ravel T, Fryns JP, Verloes A. The genetic basis of inherited anomalies of the teeth. part 2: syndromes with significant dental involvement. Eur J Med Genet. 2008;51(5):383-408. Epub 2008 May 23.

2. Soni NN, Henry JL, Silberkweit M. Polarized light study of enamel and dentin dysplasia. J Dent Res. 1968;47(3):450-6.

3. Canger EM, Celenk P, Yenisey M, Odyakmaz SZ. Amelogenesis imperfecta, hypoplastic type associated with some dental abnormalities: a case report. Braz Dent J. 2010;21(2):170-4.

Figure 14: Postoperative retracted front view of the full-mouth restorations.

Figure 15: Maxillary occlusal view of the restorations; all teeth except the anterior incisors have full-coverage restorations.

Figure 16: Postoperative mandibular occlusal view, showing how tooth #28 was converted to a canine to create a better occlusal scheme and improved esthetics.

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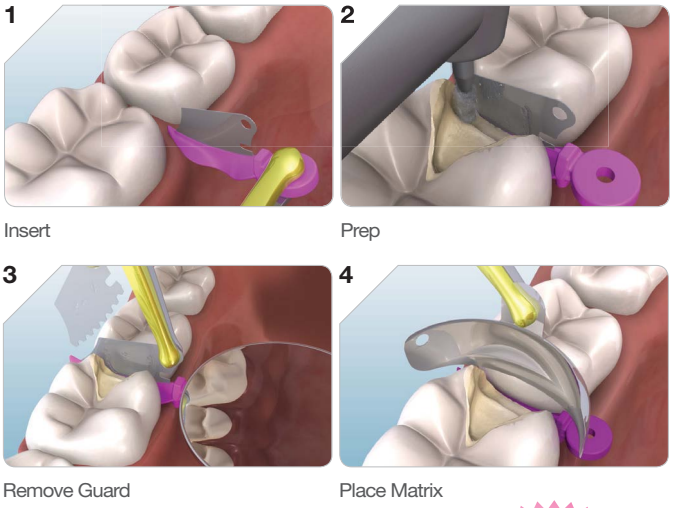

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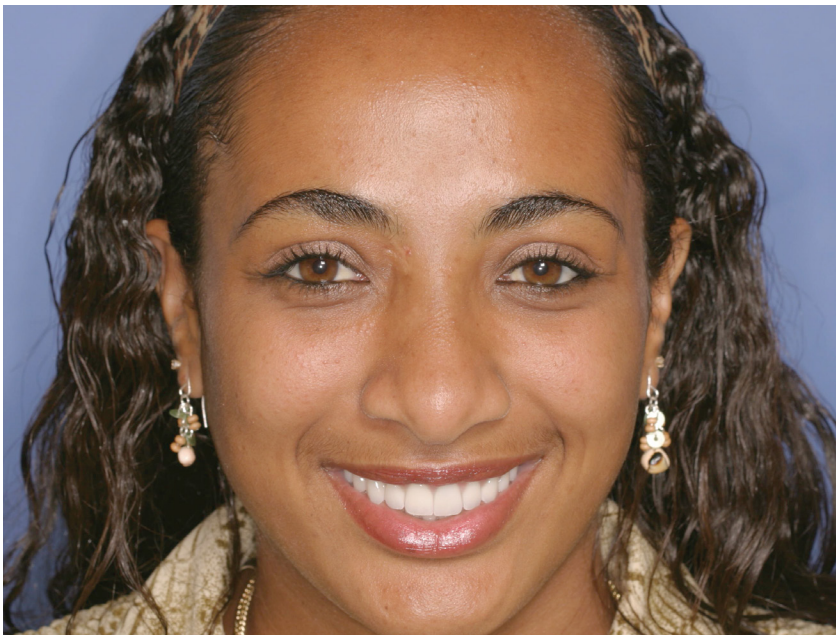

Figure 17: Postoperative full-face image demonstrating how the smile makeover is in harmony with the rest of the patient's facial features.

4. Zanganah Y. Importance of radiographs. Br Dent J. 2009;207(3):96.

5. Kahng LS. Patient-dentist-technician communication within the dental team: using a colored treatment plan wax-up. J Esthet Restor Dent. 2006;18(4):185-93.

6. Powell T. Excellence and predictability: not an accident. Dent Today. 2009;28(9):122-4.

7. Cabot LB. Using articulators to enhance clinical performance. Br Dent J. 1998;184(6):272-6.

8. Shannon JL, Rogers WA. Communicating patients' esthetic needs to the dental laboratory. J Prosthet Dent. 1991;65(4):526-8.

9. Carlson GL. Insights into occlusal problems through the use of centric relation procedures. Northwest Dent. 2007;86(1):12-3, 15, 17 passim.

10. Miyasaki M. Photography ensures better lab communications, better restorations. Dent Today. 2001;20(11):96-9.

11. Strassler HE. Perio charting systems. RDH. 1992;12(1):23-6.

12. Dawson PE. Evaluation, diagnosis, and treatment of occlusal problems. St. Louis (MO): Mosby; 1989. p. 47-52.

13. Garber DA, Salama MA. The aesthetic smile: diagnosis and treatment. Periodontal 2000. 1996;11:18-28.

14. Spears F. Too much tooth, not enough tooth: making decisions about anterior tooth position. J Am Dent Assoc. 2010;141(1):93-6.

15. Dudney TE. Using diagnostic wax-ups and preparation guides to facilitate accurate and esthetic diastema closure and functional bite ulteration. Inside Dent. 2008;4(7):54-7.

16. Killian, S. General cosmetic dentistry photographs for communicating and consulting with your technician. Dent Today. 2006;25(6):86, 88-9.

17. Magne P, Magne M. Use of additive wax-up and direct intraoral mock-up for enamel preservation with porcelain laminate veneers. Eur J Esthet Dent. 2005;1(1):10-9.

18. Pescator C. The importance of preparation design in adhesive dentistry. Aurum Ceramic News. 2000;13(3):1-4.

19. Nixon RL. Provisionalization for ceramic laminate veneer restorations: a clinical update. Pract Perio Aesthet Dent. 1997;9(1):17-27, quiz 28.

20. McLaren EA, Phong TC. Ceramics in dentistry: classes of materials. Inside Dent. 2009;5(9):94-103.

21. Tysowsky GW. The science behind lithium disilicate: a metal-free alternative. Dent Today. 2009;28(3): 112-13.

22. Chun YH, Raffelt C, Pfeiffer H, Bizhang M, Saul G, Blunck U, Roulet JF. Restoring strength of incisors with veneers and full ceramic crowns. J Adhes Dent. 2010;12(1):45-54.

23. Fradeani M, Redemagni M. An 11-year clinical evaluation of leucite-reinforced glass-ceramic crowns: a retrospective study. Quintessence Int. 2002;33(7):503-10.

24. Spears, F. Porcelain veneer cementation. Advanced esthetics and interdisciplinary dentistry—educational series. Brasseler, USA. Savannah, GA.

25. Schmidseder J. Color atlas of dental medicine: aesthetic dentistry. New York: Thieme; 2000.

26. Magne P, Belser U. Bonded porcelain restorations in the anterior dentition: a biomimetic approach. Hanover Park (IL): Quintessence Pub.; 2002. **jCD**

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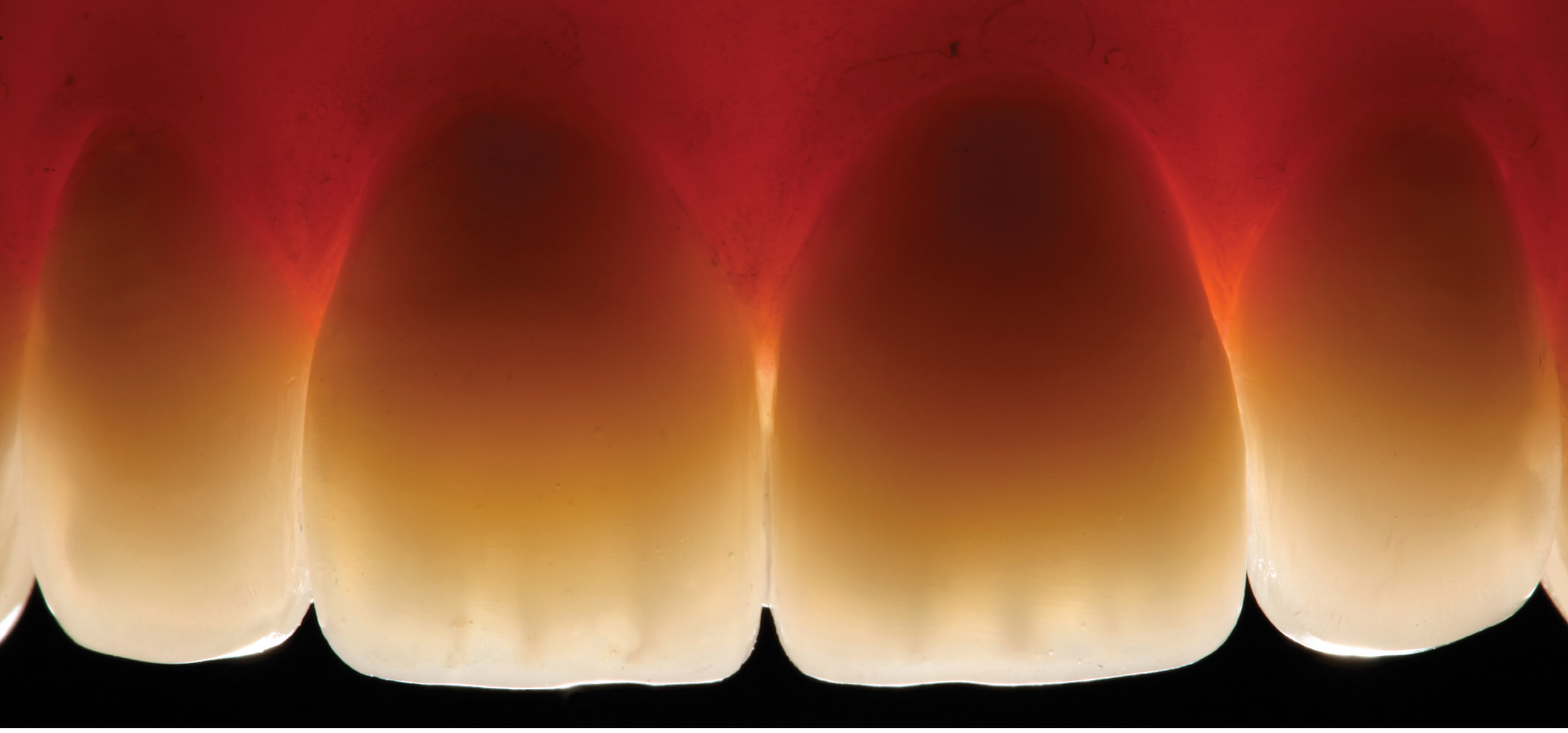


Step-by-Step Approaches for Anterior Direct Restorative Challenges

Mastering Composite Artistry to Create Anterior Masterpieces—Part 2

Newton Fahl, Jr., DDS

Abstract

This article, the second in a two-part series, continues the discussion of a conservative, effective, and artistic philosophy for performing esthetic direct anterior composite restorations based on the principles of emulating the proper form, color, and function of natural dentition. This particular article outlines step-by-step procedural approaches to solving day-to-day anterior direct restorative challenges, including tooth preparation, artistic application, and how to create seamless transitions from tooth substance to the synthetic composite restoratives using correct finishing and polishing techniques.

Clinical Direct Composite Placement Techniques

Two individual denture teeth mounted on an acrylic base were prepared and restored using the achromatic and chromatic enamel approaches. The objective is to educate the reader on how to properly select and apply diverse restorative systems based on ideal optical and physical properties to produce similar color results.[1-3]

As Part 1 of this article explained, the achromatic approach entails the use of non-VITA based enamel composites to modulate the chroma and value of the underlying artificial dentin, which provides the basic hue and facilitates the achievement of the final intended shade.[4-7] Comparatively, the chromatic approach utilizes VITA-based (Vident; Brea, CA) enamel composite to provide the final desired hue and chroma, while allowing the use of effect achromatic enamels for minor color characterizations.[4-6] Both techniques can be used predictably to promote lifelike restorations and elicit similar esthetic results (see sidebar, page 44).

Figure 1: Color mock-ups were created for each tooth according to the achromatic and chromatic enamel techniques to verify the accuracy of the layering techniques.

As Part 1 of this article explained, the achromatic approach entails the use of non-VITA based enamel composites to modulate the chroma and value of the underlying artificial dentin.

Mock-Up

A mock-up was first created for tooth #9, which underwent the chromatic approach, and tooth #8, which was restored with the achromatic technique **(Fig 1)**. For #8, Vit-l-escence composite (Ultradent Products; South Jordan, UT) was representative of the achromatic approach and, when both restorations were compared, the shades matched closely in hue, chroma, and value. When fabricating the mock-up, it was necessary to apply the composite up to the incisal edge to create the internal translucent and mamelon effects on the facial. This allowed for appraising the correct shade selection and increment placement thickness for both central incisors.[8]

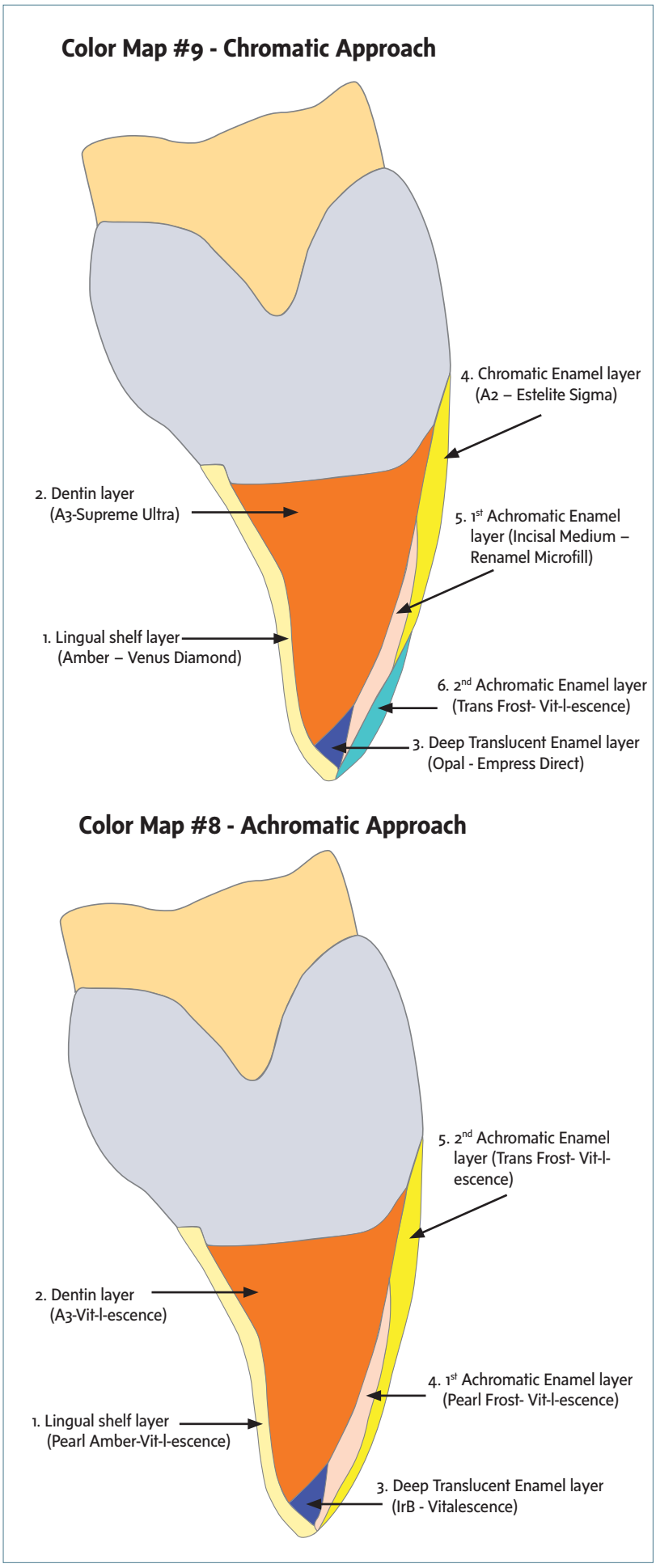
Silicone Matrix

Once the matrix was created, it was trimmed to correctly position the facial-incisal line angle and demonstrate what the final, completed restoration would look like from an incisal edge position standpoint. By trimming the matrix, a nice contour also was created, providing the facial-incisal line angle for the tooth.

Tooth Preparation

A long and thick bevel was placed on the facial aspect, while the lingual chamfer was placed on the lingual with M862-009 and M50-014 burs, respectively (Axis Logic Sets by Newton Fahl, Axis Dental; Coppell, TX). The final matrix was then complete and ready to be used for the restorative procedure **(Fig 2)**.

Figure 2: A properly trimmed silicone matrix made on a waxed-up model is key for establishing a three-dimensional blueprint for layering composite increments.



Protocol

Following tooth preparation, a single-component bonding agent (PQ1, Ultradent) was applied to the tooth surfaces. Excess material was suctioned off the preparation area, and the bonding agent was cured with an LED curing light (VALO, Ultradent) for 10 seconds.

Incremental Buildup

To begin building up the composite materials, it was first necessary to understand how far to apply the material. Using an explorer, the matrix was scratched along the lingual chamfer finish line until a white line could be seen. This provided the boundaries for the initial increment and prevented over-buildup of the composite.

Achromatic Enamel Approach—#8—Lingual Shelf Application

A pearl-amber shade of enamel composite (Vit-l-escence PA) was placed on #8 to begin the achromatic technique. The material was removed from the syringe and rolled into the shape of a ball. To achieve proper consistency, the material was patted and then worked as thinly as possible on the matrix. The matrix was then positioned onto the tooth, and the composite was tucked into the chamfered area with a contouring instrument.

A very low-viscosity, 45% filled wetting resin (Ultradent), was used to lubricate contouring instruments and artist brushes during the procedure. It is important to limit the use of this resin, however, as overuse diminishes the physical properties of the composites. With all instruments slightly lubricated, the composite material was pushed toward the incisal area, while making the material thinner or thicker as necessary to achieve the proper effects and esthetics **(Fig 3)**. A flexible contouring instrument (IPC-L, Cosmedent; Chicago, IL) was used to slice off the excess material.

To gauge the thickness of the composite, the matrix was observed. Specifically, thickness was controlled based on the color seen underneath the matrix. When the proper thickness was reached, brushes (#1 and #3, Cosmedent) were used to smooth the composite. While brushing, it was important to keep the matrix securely in position, without pressing too much or allowing the matrix to loosen. This was done so the facio-incisal line angle could be reestablished later on. Once smoothed, the composite was cured for five seconds.

After curing, the matrix was removed to reveal an enamel composite lingual shelf. Demonstrating a thickness of 0.37 mm, the ideal average thinness for this initial layer, desirable optical effects that mimicked those of natural enamel were produced. To clean excess material from the surrounding areas, a #12 surgical blade was used (Bard-Parker, Aspen Surgical; Caledonia, MI).

Figure 3: The lingual shelf must be an achromatic enamel no thicker than 0.3 mm.

Figure 4: Once cured, the lingual shelves of both centrals denote amber-whitish nuances that replicate the opalescence present in natural enamel.

Figure 5: A fine-tipped dental instrument was used to gently create the dentin mamelons.

Chromatic Enamel Approach—#9—Lingual Shelf Application

A milky-white, semi-translucent nano-hybrid universal composite (shade AM, Venus Diamond, Heraeus; South Bend, IN) was applied thinly to the matrix. The material was pressed and sculpted to shape, then tucked in. This composite was chosen based on its excellent handling characteristics and optical effects. Although it tends to be stiffer, it does not crack or tear and, when pressed, allows the operator to shape it as needed.

Using the IPC-L, the material was trimmed and cut back while being pushed toward the incisal. Like the other central incisor, it also was necessary to keep thinning the material at this point in the procedure. The incisal embrasure then was cleaned with the IPC-L where the contact areas were to be placed, followed by brushing of the chamfer area. The composite was then quickly "zapped" with the curing light to complete the lingual shelf. At this point in the procedure, the contacts are left slightly open, but the teeth should both demonstrate the same thickness and optical properties **(Fig 4)**.

Achromatic Enamel Approach—#8—Artificial Dentin Application

Shade A3 dentin (Vit-l-escence) was used to begin building the dentin on #8. This particular composite required two increments to build the mamelon effects, with one layer placed initially to create a primary contour and another layer to complete the contour. Once cured, dentin placement was complete.

To establish the contours, it was crucial to carry over the bevel until the transition line was eliminated. The incisal portion of the dentin increment was pulled toward the bevel to create as much clearance as possible between the dentin and halo so that the mamelons could be refined and room was allowed for placement of translucent enamel shades later on. The dentin composite was burnished over the bevel until it disappeared, after which it was blended in. At this point, no ledge should be visible, and the dentin should be convex, not concave, following the natural histological boundaries of the dento-enamel junction.

A fine-tipped Hollenback #6 was used to gently create the mamelons of the dentin, followed by curing of the composite layer **(Fig 5)**. At this time, the layer should curve toward the incisal, leaving room for translucent enamels over the incisal third. It was necessary to determine the irregular pattern of the mamelons, which are uneven finger-like projections, and create subdivisions to replicate natural dentition. If the mamelons needed refining, minute increments of resin would have been rolled into shape and placed where needed. The string-like pro-

To begin building up the composite materials, it was first necessary to understand how far to apply the material.

Figure 6: If correctly selected and applied, artificial dentins of different brands should provide nature-mimicking color and opacity.

Figure 7: Translucent effect enamels were used on both teeth to create natural opalescence and deep translucency around and in between the mamelons.

jections of the mamelons were brought toward the halo area to complete mamelon creation.

To gauge the room required for the enamel, the contour was checked on the previously made wax-up. This enabled a preview of the contours of the cervical-third, middle-third, and incisal-third and also allowed visualization of the space required for the enamel composite resin.

Chromatic Enamel Approach—#9—Artificial Dentin Application

A nano-filled dentin composite (Filtek Supreme Ultra, 3M ESPE; St. Paul, MN) with higher stiffness and opacity was used for #9. Because of the selected composite's handling, only one increment was necessary with this type of material, but it was important to carefully apply the correct volume in order to prevent too high of a value in the finished restoration. With the geometric contour already in place, the mamelons were created, as well as any elongations deemed necessary.

The tips of the mamelons then were created to match the form of the mamelons of #8, which is paramount to create perfect esthetics. During this stage of the procedure, the increments should be placed in a way that allows the dentist to compare the contour and thickness of each layer. In a typical clinical setting, this can be ensured by restoring both teeth sequentially. Also, it was crucial that no facture line was visible when the opaque dentin composite application was complete **(Fig 6)**.

Achromatic Enamel Approach—#8—Translucent Enamel Application

Iridescent blue translucent material (Vit-l-escence) was used on #8 to create natural opalescence and deep translucency around and in between the mamelons at the same time as #9 to control material volume and contour **(Fig 7)**. The material was rolled into a rope-like form and pressed to impart the deep translucent effect required for the restoration. Because it is slightly tackier than other composites, a trick for using the translucent material is to cut it then gently lubricate all instruments and brushes with a wetting agent to prevent sticking. This layer was brought to the facio-incisal line angle, and excess material was removed to prevent an over-translucent effect along the incisal edge. A brush was then used on the applied materials, which was followed by light-curing.

Chromatic Enamel Approach—Tooth #9—Translucent Enamel Application

A nano-hybrid translucent Opal composite (IPS Empress Direct, Ivoclar Vivadent; Amherst, NY) was chosen for #9 to give the restoration a natural opalescence and deep translucency in between and around the dentin mamelons at the same time as #8 to control material volume and contour. The material was rolled, cut, and pressed to fill the voids between the mamelons. Once the translucent composite had been applied and brushed, it was light-cured.

Chromatic Enamel Approach—#9—Body Enamel Application

Because the purpose of this article is to demonstrate how to achieve the same hue, chroma, and value using chromatic and achromatic enamels, a VITA-based enamel had to be applied first on #9 to establish a three-dimensional color baseline, after which #8 would be modeled using a non-VITA-based enamel. Application of body enamel began on the left central as the final hue, chroma, and value for the cervical middle-thirds were created. As described, this body enamel produced the final desired shade of the restoration in a single layer of Vita-based enamel composite. This technique is employed when the final hue and chroma of the restoration need to be achieved without the need for modulating the color of the underlying dentin core.

Figure 8: A Vita-based chromatic enamel was applied beyond the bevel line and contoured to create a seamless transition between the tooth structure and composite.

Demonstrating a thickness of 0.37 mm, the ideal average thinness for this initial layer, desirable optical effects that mimicked those of natural enamel were produced.

A nano-filled composite with spherical submicron fillers (Estelite Sigma, Tokuyama America; Encinitas, CA) was chosen as the chromatic enamel for the restoration, as the spherical particles promote good handling characteristics and achieve an excellent polish. Additionally, the composite forms a lifelike blend with the tooth color underneath.

Using a contour specifically required in the final restoration, the material was first tacked down beyond the bevel line **(Fig 8)**. This layer was then faded-out toward the incisal third and cut back along the incisal and proximal areas to allow room for value effect enamels and to the extent that the mamelons were visible **(Fig 9)**.

The enamel material then was brushed and cured to create a nicely blended restoration.

Figure 9: The chromatic enamel was faded-out toward the incisal third and cut back along the incisal and proximal areas to allow room for value effect enamels.

Establishing Final Contours—Lobe Morphology

At this stage of the restoration, the layering of increments was sketched to first work the contour and shades of the proximal lobes of #8 and #9, respectively. Then the cen-

ter lobes of both were restored in the same order. This technique will demonstrate the sequential application of distinct composite materials of similar optical properties.

Achromatic Enamel Approach—#8—Value Enamel Application, Proximal Lobes

Because A3 dentin was used under the enamel material, Pearl Frost and Trans Frost achromatic enamels (Vit-l-escence) were applied to the proximal and center lobes, respectively, to bring the A3 shade to the required A2, by virtue of the interplay between the thickness and opacity of the two shades. The Pearl Frost was placed over the lobes, since it demonstrates a higher opacity and color value **(Fig 10)**. At a later stage, and to finalize the achromatic enamels application that would modulate the inner dentin shade to bring the final shade to a VITA A2, the center lobe would be finished with Trans Frost to create a slightly lower value and allow the inner dentin core to show through more markedly. On the mesial and distal lobes, the Pearl Frost achromatic enamels were tacked down and brought toward the incisal area, with a thicker layer initially, since the material would be cut back after placement. The light reflecting and deflecting areas also were developed at this time to impart natural-appearing light qualities to the restoration. After placement was complete, the achromatic enamels were brushed and cured **(Fig 11)**.

Chromatic Enamel Approach—#9—Value Enamel Application, Proximal Lobes

As the hue and chroma were established with a VITA-based body enamel (i.e., Estelite Sigma A2), with a most accurate color match to the natural tooth structure, value enamels were selected only to impart greater depth and minor achromaticity in specific areas of #9. To render the proximal lobes in the same optical characteristics as those of #8, a microfill Incisal Medium shade (Renamel Microfill, Ultradent) was placed on #9 **(Fig 12)**. This demonstrates how two materials of distinct particle size (i.e., Vit-l-escence Pearl and Renamel Microfill Incisal Medium), the former a hybrid and the latter a microfill, could produce similar esthetic outcomes when used as achromatic enamels. Once tacked into place, it was necessary to smear and pat the material to build and contour the lobes of the restoration, after which brushes were used to refine and smooth the contour of the increment, followed by light-curing.

Achromatic and Chromatic Enamel Approaches—#8 and #9—Value Enamel Application, Center Lobes

To demonstrate the interplay of a microfill of denser and submicron particle size, and a hybrid of larger average particle size and distinct light behavior than the former, Vit-l-escence Trans Frost was chosen for the middle lobes

Figure 10: An achromatic enamel was placed over the lobes to promote higher opacity and color value.

Figure 11: After refinement and curing, the higher value achromatic enamel blended in, replicating optical properties of natural enamel lobes.

Figure 12: To render the proximal lobes, a microfill shade of the same optical characteristics as those of the hybrid composite used on #8 was placed on #9.

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Figures 13 & 14: A non-VITA, more translucent achromatic hybrid composite enamel was chosen for the middle lobes of both central incisors to allow more dentin show-through.

Figure 15: After application and light-curing of chromatic and achromatic enamels, both centrals depict similar optical characteristics.

Figure 16: To establish natural facial planes, the transitional line angles were evaluated and the facial planes worked with finishing discs to establish the primary anatomy.

of both central incisors **(Figs 13 & 14)**. Trans Frost also was placed on the proximal lobes, between the vertical transitional line angles and the contact area with the adjacent teeth, where the value is usually slightly lower than the crest of the proximal lobes **(Fig 15)**.

This last step determined center lobes of identical optical characteristics for both centrals, since Trans Frost was used on both; whereas the proximal lobes of both centrals, although similar in optical characteristics, were restored with different materials. At this point, the proximal lobes were covered, but were no cause for concern. During finishing, this layer would be removed to reach ideal volume and contour, and the main concern would be creating primary anatomy. When completing the final shape, the underlying Estelite Sigma and proximal Renamel Microfill were reached. To complete this stage, the embrasure forms also were sculpted, and the restoration was brought to an even and smooth contour with brushes, followed by curing. The restorations on both teeth were then ready for finishing and polishing.

Emergence Profile and Facio-Incisal Line Angles—#8 and #9

To achieve the proper incisal edge position, a finishing disc (Sof-Lex, 3M ESPE) was run back and forth to remove any flashes. The matrix was placed back on the model, aligned, and made flush with the facial-incisal line angles of both central incisors.

To establish the contours, it was crucial to carry over the bevel until the transition line was eliminated.

Figure 17: The transitional line angles were worked and the embrasures opened until symmetry was achieved.

To establish natural facial planes of #8 and #9, the transitional line angles were evaluated and the facial planes worked with the finishing disc from cervical to incisal in a single, continuous movement **(Fig 16)**.

Vertical Transitional Line Angles—#8 and #9

Once the required emergence profile was achieved, the transitional line angles were worked. Lines were drawn with a pencil to determine their ideal position, starting at the point angles and going upward according to a natural ascending path. With a red disc (Sof-Lex) at a very low speed, and viewing the restorations from different perspectives, the embrasures were opened until symmetry was achieved **(Fig 17)**. Any sharp transitions between aspects were softened with the disc at low speed. Straight line angles were and should be visible, even though the restorations are round.

The incisal embrasure was worked with the same disc at a very low speed. Immediately after, the incisal embrasures were worked to suit the desired shape based on the roundness or squareness of the restorations, which created symmetry.

To redefine the lobes, the diamond bur was used to create delta-like developmental grooves that narrowed toward the cervical area.

Figure 18: Anatomy mapping was penciled in on the centrals to aid in attaining proper tooth morphology during finishing.

Secondary Anatomy—#8 and #9

To finish the secondary anatomy, the line angles first were penciled in, and a long axis was drawn dividing the teeth into thirds, with anatomy mapping on the centrals **(Fig 18)**. Finishing began with a long flame-shaped, fine diamond bur (F888-012, Axis Dental) in a swinging motion on the center lobe to reduce volume and emphasize the proximal lobes **(Fig 19)**. To redefine the lobes, the diamond bur was used to create delta-like developmental grooves that narrowed toward the cervical area. A soft silicone carbide brush (Jiffy Brush, Ultradent) was used intermittently to buff the restorations in circular movements. This allowed for assessment of the surface texture achieved up to that point.

Tertiary Anatomy—#8 and #9

After using the silicone carbide brush, it was discovered that some tertiary anatomy still needed to be completed. With the diamond bur at the slowest possible speed, the surface was blended with a back-and-forth horizontal motion **(Fig 20)**. The silicone carbide brush was used again to brush and buff the surface and verify the level of micro texture achieved. The point angles were rounded off with polishing discs (Sof-Lex Orange and Yellow).

A comprehensive esthetic composite system must provide artificial dentin shades, and chromatic and achromatic enamels, in addition to bleach shades.

Figure 19: Secondary anatomy was achieved with a flame-shaped, fine diamond bur to reduce volume and emphasize the proximal lobes.

Figure 20: Tertiary anatomy was completed with a diamond bur at slow speed to create arch-like horizontal lines.

Finishing and Polishing—#8 and #9

Symmetry was checked, and a worn blunt finishing rubber cup (FlexiCup, Cosmedent), was used to buff the lobe areas, thereby diminishing undesired texture over selected areas where the otherwise natural enamel would present a smoother appearance **(Fig 21)**. The lingual area was finished and polished with fine diamonds and rubber rotaries. Although the two materials used in this restoration demonstrated different handling and placement techniques in many instances, the finishing and polishing techniques are the same for both.

Specialized chamois and cotton wheels (Brasseler USA; Savannah, GA) were used to initiate the polishing **(Fig 22)**. Final gloss was achieved with a flexible felt disc (FlexiBuff, Cosmedent), along with an aluminum oxide polishing paste (Enamelize, Cosmedent), used initially at high pressure and a low speed and decreasing the pressure while increasing the speed as the paste was splattered off the surface **(Fig 23)**. The end result was restorations that mimicked and would be indistinguishable from natural dentition **(Figs 24 & 25)**.

Discussion

The restorative sequence described above presented the implementation of concepts discussed in Part 1 of this article,[9] namely the use of VITA (chromatic) and non-VITA (achromatic) enamels to achieve the same color results for two large composite buildups. It also demonstrated the selection of different brands of similar optical and physical properties for each individual shade used in the buildups. As there are more restorative composite systems available on the market than one could possibly attempt to know or master individually, it becomes imperative that the dentist who wants to be proficient at producing nature-mimicking composite restorations understands the interplay of the four-dimensional color system with the natural dental tissues.

A comprehensive esthetic composite system must provide artificial dentin shades, and chromatic and achromatic enamels, in addition to bleach shades. Although there are several excellent composite brands that can singlehandedly produce superior esthetic results, there is a growing number of restorative dentists who like to mix two or more systems, utilizing certain shades based on specific characteristics and properties that they favor for a particular layer of the restoration. The main advantage of this approach is that a customized kit can be composed

to suit one's preferences, which, in turn, results in the mastery of such assembly of brands and shades. Once the operator becomes fully familiar with the properties of each shade, such as handling, polishability, translucency/opacity, opalescence, etc., the likelihood of achieving predictable and consistent esthetic results is enhanced exponentially.

This step-by-step procedural article demonstrates that similar and satisfactory esthetic outcomes can result from using distinct composite resin materials according to a systematic protocol based on knowledge of materials currently available and their physical and optical properties.

Conclusion

With advances in material sciences, dentists can now more artistically and predictably mimic natural dentition and create restorations that are not only fully functioning, but are also beautiful.[10] To perfectly emulate a patient's dentition, dentists must correlate form and color seamlessly, while preventing any loss of function.[2] With new composite systems that are equal or better than most porcelain systems, great optical properties and esthetics can be achieved.[11] However, it is ultimately up to the dentist, as an artist, operator, and scientist, to understand the principles of working with composite systems and how to correlate them with natural tooth structures.[2]

References

1. Villarroel M, Fahl N Jr., Sousa AM, Oliveira OB Jr. Direct aesthetic restorations based on translucency and opacity of composite resins. J Esthet Rest Dent. Forthcoming 2011.

2. Heymann HO. The artistry of conservative esthetic dentistry. J Am Dent Assoc. 1987 Dec;(Spec. No.):14E-23E.

3. Carlson RS. Dental artistry. Gen Dent. 2003;54(4):326-30.

4. Fahl N Jr. A polychromatic composite layering approach for solving a complex Class IV/direct veneer-diastema combination: part I. Pract Proced Aesthet Dent. 2006;18(10):641-5.

5. Fahl N Jr. A polychromatic composite layering approach for solving a complex Class IV/direct veneer-diastema combination: part II. Pract Proced Aesthet Dent. 2007;19(1):17-22.

6. Fahl N Jr. Achieving ultimate anterior esthetics with a new microhybrid composite. Compend Contin Educ Dent Suppl. 2000;(26):4-13; quiz 26.

Figure 21: Worn blunt rubber rotaries were used to eliminate undesired texture and to impart a smoother appearance.

Figure 22: Specialized chamois and cotton wheels were used in the polishing steps to produce an enamel-like gloss.

Figure 23: Felt disc and aluminum oxide paste finalized the polishing, bringing the restorations to a smooth and glossy surface.

It is ultimately up to the dentist, as an artist, operator, and scientist, to understand the principles of working with composite systems and how to correlate them with natural tooth structures.

Figure 24: The finished restorations presented identical color and optical characteristics and were indistinguishable from the surrounding dentition.

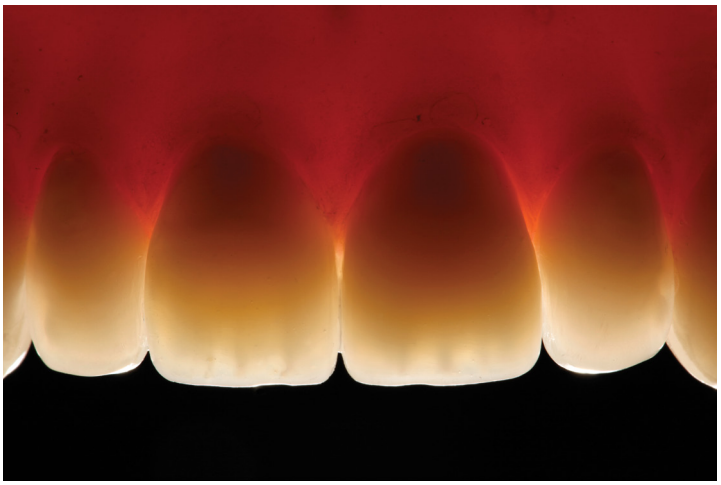

Figure 25: The optical properties of the dentin and enamel composites selected for the buildups replicate the lifelike qualities of natural tooth structures.

7. Fahl N Jr. Optimizing the esthetics of Class IV restorations with composite resins. J Can Dent Assoc. 1997;63(2):108-11, 114-5.

8. Felippe LA, Monteiro S Jr., De Andrada CA, Ritter AV. Clinical strategies for success in proximoincisal composite restorations. part ii: composite application technique. J Esthet Restor Dent. 2005;17(1):11-21.

9. Fahl N Jr. Mastering composite artistry to create anterior masterpieces—part 1. J Cosmetic Dent. 2010;26(3):56-68

10. Nathanson D. Current developments in esthetic dentistry. Curr Opin Dent. 1991;1(2):206-11.

11. Terry DA, Leinfelder KF. An integration of composite resin with natural tooth structure: the Class IV restoration. Pract Proced Aesthet Dent. 2004;16(3):235-42; quiz 244. **jCD**

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20 Tips on CAMBRA

Effectively Treating Dental Caries

V. Kim Kutsch, DMD

Figure 1: Any elective cosmetic dental procedure can be performed with confidence for a patient with a healthy smile.

Originally considered a disease of the two primary pathogens *Mutans streptococci* and *Lactobacillus*, recent biofilm science has expanded this disease model to include numerous pathogens in a biofilm community.

Dental Caries

Dental caries is a bacterial biofilm mediated disease with known disease indicators and risk factors. It is a disease that results from prolonged episodes of low pH in dental biofilm that selects for cariogenic pathogens and favors demineralization. The end result is net mineral loss and cavitation of the teeth. Originally considered a disease of the two primary pathogens *Mutans streptococci* and *Lactobacillus*, recent biofilm science has expanded this disease model to include numerous pathogens in a biofilm community.[1-3] Dental caries is a complex interaction of bacterial, dietary, behavioral, environmental, socio-economic, and physiological factors. It is a biofilm disease that includes numerous bacteria. The point for practitioners is instead of focusing or targeting one or two bacterial species in their therapy, they should look at treating the biofilm dysfunction, which is driven by prolonged periods of low pH.

Treatment

To effectively treat dental caries, the teeth must be restored to function and the dental biofilm behavior needs to be corrected to health. Dentists have traditionally spent the majority of their clinical time actively treating and restoring the serious damage caused by dental caries. Cosmetic dentists have added the focus of making these repairs with tooth-colored materials. They provide services that range from complete restoration of the caries-ravaged smile to elective cosmetic services for the healthy smile **(Fig 1)**. For the patient with active dental caries, the greater the extent of the disease and restorative need, the greater the risk of restoration failure due to recurring decay. The cosmetic dentist can provide excellent esthetic care with predictable treatment outcomes by addressing and correcting the caries biofilm disease, in addition to adhering to a careful esthetic restorative plan.

1 Caries management by risk assessment (CAMBRA) is a standard of care that includes early risk assessment and diagnosis of the caries disease process and then treatment with minimally invasive procedures.

2 The best approach to CAMBRA is to create a system within your practice to identify and treat patients at risk for dental caries.

3 Involve and educate your dental team about caries risk assessment and have them help develop the system, from appointment scheduling to fees.

4 The most successful CAMBRA system is simple for the team to implement. CAMBRA starts with risk assessment followed by diagnosis and then development of treatment strategies.

5 Start with a standardized caries risk assessment form that is used for all patients in the practice. Several standardized caries risk assessment (CRA) forms are available **(Fig 2)**. The CRA form has been clinically validated by Dr. John Featherstone at the University of California, San Francisco.[4] Use a simple form that provides the information you need to make an accurate assessment.

6 While it is easy to identify the patient with obvious caries lesions **(Fig 3)**, the real intent of the CRA form is not to identify these patients, but rather to discover why they have cavities. What risk factors are contributing to their disease state, and what factors can be modified?

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Adults/Children Age 6 and Over

Patient Name: _____ Date: _____

Instructions: Check all answers that apply.

If **1 or more Disease Indicators** *or* **2 or more Risk Factors** are circled, then this patient is at risk and therapeutic intervention is recommended.

1 ASSESS

DISEASE INDICATORS	AT RISK	LOW RISK
Visible Cavitations	yes	no
Radiographic Lesions	yes	no
White Spot Lesions	yes	no
Cavity in Last 3 Years	yes	no
RISK FACTORS		
Visible Plaque	yes	no
Inadequate Saliva Flow	yes	no
Hyposalivary Medications	yes	no
Acidic Beverages	yes	no
Frequent Snacking (1-3 times daily)	yes	no
Appliances Present	yes	no
Deep Pits and Fissures	yes	no
Other	yes	no
TESTING		
CariScreen	9,999 – 1,501	1,500 – 0

2 DIAGNOSE

Risk Assessment	AT RISK	LOW RISK

3 PRESCRIBE

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I understand my risk for caries based on this assessment, as well as the benefits of the recommendations for therapeutic intervention.

Release Signature: _____

* Based on clinically proven Caries Risk Assessment Form in the Featherstone 2003-2005 study.
* Caries risk criteria as defined by the American Dental Association Council on Scientific Affairs, JADA August 2006.

Figure 2: CariFree caries risk assessment form.
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For the patient with active dental caries, the greater the extent of the disease and restorative need, the greater the risk of restoration failure due to recurring decay.

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7 Once the risk factors have been identified, counseling should be directed to the behaviors that can be modified and provide therapeutic strategies to overcome the risk factors that cannot be modified by behavioral counseling. Consider creating a balance between risk factors and protective factors that re-establishes a healthy biofilm and a healthy mouth.

8 Use a biometric to screen for at-risk patients, measure progress, and provide an end-point to therapy. Adenosine triphosphate bioluminescence is a rapid, simple, accurate chair-side biometric test that involves just a swab and a meter.

9 Direct your treatment strategies at the biofilm dysfunction. By correcting the biofilm you re-establish a healthy balance of the remineralization and demineralization, resulting in healthy maintenance of tooth mineral.

10 The best immediate anti-caries therapy is the use of fluoride varnish.[5] At-risk patients should receive an immediate fluoride varnish and then on a regular basis every three months until they are healthy. Fluoride varnish provides excellent fluoride retention, causes less discomfort, and achieves greater patient compliance.[6,7]

11 Other fluoride products belong in your therapeutic plan. Consider adding fluoride toothpaste, rinse, or gels as appropriate for your patient's individual needs.

Figure 3: Patients at risk for or with active dental caries must have the biofilm dysfunction treated, as well as cosmetic restorations to ensure a predictable and successful long-term outcome.

12 Antimicrobial agents provide a bacterial load reduction and give the commensal bacterial an opportunity to re-establish control of the biofilm. Chlorhexidine has been a standard antimicrobial agent, although it has little activity on *Lactobacillus*. Sodium hypochlorite in an oral rinse works as a rapid broad-spectrum antimicrobial agent.

13 Xylitol, a five-carbon, naturally-occurring sugar alcohol, is a proven anti-caries agent. The cariogenic bacteria ingest the xylitol, cannot metabolize it, and expend energy to expel it from their cells. Xylitol is known to potentiate even small amounts of fluoride.

14 It makes sense to correct the biofilm pH dysfunction by creating pH strategies and frequently using products that neutralize the biofilm. This drives remineralization and also selects for healthy commensal bacteria in the biofilm.

15 Dietary counseling plays an important role for many patients at high risk for caries. Frequent snacking results in periods of low pH, contributing to dental caries dysfunction of the biofilm.

16 Many risk factors cannot be modified by counseling. Patients on multiple medications often experience medication-induced xerostomia, and the low saliva volume reduces their ability to neutralize their mouth following eating, increasing their caries risk.

17 Saliva is already supersaturated with calcium phosphate, hydroxyl apatite and fluor-apatite, but the xerostomic patient does not have enough saliva to begin with, so it makes sense to add a form of calcium phosphate supplement to their oral hygiene regimen **(Fig 4)**.

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Figure 4: Patients with xerostomia represent a special risk, with unique needs related to their therapeutic strategies.

18 Probiotics are products that have bacteria added to them to help influence the bacterial mix of the biofilm. While many of the probiotic bacteria being used are aciduric, this approach may have anti-caries potential in the future.

19 It is important to keep the treatment regimen simple for patients; a complicated regimen may well result in non-compliance and ultimate failure.

20 For patients at risk for caries, it is important to provide recare appointments at three-month intervals to reevaluate them; and to provide ongoing counseling and supportive care to create a healthy smile and keep them cavity-free.

References

1. Kutsch VK, Kutsch CL, Nelson BC. A clinical look at CAMBRA. DPR. 2007 Aug;41(8):62-7.
2. Takahashi N, Nyvad B. Caries ecology revisited: microbial dynamics and the caries process. Caries Research. 2008; 42(6):409-18.
3. Palmer CA, Kent R, Loo CY, Hughes CV, Stutius E, Pradhan N, Dahlan M, Kanasi E, Arevalo Vasquez SS, Tanner AC. Diet and caries-associated bacteria in severe early childhood caries. J Dent Res. 2010 Nov;89(11):1224-9.
4. Domejean-Orliaquet S, Gansky SA, Featherstone JD. Caries risk assessment in an educational environment. J Dent Educ. 2006 Dec;70(12):1346-54.
5. Azarpazhooh A, Main PA. Fluoride varnish in the prevention of dental caries in children and adolescents: a systematic review. J Can Dent Assoc. 2008 Feb;74(1):73-9.
6. American Dental Association Council on Scientific Affairs. Professionally applied topical fluoride: evidence-based clinical recommendations. J Dent Educ. 2007 Mar;71(3):393-402.
7. Quock RL, Warren-Morris DP. Fluoride varnish: the top choice for professionally applied fluoride. Tex Dent J. 2010 Aug;127(8):749-59. **jCD**

Additional Sources

Kutsch VK, Milicich G, Domb W, Anderson M, Zinman E. How to integrate CAMBRA into private practice. J Calif Dent Assoc. 2007 Nov;35(11):778-85.

Marsh PD. Controlling the oral biofilm with antimicrobials. J Dent. 2010 Jun;38 Suppl 1:S11-5. Review.

Marsh PD. Microbiology of dental plaque biofilms and their role in oral health and caries. Dent Clin North Am. 2010 Jul;54(3):441-54.

Young DA, Featherstone JD. Implementing caries risk assessment and clinical interventions. Dent Clin North Am. 2010 Jul;54(3):495-505.

Young DA, Featherstone JD, Roth JR, Anderson M, Autio-Gold J, Christensen GJ, Fontana M, Kutsch VK, Peters MC, Simonsen RJ, Wolff MS. Caries management by risk assessment: implementation guidelines. J Calif Dent Assoc. 2007 Nov;35(11):799-805.

Young DA, Kutsch VK, Whitehouse J. A clinician's guide to CAMBRA: a simple approach. Compend Contin Educ Dent. 2009 Mar;30(2):92-4, 96, 98.

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4
Monitor & Review
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New Challenges in Treatment Planning

Shifting the Paradigm Toward Risk Assessment and Perceived Value—Part 1

John C. Kois, DMD, MSD

Abstract

The fundamental rationale for a comprehensive treatment approach is a long-term strategy for dental health commensurate with an enhanced level of wellness for patients. Understanding parameters of disease expression can be confusing due to inaccurately implemented science or a lack of diagnostic information available to the patient. Formulating specific treatment needs based upon an individual's risk assessment can be challenging without objective data and better metrics. This two-part article (Part 2 will be published in the Spring 2011 *jCD*) will help to eliminate confusion in the diagnostic process by outlining a systematic approach for treatment planning; by reviewing the five most important diagnostic categories; and by detailing how to develop critical risk parameters that can minimize failure and maximize successful outcomes. These articles also discuss protocols that can be implemented during treatment-planning strategies.

Introduction

Many dentists have become more astute about and very efficient when evaluating the dental health of a new patient or reevaluating an existing patient. An interaction that involves examining a radiograph for five seconds and the patient's mouth for five seconds does not provide enough value. Ironically, instead of perceiving the doctor as better trained, many patients believe the doctor is uncaring, uninvolved, and lacking in expertise.[1] Transcending such perceptions requires clinicians to provide care that exceeds patient expectations[2] and to cultivate patient understanding of what is being reviewed, evaluated, and diagnosed in those crucial five seconds.

When patients understand the "why" behind the "do," they are better equipped to make decisions about their treatment and are more likely to perceive their dentist as a healthcare provider.

To this end, the careful incorporation and utilization of "disruptive technologies" that enable precise diagnosis and, subsequently, predictable and effective therapies valued by patients have the potential to transform the practice.[3] Typically viewed as a financial and competitive threat by the major pharmaceutical companies, a shift in market leaders is plausible as new companies adopt and deploy these technologies more efficiently.[3] However, these so-called disruptive technologies (e.g., new machinery, production methods, risk analysis) can enable doctors to provide comprehensive explanations of a patient's condition, along with options for treatment and the risks involved with each.[2,4-6] When patients understand the "why" behind the "do," they are better equipped to make decisions about their treatment and are more likely to perceive their dentist as a healthcare provider.

While technologies that provide diagnostic information are making headway in the dental arena, they already are in place in other areas of healthcare to help start making universal care a reality.[7] All health records will eventually be in digital format, and there may come a day when public kiosks can provide individuals with diagnostic data indicating whether a physician visit is necessary.[4-6]

Such precision medicine lends itself to the concepts of "the healer" and "the hit-man," which are significant to the manner in which patients respond to dentists when presented with treatment options. Today, dentists still are considered "the hit-man" or bearer of bad news.[8] When patients present with no data and are informed of problems, the practitioner is to blame in the patient's mind.

Functional Disorders Checklist: Nine Questions

Conditions of the temporomandibular joints (TMJs) are among the most difficult to diagnose and manage. Therefore, a complete understanding of the patient's oral and overall health is required. To help dentists and patients understand functional disorders, the nine questions allow for simple risk assessment of conditions of the TMJ and occlusion. By using these questions as diagnostic tools, dentists can gain better insight into what may be causing their patient's pain and functional disorders.

If the patient answers affirmatively, they do not necessarily need treatment; rather, their responses indicate that their occlusion is in some way incorrect. The focus should be on risk assessment and quantifying the facts so the patient can develop an understanding of their conditions and why certain treatments may be necessary.

✓ **1. Do you/would you have any problems chewing gum?**
If the patient cannot chew gum, there is a functional problem with the patient's occlusion and TMJ and the patient is at risk. This should be quantified to inform them that although it may not be a problem requiring immediate attention, it is one that may need correcting in the future.

✓ **2. Do you/would you have any problems chewing bagels or other hard foods?**
When asked this question, the majority of patients feel that they do not. In actuality, the patient may have been avoiding foods that bother their TMJ. By doing so, the patient has actually begun a form of treatment for their specific problem, reducing the risk of pain and discomfort. The cause of this problem is occlusal.

✓ **3. Have your teeth changed in the last five years, becoming shorter, thinner, or worn?**
This question is of paramount importance to diagnosing and treating a patient's condition. If the patient has an old yearbook or wedding photograph, it can provide a historical timeline of tooth changes that have occurred.

✓ **4. Are your teeth crowding or developing spaces?**
The spacing of the teeth should not change much as patients age. If they are, an underlying functional issue is likely to blame. Patients should understand that no matter what condition has caused the change, orthodontics will need to be involved to some extent.

However, if technology and the subsequent data they provide were to first explain the clinical situation, then technology becomes the "hit-man" and the dentist becomes "the healer," since the patient now schedules the appointment with full knowledge of his or her condition and possible solutions.[8]

Preparing for the Paradigm Shift

Acknowledging and accepting a shift in the paradigm of dental practice requires adaptation to maintain success.[9] Unfortunately, creating change is very difficult in practice because it must be justified, similar to the manner in which a patient's need for treatment must be supported by diagnostic data.[2]

Six Sigma, a concept designed by Motorola, is a business model that promotes change and working smarter with simple tools and practices.[10,11] An example of its application to dentistry is eliminating the likelihood of chipped porcelain through the use of data and systematic diagnostic/treatment processes that assess and reduce risk. "Six Sigma dentistry" therefore is a concept aimed at removing what causes added stress or risk throughout the workday, even if it involves the simplest procedures.[10,11]

Six Sigma dentistry also involves predictability, which can be improved with technology and repeatable procedures, as well as a smarter workflow that enables practitioners to embrace opportunities for expansion, efficiency, and cost effectiveness. By solving small problems first, correcting large issues is less daunting.[10,11]

Guiding Patients with Technology and Risk Assessment

Dental practitioners following a Six Sigma model are leading a paradigm shift of addressing patient and practice problems from a systematic perspective. In the process, they are improving their lives and practices by removing even the smallest obstacles.[10,11] Among the tools that are useful for systematically examining both practice and patient "conditions" are checklists that can help identify why situations occur. For example, a part of my dental history form helps to uncover problems that can be evaluated by a traditional exam that evaluates morphology **(see sidebar, Functional Disorders Checklist, beginning on page 69)**.[12] In the context of diagnosing and evaluating patients, a risk assessment checklist that encompasses evaluation of five key areas (periodontics, biomechanics, function, dentofacial, medical) is fundamental to necessary data collection, regardless of the technologies used.

For example, consider the case of restoration breakage. It is well known that most patients do not break restora-

✓**5. Do you have more than one bite, or do you clench (squeeze) to make your teeth fit together?**
If the patient is clenching or squeezing, a functional problem needs to be addressed. Equilibration will likely be the required treatment for this condition.

✓**6. Do you have any problems with sleep or wake up with an awareness of your teeth?**
Studies have found that, in some populations, 15% of people with restless leg syndrome have sleep bruxism. When patients experience restless sleep, the condition is actually one of the central nervous system, not local to the teeth. Therefore, a nightguard will not fix the problem; it will simply ameliorate the symptoms.

✓**7. Do you have problems with your jaw joint? (pain, sounds, limited opening, locking, popping)?**
Even if the patient is experiencing no pain in the joint, except when loading, it is still an unhealthy joint when these symptoms are present. With clicking and popping, the patient is at future risk for more damaging conditions that will cause functional disorders.

✓**8. Do you have tension headaches or sore teeth?**
A patient presenting with these symptoms is more likely than not experiencing symptoms of a functional disorder of occlusion or the TMJ. The added stress on the tooth structures and joints can cause problems elsewhere in the body, leading to headaches and soreness.

✓**9. Do you wear or have you ever worn a bite appliance?**
If the patient has, it should be brought to the office so it can be read. The marks on the appliance should be examined and should be linear, with no chewing marks. A splint, used not to stop nocturnal bruxism but to prevent further tooth damage, should have a pattern to the marks. By examining this pattern, the dentist should be able to develop a better understanding of the patient's functional disorder.

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tions when sleeping.[13] For the most part, breakages occur while eating. Many times restoration failure also is directly related to parafunction.[13] This issue could be solved by simply questioning the cause, studying why it occurs, and quantifying it. Once this problem is assessed systematically and understood, a solution can be developed.

However, presentation of the patient's condition and possible treatment options also must be approached systematically and appropriately.[14] Once patients are advised of the problems, focus should shift to what is clinically relevant to enhance understanding and comprehension.[14]

For example, consider that teeth should not wear more than 11 µ per year, which means it would take 100 years to lose 1 mm of tooth structure. A patient who has lost 4 mm of tooth structure needs to be told that the amount of wear they present is equivalent to 400 years of use. Based on this explanation, any occlusal restoration or treatment can be viewed as an anti-aging strategy and more likely to be accepted by the patient, since the problem can be more clearly understood.[14]

Unfortunately, many times a lack of clear and objective data allows one dentist to determine a treatment that another dentist may deem inappropriate.[14,15] The result of this emotionally-driven decision making creates much of the stress experienced in the dental practice and that Six Sigma dentistry and systematic approaches aims to eliminate.[14,15] As a result, things may happen in the practice and treatment process that should not. When risks are known and ignored due to emotions, the final outcome often is compromised.[15]

By utilizing a better technologically-based metric, much of the dentist's clinical decision making can be removed from an emotionally-driven state. With better metrics and a systemic approach to risk assessment and evaluation, patients can be offered significantly improved treatments.[14,15]

Conclusion

The paradigm of systematically approaching patient examinations, risk assessment, diagnosis, and treatment planning emphasizes the need to prevent oral health problems from progressing in the future.[16] Because the burden of responsibility rests with the dentist, problems should not be corrected with solutions that will not be permanent.[2]

All health records will eventually be in digital format, and there may come a day when public kiosks can provide individuals with diagnostic data indicating whether a physician visit is necessary.

Although it is generally accepted that most choices are never perfect, they should be, at the least, well calculated.[2] In dentistry, calculating risk and predicting the outcome many times may involve the lesser of two evils. The critical objective is to utilize systems that eliminate subjectivity so patients receive the best in care at the lowest functional, periodontal, biomechanical, dentofacial, medical, and financial cost while simultaneously increasing reward.[2] After all, part of what patients pay for is guidance from their dentists toward the best treatment options for their case, whether for longevity or esthetics.[2,14]

Risk assessment is beneficial not only for patients, but also for dentists.[17] The struggle, however, is not in understanding the risk. The problem most dentists face is in implementing risk-reducing protocols. Although implementing science into practice remains a challenge, using evidence enables dentists to better predict and control the outcome.[2]

Part 2 of this article will elaborate on the process of risk assessment and the categories to be addressed therein.

References

1. Whitehouse J. Dealing with patient feelings. Dent Today. 2004;23(12):99-102.
2. MacRobert M. A leadership focus on evidence-based practice: tools for successful implementation. Prof Case Manag. 2008;13(2):97-101.
3. Schmid EF, Ashkenazy R, Merson J, Smith DA. Will biomedical innovation change the future of healthcare? Drug Discov Today. 2009;14(21-22):1037-44. Epub 2009 Jul 30.
4. Silvey GM, Willis JM, Lobach DF. Deployment of health information kiosks in diverse community settings: experience and lessons learned. AMIA Annu Symp Proc. 2008:1132.
5. Lowe C, Cummin D. The use of kiosk technology in general practice. J Telemed Telecare. 2010;16(4):201-3.
6. Pendleton BF, Labuda Schrop S, Ritter C, Kinion ES, McCord G, Cray JJ, Costa AJ. Underserved patients' choice of kiosk-based preventive health information. Fam Med. 2010;42(7):488-95.
7. Chen W, Shih CC. Architecture of portable electronic medical records system integrated with streaming media. J Med Syst. 2010 Feb. 17. [Epub ahead of print].
8. Pendleton BF, Labuda Schrop S, Ritter C, Kinion ES, McCord G, Cray JJ, Costa AJ. Underserved patients' choice of kiosk-based preventative health information. Fam Med. 2010;42(7):488-95.
9. Garcia RI, Inge RE, Niessen L, DePaola DP. Envisioning success: the future of the oral health care delivery system in the united states. J Public Health Dent. 2010;70 Suppl:S58-65.

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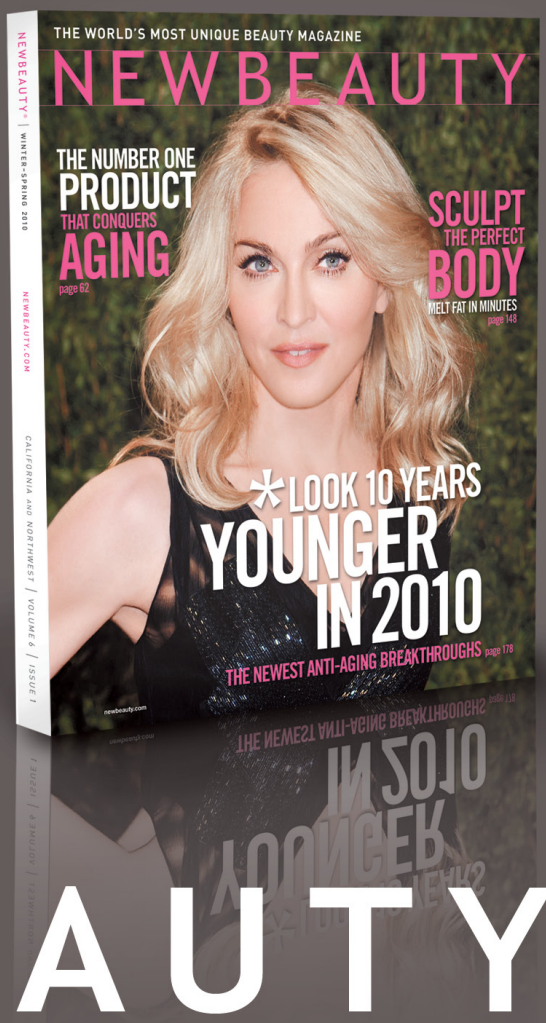

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10. Schweikhart SA, Dembe AE. The applicability of lean and six sigma techniques to clinical and translational research. J Investig Med. 2009;57(7):748-55.

11. Fischman D. Applying lean six sigma methodologies to improve efficiency, timeliness of care, and quality of care in an internal medicine residency clinic. Qual Manag Health Car. 2010;19(3):201-10.

12. Weiser TG, Haynes AB, Lashoher A, Dziekan G, Boorman DJ, Berry WR, Gawande AA. Perspectives in quality: designing the who surgical safety checklist. Int J Qual Health Care. 2010;22(5):365-70. Epub 2010 Aug 11.

13. Taskonak B, Mecholsky JJ Jr, Anusavice KJ. Fracture surface analysis of clinically fixed partial dentures. J Dent Res. 2006;85(3):277-81.

14. Weiner AA, Stark PC, Lasalvia J, Navidomskis M, Kugel G. Fears and concerns of individuals contemplating esthetic restorative dentistry. Compend Contin Educ Dent. 2010;(31)6:446-8, 450, 452 passim.

15. Jaffe DS. Empathy, counteridentification, countertransference: a review, with some personal perspectives on the "analytic instrument". Psychoanal Q. 1986;55(2):215-43.

16. McLaughlin N. Where the buck stops. healthcare needs to stop blaming patients and take responsibility for errors. Mod Healthc. 2006;36(48):22.

17. Dym H. Risk management techniques for the general dentist and specialist. Dent Clin North Am. 2008;52(3):563-77, ix. **jCD**

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CONSIDERING A PAPILLA REGENERATION TECHNIQUE

Closing a Diastema with Direct Composite

David J. Clark, DDS

INTRODUCTION

Esthetics and Diastema Closure

Many esthetic procedures that we routinely provide can actually improve the structural integrity of the tooth and also facilitate better health of the surrounding gingiva. Diastema closure, at least in the anterior sextant, rarely gives either of these secondary benefits. Unfortunately, the esthetic diastema closure often results in significant compromises in the root/crown architecture, and increased plaque retention with subsequent deterioration in periodontal health and poor "pink" esthetics.[1]

Number of total teeth planned for treatment	If > 4, the skill and patience of the operator will dictate the composite/porcelain decision.
Incisal edge to be lengthened?	If yes, the skill and patience of the operator will dictate the composite/porcelain decision.
Is papilla regeneration desired?	If yes, direct composite combined with a cervically pre-curved matrix is advantageous.
Is the color of the tooth/teeth acceptable?	If no, consider internal or external preoperative bleaching.
Cost considerations	Porcelain laminates could carry a fee two to four times that of the direct composite.
Previous restorations	Previous restorations involving extensive incisal areas favor porcelain re-restoration.
Tooth proportions	A diagnostic wax-up and a review of the *AACD Smile Design Criteria* will be helpful.

Table 1: Diagnostic work-up.

Unfortunately, the esthetic diastema closure often results in significant compromises in the root/crown architecture.

Figures 1 & 2: Preoperative views demonstrate several symmetry and ledge problems common with placement of direct composites to correct a midline diastema.

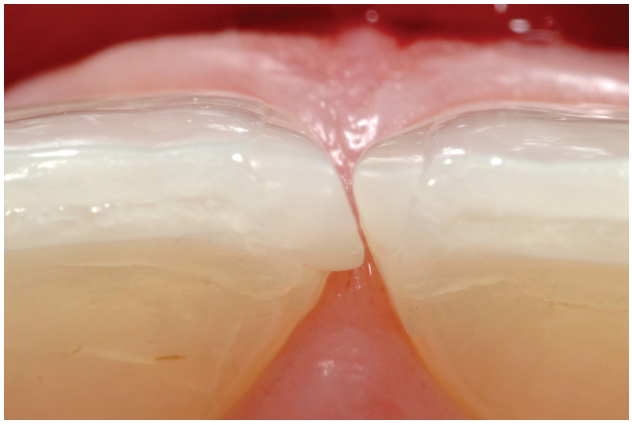

Figure 3: Preoperative incisal view highlights another common midline problem featuring a poor palatal-facial embrasure shape; most of these failures can be traced back to matrixing technique dilemmas.

Figure 4: Preoperative palatal condition. The significant ledge on the left central is even more apparent. In this case, 1.5 mm of gingival retraction occurred with placement of a well-punched and well-cuffed rubber dam.

The case discussed here demonstrates a classic iatrogenic diastema closure. It was then re-treated, featuring new strategies and being mindful of the myriad problems associated with traditional direct composite treatment of diastemas. The outcome is compared to the treatment of the lateral incisors which underwent simultaneous replacement of failing porcelain laminates with new porcelain laminates. Papilla regeneration should be considered any time that a diastema is closed, as open gingival embrasures (black triangles) do more damage than just prematurely age the smile; they also encourage accumulation of food debris and excessive plaque. In contrast to earlier thinking, we now understand that black triangles can adversely affect the peridontium.[2]

Considerations in treatment planning of diastema cases are outlined in **Table 1** (page 71).

Diastema Closure Using Composite Resins

When patients request that large diastemas be closed, alternative choices should always be discussed. However, patients will sometimes choose the most expedient option, such as direct composite. When faced with this challenge, we have limited options.

Until now there have been few techniques available to the clinician that provided a reasonable chance for success. There is a smattering of published techniques performed by some of the masters.[3] In the past there were three options:

Option 1: No Matrix: In the severe diastema case featured in this article, it appears that the previous clinician used the papilla as the gingival matrix on the left central incisor **(Figs 1-4)**. It resulted in an adequate physical space closure but a biologically horrific contour. A sharp 90° angle, and a lumpy and porous surface combines for the worst environment for soft tissue health.

Option 2: With Matrix, With Wedge: The problem with traditional clear Mylar strips is that they are flat and require wedging, do not conform to the tooth, and are nearly impossible to maintain deep in the sulcus. The result is often an esthetic compromise. Holding all four ends of the strips and simultaneously light-curing is always a challenge.

Option 3: With Matrix, Without Wedge: This approach can yield the worst of all possible worlds—incomplete space closure and a gingival overhang.

Figure 5: Old composite has been removed and all surfaces blasted with pressurized sodium bicarbonate spray. No tooth preparation is needed when a total etch technique is utilized.

Case Presentation: Diastema Closure Combined With Papilla Regeneration

Chief Complaints

The 32-year-old female presented for treatment with chief complaints of bleeding gums, brown stain, floss shredding, and incomplete direct composite diastema closure in the interproximal area of #8 and #9. The patient desired complete diastema closure and resolution of the above-mentioned problems. She also complained of discolored porcelain laminates and dark gingival margins on lateral incisors #7 and #10. All four incisors had been treated previously to close diastemas. As is typical with traditional direct composite techniques that rely on Mylar strip matrices, the previous composites did not have adequate cervical curvature to close the gingival half of the embrasure, much less to provide a "scaffold" for papilla regeneration.

Treatment Options

A plan including pre-prosthetic orthodontics to evenly distribute the spacing followed by porcelain laminates was presented to the patient. As part of a comprehensive treatment plan several other options were proposed to the patient, including removal of the offending composites and return to the natural diastema; orthodontic treatment alone; a mixed case of direct composites for the central incisors and porcelain laminates for the lateral incisors; and, finally, porcelain laminates for #5 through #12. The patient declined the comprehensive approach and was provided with information to give informed consent regarding the esthetic compromises before beginning treatment. The patient opted for retreatment of the central incisors with direct composite and retreatment of the lateral incisors with porcelain laminates.

Treatment

Preoperative views **(Figs 1-4)** demonstrate many of the typical limitations and problems associated with diastema closure treated with the direct composite approach. They are as follows:

- black triangle remaining
- ledge that creates periodontal compromise and snags floss
- incorrect midline symmetry
- incorrect angulation of midline in gingivo-incisal inclination
- incorrect midline in palato-facial inclination
- light or "point" contact area.

The author has observed that the majority of cases that have presented in his office after these treatments have unacceptable contours, compromising the periodontal health of the affected teeth. Research has shown that prosthetic marginal discrepancy greater than 50 µ will cause untoward tissue response.[4-7] Overhangs in direct materials demonstrate similar periodontal breakdown.[8] A large percentage of the diastema closures currently being treated with direct composites can have marginal ledges exceeding 500 µ. If we are to "do no harm" as we embark on elective diastema closure, we must elevate our game.

As the case progressed, the old composite was removed with a coarse flame-shaped diamond. In order to adequately remove biofilm, the teeth were painted with disclosing solution and then meticulously sprayed with a pressurized sodium bicarbonate/water mix **(Fig 5)**.

Use of a Rubber Dam

Rubber dam utilization is often dismissed for anterior esthetics as being unnecessary or, worse, counterproductive. The author has observed in most cases that the amount of interproximal gingival retraction afforded by the rubber dam is ideal for predicting the amount of static tension needed to generate or regenerate a papilla.[9,10] Immediately before matrix placement, application of an astringent

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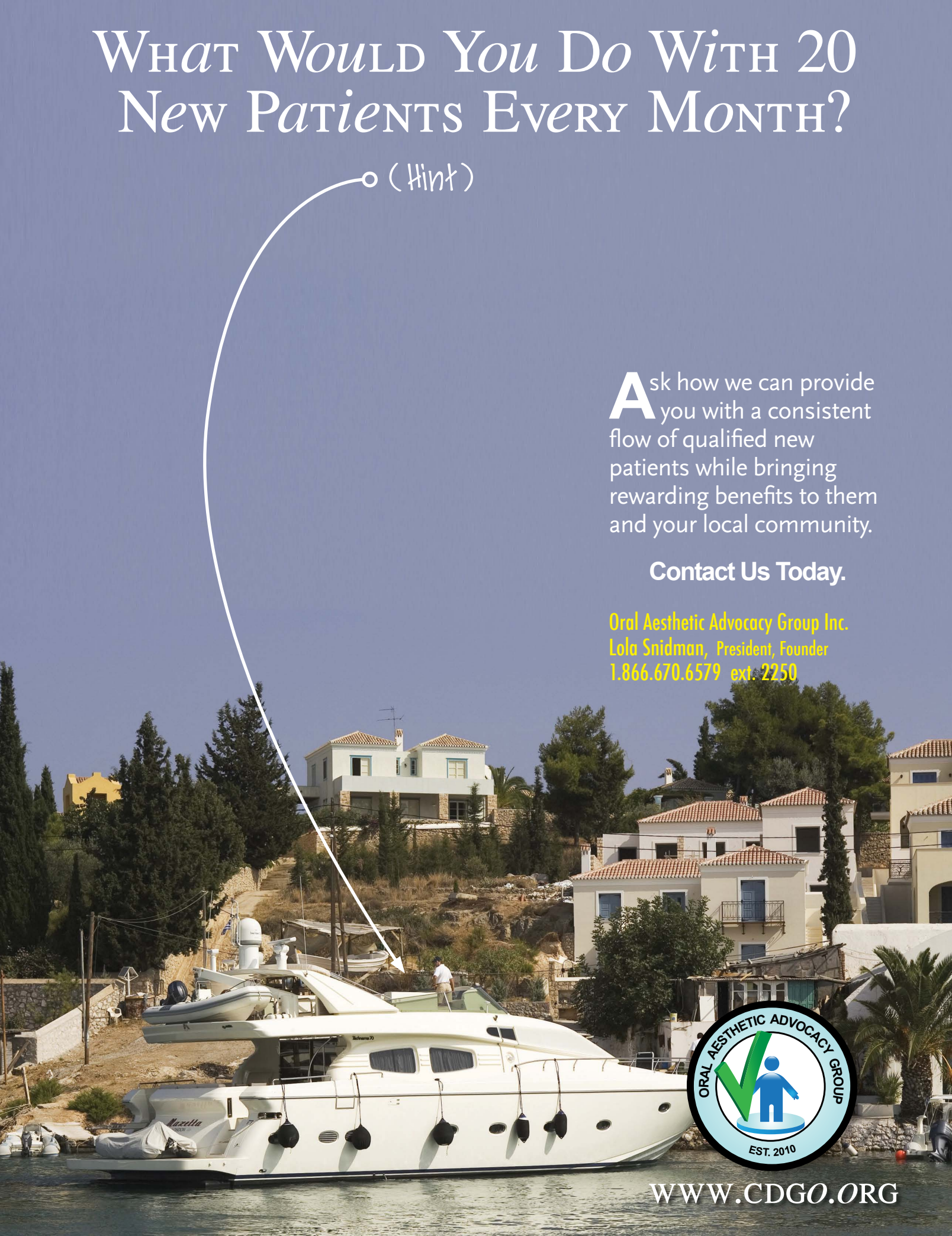

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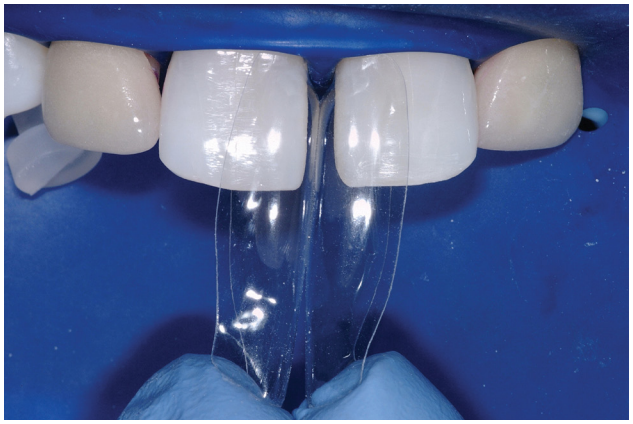


Figures 6 & 7: Low- and high-magnification views of pre-curved dedicated diastema closure matrices fully seated. Note how the rubber dam aids in pressing the matrices against the teeth.

is accomplished with aluminum chloride (Hemodent; Philadelphia, PA) underneath the dam and a small contra-angle disposable brush. The astringent is massaged with the brush into the sulci, which provides an ideal control of crevicular fluids for up to15 minutes. Once the rubber dam is removed, the tissue rebounds and the papilla shape is generally ideal.

Two dedicated diastema closure matrices (Bioclear matrix DC-201; Tacoma, WA) were inserted inciso-gingivally until the gingival aprons of the matrices were near the depth of the sulcus **(Figs 6 & 7)**. The rubber dam and/or gingival sulcus and/or gentle approximating devices such as a Wedget (Coltene/Whaledent; Mahwah, NJ) or Bioclear Interproximator provide sufficient lateral pressure to seal the gingival margins of the matrix. Use of a traditional wooden or plastic wedge during phase one of wedging must be eliminated to avoid deformation of a pre-curved matrix.

The teeth were then etched with 37% phosphoric acid, rinsed and dried, and a thin layer of bonding resin placed and air-thinned but not cured. Then a small canula of flowable composite was angled into the interproximal from both the facial and the lingual aspects and a small amount of flowable composite was placed and then light-cured **(Fig 8)**.

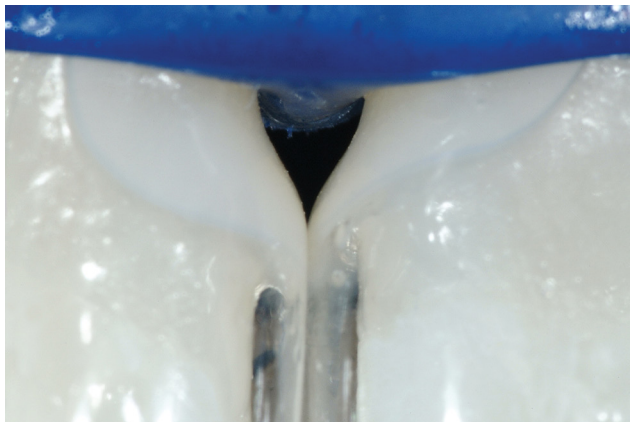


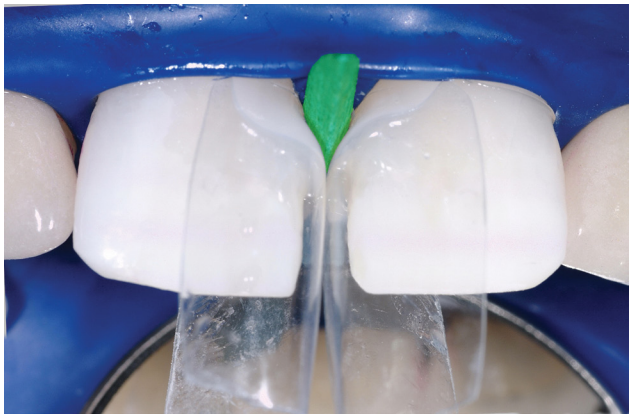
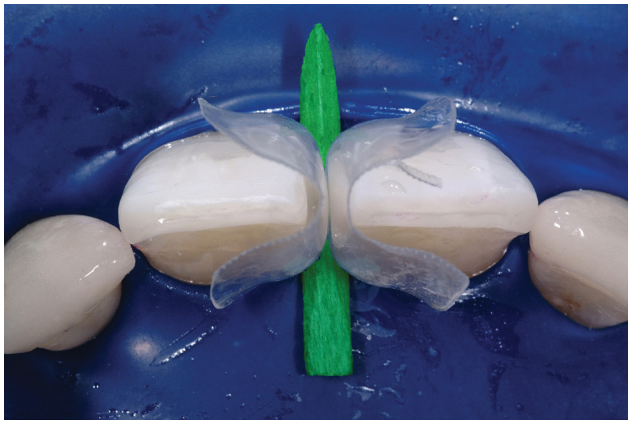
Figure 8: The first increment of flowable composite was placed and light-cured.

Staged Wedging Technique

Once a small "hip" or undercut area of flowable composite has been placed and light-cured, an aggressive wedging force with a traditional wedge must be implemented to separate the teeth **(Figs 9 & 10)**. For anterior teeth that are more easily displaced than posterior teeth, strong wedging pressure will generally compensate for the two sheets of Mylar in order to achieve a tight contact. Once the teeth are wedged, the remainder of the space is filled with paste composite and then light-cured **(Figs 11 & 12)**.

Cervical Curvature

The key to ideal papilla regeneration in the diastema closure procedure—whether performed with porcelain or composite—is to provide aggressive cervical curvature that begins subgingivally.[11] Many traditional diastema treatments achieve closure with composite

Figures 9 & 10: Facial and incisal views of the second step of staged wedging.


Figures 11 & 12: Low- and high-magnification views after injection molding the second phase of the composite restorations.

or porcelain that reaches mesio-distally; "on top" of the gingival; or, as in the failed initial treatment of this case, in mid-tooth. These maxillary central incisors were retreated using the Bioclear DC-201 matrix. The bi-concave gingival contour of the matrix provides a shape that has heretofore been predictably created only by using porcelain as the restorative material.[12] Most importantly, it allows predictable deflection of the soft tissue to accomplish subgingival alteration of the emergence profile. The aggressive cervical curvature transitions to a fairly flat shape in the incisal two-thirds of the matrix. The immediate postoperative image **(Fig 13)** demonstrates the significant difference that a double concave pre-curved matrix can provide. The regenerated papilla completes the space closure and the static tension of the gingiva against the interproximal tooth surfaces provides a youthful seal, eliminating bacterial colonization and debris accumulation. Vertical striations, which manifest themselves as modified specular highlights in the composite, were placed to minimize an excessively wide look to the central Incisors.[13]

Outcome

Patient's Reaction

The patient was extremely pleased with the result. The function and health of the midline contact were certainly improved and immediate papilla regeneration was fairly spectacular. The patient reported three important improvements: elimination of the dark space, elimination of food impaction, and reduced plaque accumulation. The highly polished composite surface attracts less plaque than the previous large embrasure space and actually felt smoother than her natural tooth surfaces.

Clinician's Assessment

Assessment of the case included the following criticisms:

- As is often the case with large diastemas that are treated without pre-restorative orthodontics, the final height-to-width ratio of the central incisors was not ideal (teeth appear slightly too broad); the patient was warned about this when she chose a limited versus a comprehensive treatment plan. The patient did not agree to have the teeth lengthened, which could have improved the height-to-width ratio.
- There is a slight color discrepancy between the flowable composite and the cervical enamel; however, the match becomes much better in the coronal two-thirds of the tooth. The paste component, Filtek Supreme (3M ESPE; St. Paul, MN) Body shade is fairly opaque and matches well with the 3M flow-

Figure 13: Immediately after treatment.

Figure 14: Three weeks postoperative with the more natural "wet look."

able composite which, at this time, is available in only one type of opacity. Currently there are limited options for flowable composite in terms of color and translucency, although many more flowable composites are being developed.

In retrospect, a more translucent and/or lower-value flowable composite could have been chosen for the cervical fourth; however, this can create more problems than it solves because of the challenges inherent in placing different shades of direct composites in a dedicated diastema closure matrix. In the grand scheme of things, once the teeth are rehydrated and viewed with lower magnification the color discrepancy becomes fairly minimal **(Fig 14)**. To remedy this problem in this case, the composite could be re-roughened with a medium-grit diamond, the enamel and composite re-etched, and the transition could easily be softened with a thin skin of cervical composite extending to mid-tooth. The author, the developer of the matrix used in this case, recommends that the interproximal should be addressed first, the rubber dam removed, and then problems such as facial abrasions or additions to the interproximal composite be addressed as a separate step. The rubber dam has been an asset in the gingival-interproximal but a liability in gingival-mid tooth. Filtek Supreme Plus Flowable is one of the most opaque and most consistent with the corresponding body shades of paste composite. A similar case (but with more translucent composites) was discussed last year in *Oral Health* and provides an excellent contrast to the opacity of the composites used in this case.[12]

The three-week postoperative image **(Fig 14)** shows reasonable esthetics for both the central incisors treated with direct composite, and the lateral incisors treated with porcelain laminates. The occlusal view **(Fig 15)**, however, demonstrates a healthier palatal contour for the direct composite and a more fully regenerated papilla as well for the direct composite approach. The inciso-facial path of insertion of a porcelain veneer precludes it from wrapping through the interproximal area to the palatal line angle.

Summary

This article highlights a clinical case that demonstrated many of the common problems associated with direct composite treatment of midline diastemas. The patient was retreated successfully with a minimally invasive approach that included careful placement of composites using ideal tissue retraction, balanced use of flowable and paste composites, the staged wedging technique, and pre-curved/dedicated diastema closure matrices. Porcelain laminates are often considered to be superior to direct composites for treatment of diastemas. This case, however, demonstrates that direct composites can be superior to porcelain in terms of gingival health and for potential papilla regeneration.

The key to ideal papilla regeneration in the diastema closure procedure—whether performed with porcelain or composite—is to provide aggressive cervical curvature that begins subgingivally.

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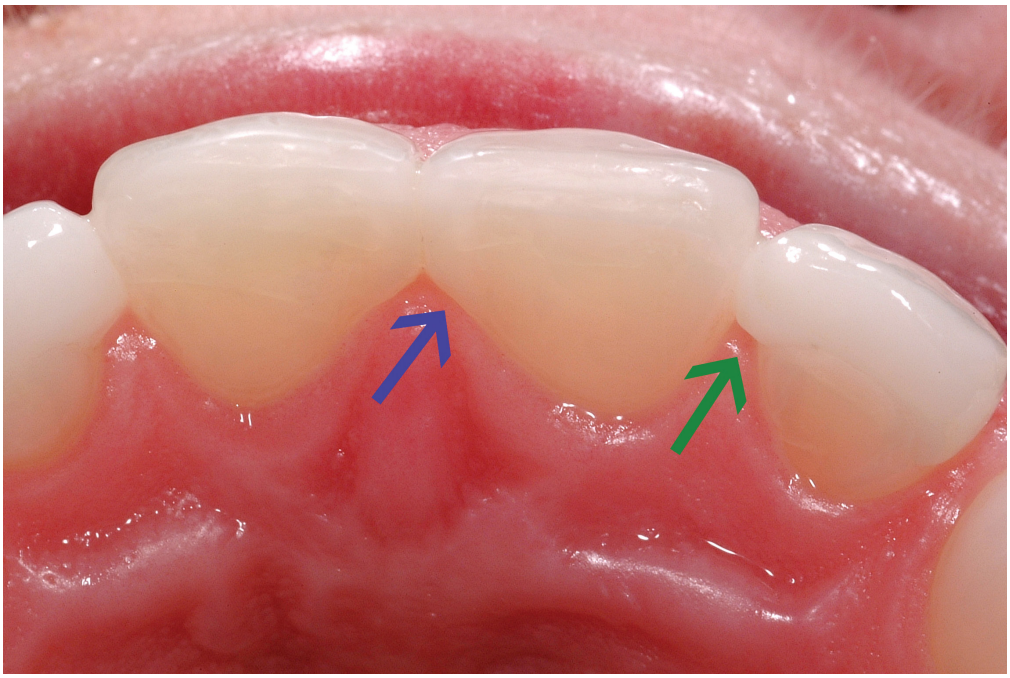

Figure 15: The blue arrow highlights the favorable "wrap" of the direct composite past the line angle of the tooth and favorable engagement of the palatal gingiva. The green arrow highlights the compromise that is typical with porcelain laminates for diastema closure with a more limited engagement of the palatal gingiva. This area will have higher potential for bacterial accumulation and less potential for ideal papilla regeneration.

References

1. Clark DJ, Kim J. Optimizing gingival esthetics: a microscopic perspective. Oral Health. 2005 Apr;116-26.

2. Ko-Kimura N, Kimura-Hayashi M, Yamaguchi M, Ikeda T, Meguro D, Kanekawa M, Kasai K. Some factors associated with open embrasures following orthodontic treatment. Aust Orthod J. 2003:19:19-24.

3. Willhite C. Freehand resin bonding: clinical technique for diastema closure. AACD Monograph. Vol III. Mahwah (NJ): Montage Media; 2006. p. 76-80.

4. De Boever JA, De Boever AL, De Vree HM. Periodontal aspects of cementation: materials, techniques and their biologic reactions. Rev Belge Med Dent. 1998;53(4):181-92.

5. Sorensen Se, Larsen IB, Jorgensen KD. Gingival and alveolar bone reaction to marginal fit of subgingival crown margins. Scand J Dent Res. 1986 Apr;94(2):109-14.

6. Sorenson JA. A rationale for comparison of plaque-retaining properties of crown systems. J Prosthet Dent. 1989 Sep;62(3); 264-9.

7. Lang NP, Kiel RA, Anderhalden K. Clinical and microbiological effects of subgingival restorations with overhanging or clinically perfect margins. J Clin Periodontol. 1983 Nov;10(6):563-78.

8. Kuonen P, Huynh-Ba G, Krummen VS, Stössel EM, Röthlisberger B, Salvi GE, Gerber J, Pjetursson BE, Joss A, Lang NP. Restoration margins in young adolescents: a clinical and radiographic study of Swiss Army recruits. Oral Health Prev Dent. 2009;7(4):377-82.

9. Tarnow DP, Magner AW, Fletcher P. The effect of the distance from the contact point to the crest of bone on the presence or absence of the interproximal dental papilla. J Periodontol. 1992 Dec;63(12):995-6.

10. Holmes CH. Morphology of the interdental papillae. J Periodontol 1965;36:455-60.

11. Bichacho N. Cervical contouring concepts: enhancing the dentogingival complex. Pract Perio Aesthet Dent. 1996 Apr;8(3):241-54 .

12. Pollak M. Aesthetic diastema closure using a novel matrix system. Oral Health. 2010 Mar;100(3):38-47.

13. Jones LM, Robinson MY. Case study: esthetic and biologic management of diastema closures using porcelain-bonded restorations for excellent and predictable results. J Cosmetic Dent. 2002;18(3):73-84. **jCD**

Dr. Clark graduated from the University of Washington School of Dentistry in 1986. He practices in Tacoma, Washington.
Disclosure: Dr. Clark is the developer and owner of Bioclear Matrix Systems.

The first clinical sign of the active caries process on a smooth tooth surface is a change in the tooth enamel's optical properties, evidenced as a white spot lesion.

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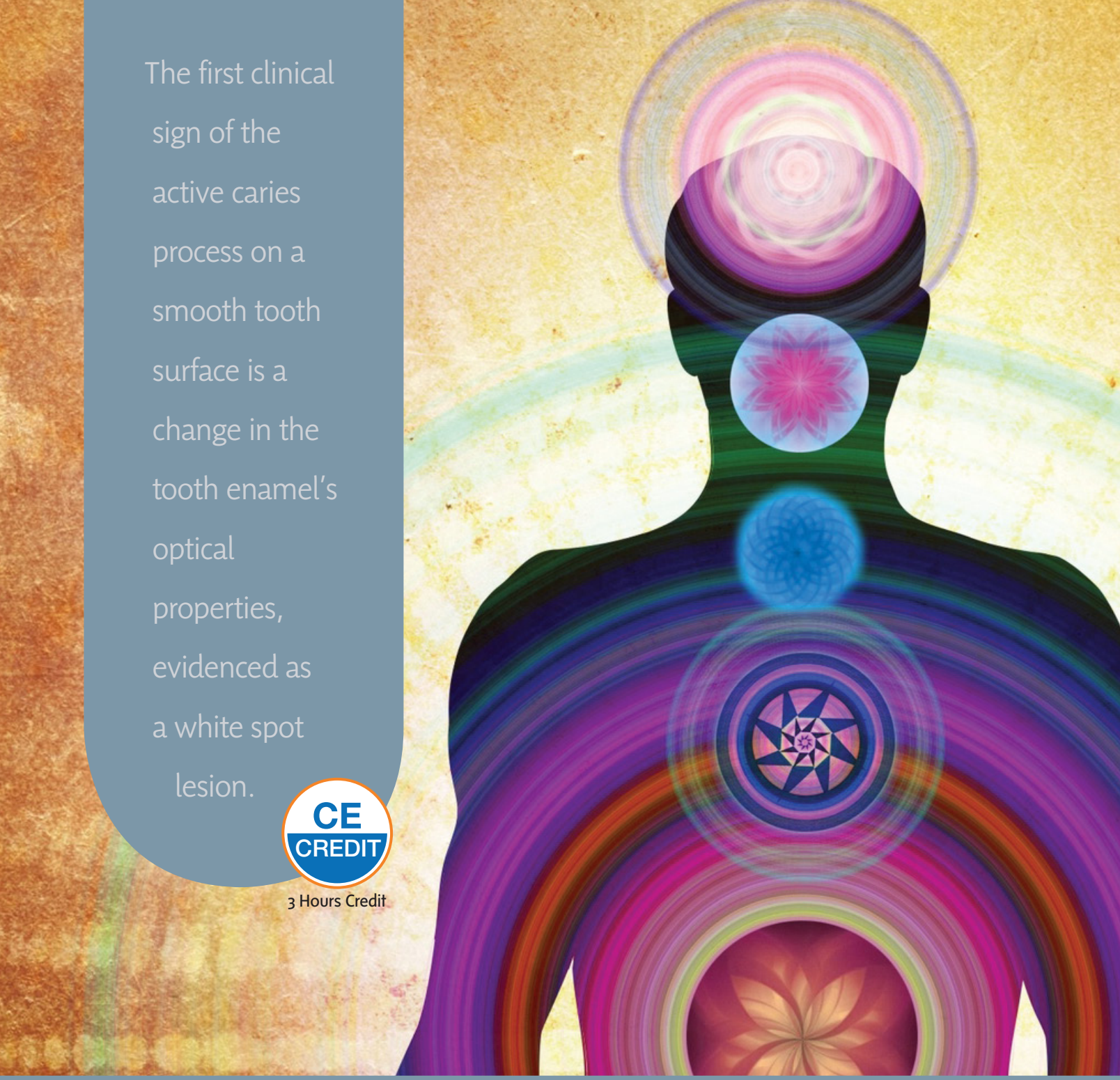

MANAGING EARLY STAGES **OF**

Remineralization of Smooth Surface Incipient Enamel Lesions

Learning Objectives

After reading this article, the participant should be able to:

1. **Understand current concepts of dental caries as a multifactorial infectious disease.**
2. **Recognize commonly used remineralization strategies for the management of early caries lesions, as well as emerging new strategies.**
3. **Use evidence-based knowledge to select the best remineralization strategy for a given clinical situation.**

DENTAL CARIES

André V. Ritter, DDS, MS
Michael W. Roberts, DDS, MScD
J. Timothy Wright, DDS, MS

Abstract

Dental caries results from the process of bacterially mediated acid dissolution or demineralization. Complex tooth-biofilm interactions play an important role in mediating the onset and progression of the disease. If the caries process is not controlled, chronic demineralization will result in a caries lesion. The first clinical sign of the active caries process on a smooth tooth surface is a change in the tooth enamel's optical properties, evidenced as a white spot lesion. This article discusses current remineralization strategies that can be used in the management of these non-cavitated incipient enamel lesions, including the use of fluoride, xylitol, calcium phosphate, and other treatments. Also briefly discussed is the infiltration of enamel white spot lesions with low-viscosity resins as a means to arrest lesion progression.

Figure 1: The arrows point to white spot lesions on the facial surface of #7 and #8.

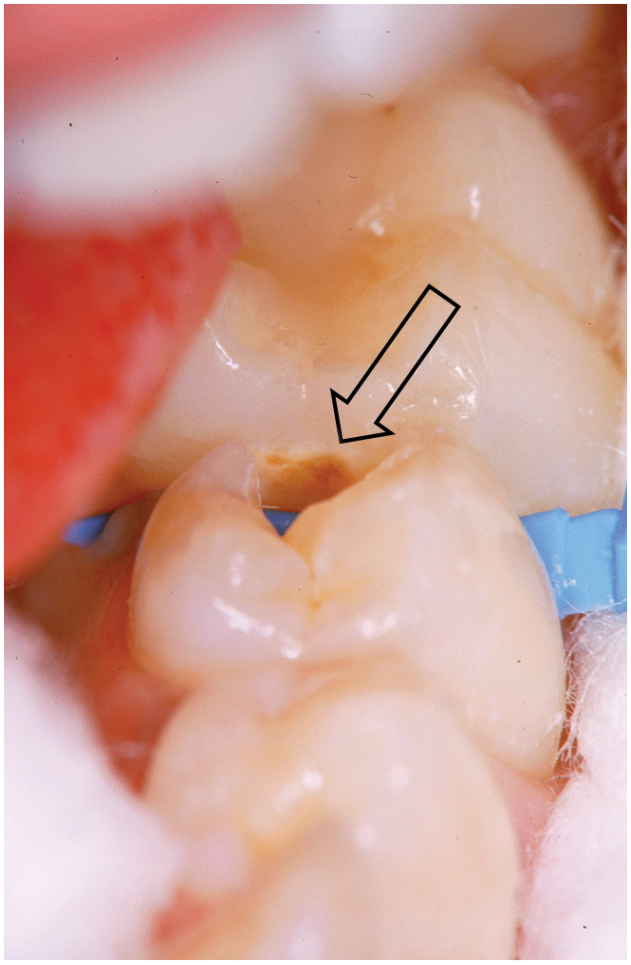

Figure 2: The arrow points to an incipient enamel lesion on the mesial surface of #19. The interproximal surface just gingival to the proximal contact is a high-risk area for caries.

Introduction

Dental Caries: The Disease and Its Manifestations

Dental caries is a multifactorial, transmissible infectious oral disease caused by the complex interplay of the tooth with fermentable dietary carbohydrates, saliva, and cariogenic oral flora (biofilm) over time. The disease continues to be highly prevalent in many countries.[1-4] The U.S. Surgeon General stated that tooth decay was the single most common chronic childhood disease—five times more common than asthma and seven times more common than hay fever; that 50% of children aged five to nine had at least one caries lesion or dental restoration; and that that proportion increased to 78% among 17-year-olds.[5] A national survey found that 7% of children aged 2 to 17 had unmet dental needs,[6] while another study indicated that progress toward improving the oral health of Americans during the past decade has been mixed, with 19-28% of children 15 and younger still presenting with untreated disease.[7]

The application of topical

Although the onset and activity of the caries lesion is modulated by complex tooth-biofilm interactions, at the tooth surface and subsurface levels dental caries results from a dynamic process of attack on and restoration of the tooth matter, respectively known as *demineralization* and *remineralization*. These actions take place several times a day over the life of the tooth, and are modulated by many factors including number and type of microbial flora in the biofilm, diet, oral hygiene, use of fluorides and other chemotherapeutic agents, salivary flow and buffering capacity, and inherent resistance of the tooth structure and composition that will differ from tooth to tooth and site to site.

Dental enamel is composed primarily of carbonate-substituted hydroxyapatite with smaller amounts of water, protein, and trace elements, including fluoride. When untreated, dental caries is characterized clinically by the gradual loss of tooth matter by demineralization. At the tooth surface level, the process of demineralization and dental caries formation begins when cariogenic micro-organisms are present in sufficient numbers and virulence; and dietary fermentable carbohydrates, especially sucrose, are available to provide the substrate for the cariogenic micro-organisms in the biofilm to form organic acids. The enamel demineralization process begins when these acids lower the pH of the biofilm to below 5.5. The acids result in the loss of ions including calcium and phosphates from the surface and subsurface enamel into the

Figure 3: If untreated and the demineralization process continues, white spot lesions can progress to loss of the intact surface layer and cavitation. This image shows an area (circled) that is cavitating on the facial surface of #7. Note also white spot lesions on several other teeth.

fluoride to teeth enhances the remineralization process.

acquired enamel pellicle (AEP) and biofilm. The first clinical sign of the active caries process on a smooth enamel surface is a change in its optical properties, evidenced as a white spot lesion, also known as *early enamel lesion or incipient enamel lesion* **(Figs 1 & 2)**.[8] A white spot lesion is in fact a subsurface phenomenon, characterized by low calcium and phosphate content; it is the initial detectable evidence of subsurface enamel demineralization. If untreated and the demineralization process continues, the white spot lesion can progress to loss of the intact surface layer and cavitation **(Fig 3)**.[9]

Remineralization: A Viable Option for Early Caries

The demineralization process is reversible provided that the acidogenic properties of the biofilm are neutralized and that calcium and phosphate ions are available in the oral fluids to be deposited on the partially dissolved and demineralized enamel crystallites in the subsurface lesion. The buffering capacity of saliva plays a critical role in helping restore a neutral pH at the tooth surface. Remineralization occurs when the dietary carbohydrate is removed and the pH of the biofilm is raised to approximately 7.0. Once the pH returns to above the critical point, demineralization is arrested and bio-available minerals can be added back to the partially dissolved enamel crystallites. The application of topical fluoride to teeth enhances the remineralization process due to its highly reactive nature, and increasing the deposition of fluoride onto partially dissolved crystallites can significantly increase caries resistance.[10,11] Fluoride has also been shown to have bacteriostatic effects, which may help target bacteria within the biofilm.[12,13]

Treatment of early caries by remineralization provides a significant advance in minimally invasive clinical management of caries lesions. Calcium and phosphate in the saliva and biofilm allow the recovery of some lost mineral content by the enamel. In some cases, the initial white spot lesion can be fully remineralized and restored to a normal enamel appearance, while in other cases the lesion may be remineralized and arrested, with the white spot remaining as a "scar." Regardless of the outcome, it is critical that the surface of the enamel is intact and allows penetration of the remineralization ions (i.e., that the surface be permeable). Interestingly, extreme high calcium and phosphate concentrations in the dental pellicle can actually adversely affect the quality of remineralization.[14] High concentrations favor formation of calcium-phosphate mineral phases on the enamel surface, reducing its permeability and limiting remineralization of the subsurface enamel. As the remineralization of the subsurface demineralized enamel depends upon penetration of calcium and phosphate ions through the enamel surface, a more complete remineralization process occurs preferentially when the calcium and phosphate concentrations are lower.[15,16] Consequently, the type and concentration of ions available are critical for development of the optimal remineralizing agent. Numerous calcium and phosphate compounds such as

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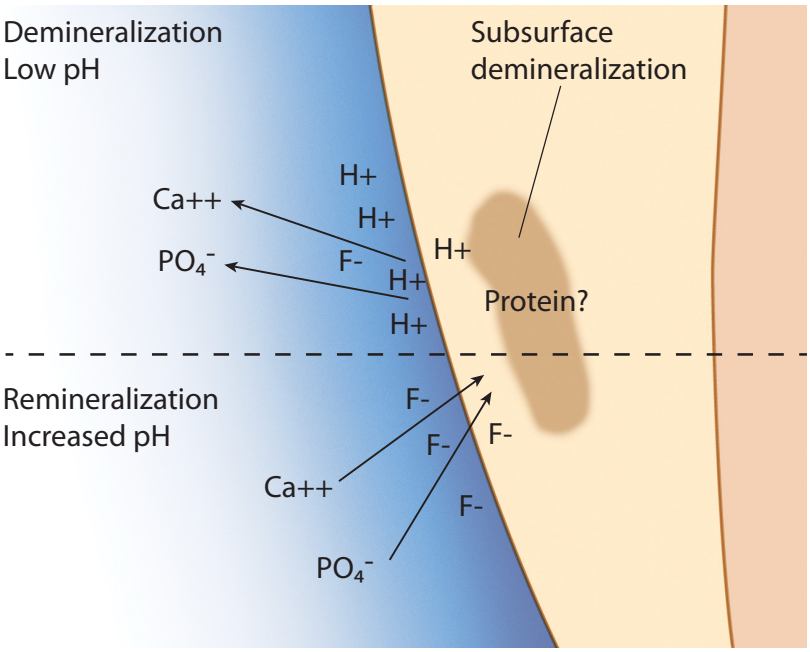

Figure 4: Demineralization and remineralization process. Under low pH conditions (top half), the biofilm is undersaturated with respect to hydroxyapatite, and Ca^{2+} and PO_4- are lost from the enamel. Once the pH of the biofilm returns to higher than the critical point (~5.5), demineralization is arrested and minerals can be added back to the partially demineralized enamel. The role of enamel proteins on this process is largely unknown. (*Image modified with permission from MW Roberts and JT Wright, "The Dynamic Process of Demineralization and Remineralization,"* Dimensions of Dental Hygiene *2009;7(7):16-21.*)

amorphous calcium phosphate (ACP), calcium sodium phosphosilicate, and casein phosphopeptides (CPP) are commercially available for remineralization of early carious lesions in teeth. However, the clinical evidence that these products work as well as traditional fluoride therapies in remineralizing incipient caries or preventing new caries is lacking at this time and further clinical research in this area is needed.[17-20]

Calcium, phosphate, and fluoride ions in the saliva assist in the remineralization process **(Fig 4)**. Saliva is the vehicle that delivers available fluoride ions to the demineralized enamel and partially dissolved crystallites.[21] The predominant enamel/fluoride reaction products from topical fluoride are CaF_2 and $CaH(PO_4)$[22] **(Fig 5)**. Without saliva to slowly dissolve the CaF_2 surface products over time and deliver the fluoride ion to the demineralized enamel, the remineralization process will not occur. For this reason careful selection of neutral pH remineralizing treatment approaches should be selected for xerostomic patients. Low pH treatments such as use of acidulated phosphate fluoride products will partially dissolve the teeth during exposure and with inadequate saliva there will be little or no subsequent remineralization.

Remineralization of white spot lesions is valuable for esthetic and biological reasons, as it can potentially interrupt the natural progression of the caries process before it becomes a cavitated lesion. However, it is important to note that a sole focus on the remineralization of isolated enamel white spot lesions, no matter how successful, does not address the multifactorial nature of dental caries as an oral disease. From a comprehensive disease management perspective, the targeted remineralization of white spot lesions is similar to the excavation and restoration of a cavitated caries lesion in that these procedures address the signs of the disease, and have little if any impact in disease management. Restoring cavitated lesions and remineralizing white spot lesions are not, per se, the treatment for dental caries.[23] Adding a remineralizing regime as part of a comprehensive prevention program can, however, also be beneficial in primary prevention and reducing the development of new early and cavitated lesions.

Remineralization Strategies

Fluoride

Although saliva and biofilm fluid have the capacity to enable remineralization of early enamel lesions because of the calcium and phosphate they contain, this process can be enhanced by the presence of fluoride.[23] Fluoride is the most-researched and most-used dental caries prevention and remineraliza-

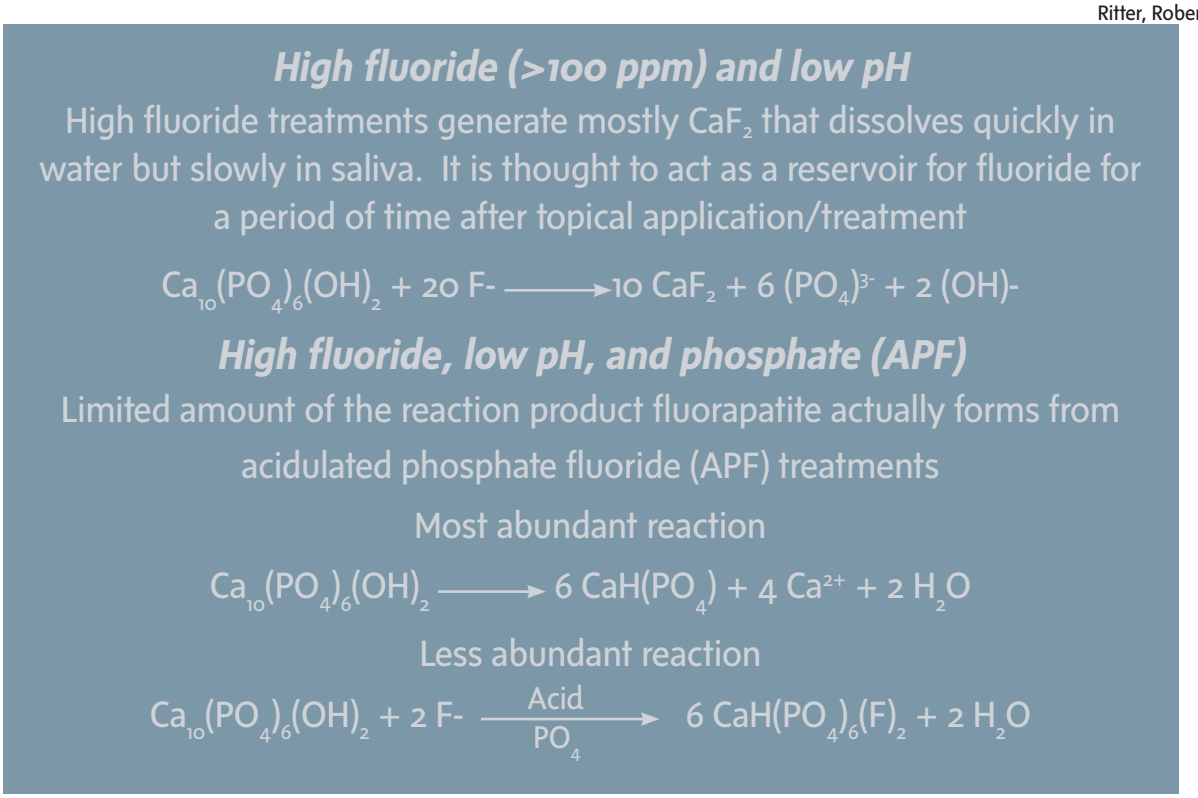

Figure 5: Enamel surface reactions with fluoride compounds. (*Image modified with permission from MW Roberts and JT Wright, "The Dynamic Process of Demineralization and Remineralization,"* Dimensions of Dental Hygiene *2009;7(7):16-21.*)

tion agent. It is commercially available in many delivery methods, including drinking water, toothpaste, rinse, gel, foam, varnish, chewing gums, and some restorative materials and dental cements. Concentrations of fluoride products, and their specific chemical composition, vary according to their presentation form and prescribed use (i.e., over-the-counter [OTC] or professional). The presence of fluoride in the biofilm limits demineralization and stimulates remineralization of the hydroxyapatite crystal. Fluoride ions react with the partially dissolved enamel crystallites and attract calcium and phosphate ions in the saliva to the demineralized dental enamel. Fluoride's mechanism of action depends therefore upon calcium and phosphate ions being available in the saliva and/or biofilm on the tooth surface. When these ions are bio-available, the increased deposition of fluoride into the crystallites produces an enamel that is physically harder and more resistant to acid dissolution than hydroxyapatite with a lower fluoride content.

The effectiveness of fluoride for the management of caries is mainly related to its bio-availability or application frequency, and not to its concentration. Frequent exposure to low concentrations of fluoride is thought to produce a better remineralization environment than less frequent exposure to high concentrations of fluoride.[10] This can be achieved by the regular ingestion of fluoridated drinking water, daily use of OTC oral rinses containing 0.05% sodium fluoride, and the regular use of dentifrice or chewing gum containing fluoride.[24]

Periodic, professionally applied topical fluoride agents are also beneficial to prevent demineralization and stimulate remineralization. These are usually delivered via gel/foam, solution, or var-

...it is important to note that a sole focus on the remineralization of isolated enamel white spot lesions, no matter how successful, does not address the multifactorial nature of dental caries as an oral disease.

Figure 6: Topical 2% sodium fluoride varnish can be used as a remineralizing agent in caries control.

nish **(Fig 6)**. The American Dental Association (ADA) has approved the use of professionally applied topical agents 1.23% acidulated phosphate fluoride (APF) gel/foam, 8% stannous fluoride solution, and 2% sodium fluoride gel as being clinically effective in the prevention of dental caries.[25]

European studies of a varnish containing 5% sodium fluoride also report caries-preventive benefits similar to APF gel/foam when applied topically to the teeth.[26-28] Because similar studies have not been done in the U.S., fluoride varnishes are approved only for use as cavity liners and treatment of hypersensitive teeth by the U.S. Food and Drug Administration.[25] However, the ADA Council on Scientific Affairs recently endorsed the use of varnishes containing fluoride as caries-prevention agents.[25] Fluoride varnish is now widely used in U.S. Public Health Service programs for children, particularly in Head Start programs. The ADA panel concluded that there is strong evidence from systematic reviews of randomized controlled trials (Level 1a) that fluoride gel applied for four minutes every six months, and fluoride varnish applied every six months are effective in preventing caries in children and adolescents.[25] The time interval between applications may decrease as the caries risk increases. The topical application of aqueous stannous fluoride solution to the teeth has been shown to be effective in preventing dental caries but does not encourage the remineralization process as well as other topical fluoride products due to the deposition of tin ions on the tooth surface that can prevent optimal ion mobilization.[25] Furthermore, fluoride in varnish or other topical forms is widely used to "recharge" glass ionomer (GI) restorations, which is especially important on Class V restorations of geriatric patients for root surface lesions, and on Class I and II GI restorations on deciduous teeth.[29]

Calcium Phospate Derivatives

Remineralization by delivery of soluble calcium phosphate ions to the biofilm on the tooth surface has emerged in recent years as a possible strategy to remineralize white spot lesions. There are several types of calcium phosphate remineralization technologies currently available, including an unstabilized ACP product (Enamelon [Enamelon, Inc.; Cranbury, NJ]); a CPP-stabilized ACP product (Recaldent [Cadbury Enterprises; Melbourne, Australia]); a bioactive glass-containing calcium sodium phosphosilicate product (NovaMin, GlaxoSmithKline; London, U.K.); and an organically modified crystalline beta tricalcium phosphate product (Clinpro Tooth Crème [3M ESPE; Pymble, Australia]).

ACP is a reactive and soluble calcium phosphate compound that releases calcium and phosphate ions to convert to apatite and remineralize the enamel when it comes in contact with saliva. Forming on the tooth enamel and within the dentinal tubules, ACP provides a reservoir of calcium and phosphate ions in the saliva.[30]

CPP is a sticky, milk-derived protein that binds to AEP and bacterial plaque. CPP is used to stabilize ACP. Remineralization products have recently been introduced using CPP as a vehicle to deliver and maintain a super-saturation state of calcium and phosphate (ACP) at or near the tooth surface. Some of these products contain other caries-prevention agents, such as fluoride and xylitol (e.g., MI Paste Plus, GC America; Alsip, IL). Gum, lozenges, and topically applied solutions containing CPP-ACP have also been reported to remineralize white spots.[31,32] There is mounting evidence that CPP-ACP complexes, when used regularly, are effective in enamel remineralization.[17, 33-35]

Calcium sodium phosphosilicate contains calcium, phosphorous, sodium, and silica. It reacts with saliva, releasing $Ca^{2}+$, $P^{5}+$, and Na+ into the

oral environment. First the Na+ buffers the acid and then the charged Ca^{2}+ and P^{5}+ ions saturate the saliva precipitating into demineralized areas to form a new layer of hydroxyapatite filling the demineralized lesions.[36]

Crystalline beta tricalcium phosphate is another delivery mechanism for calcium and phosphate ions, at a 1:5 calcium:phosphate ratio (vs. 1:67 of hydroxyapatite and fluorapatite). Laboratory studies show that this product has good potential as an enamel remineralizing agent when used in conjunction with fluoride.[37]

While many of these new products appear promising as potential adjunctive remineralizing agents, none has sufficient clinical evidence to strongly support their efficacy as being equal or superior to conventional fluoride therapies.

Given the composition of these milk-derived products, clinicians should include documentation of dairy allergies when completing their patients' clinical health histories.

Resin Sealants

There is evidence that resin sealants are effective in preventing caries from developing in at-risk pits and fissures on teeth, and can prevent progression of early non-cavitated caries lesions.[38] When properly placed, resin sealants provide a physical barrier between the dental enamel and the oral environment, shielding the tooth surface from acid challenge. Sealants do not promote remineralization but they have been shown to be effective in arresting caries progression when properly applied to incipient demineralized occlusal lesions.[39] Fluoride-releasing sealants have also been developed and marketed. The manufacturers of fluoride-releasing sealants have claimed that their products promote remineralization by releasing fluoride in the immediate area adjacent to the sealant. There is, however, no clinical evidence that fluoride-releasing sealants perform better than non-fluoride releasing sealants in preventing dental caries.

Another strategy that has been recently introduced is the use of extremely low-viscosity resin sealants for infiltration of white spot caries lesions on smooth surfaces.[40] In situ studies demonstrate the ability of resin sealants, also called *infiltrants*, to prevent further demineralization under cariogenic conditions.[41] This technique can reportedly be used in free (i.e., facial and lingual) as well as in interproximal surfaces, but, similarly to the occlusal sealant technique, is highly subject to technique sensitivity. To date, there is virtually no clinical data on the performance of the technique.

Chewing Gum

The importance of saliva in the remineralization of demineralized hard dental tissues and the maintenance of optimum oral health is well established. Recently there has been renewed interest in the benefits of chewing gum as a means to stimulate saliva flow to prevent dental caries. Chewing gum increases the flow of saliva, resulting in an elevated presence of calcium and phosphate ions, and raises the pH of the biofilm. All of these traits are important to the remineralization process. Numerous studies have demonstrated the caries-preventing properties of frequent use of chewing gum sweetened by sugar alcohols such as xylitol and sorbitol.[42-49] In addition, chewing gums may contain some of the calcium phosphate derivatives discussed earlier (s.a. Trident Xtra Care [Cadbury] with Recaldent), which enhances their remineralization potential. Chewing gum, particularly sugar-free gum, may offer a valuable adjunct to a caries prevention and remineralization program.

Conclusions

At the tooth level, dental caries is characterized by a dynamic process of many cycles of demineralization and remineralization. The human body when under physiological conditions is able to maintain this balance in a healthy state (i.e., favoring remineralization). Remineralization is the body's natural process for repairing subsurface non-cavitated carious lesions caused by organic acids created by bacterial metabolism of fermentable carbohydrates. When intraoral conditions change at the biofilm, due to an imbalance triggered by poor oral hygiene, poor diet, or poor salivary conditions, the balance no longer favors remineralization and conditions favor demineralization. If demineralization-prone conditions are not reversed, the tooth will continuously lose mineral and cavitated caries lesions can develop.

Remineralization of incipient carious lesions is a conservative alternative to conventional caries removal and dental restoration. Fluoride ions in the presence of calcium and phosphate can promote remineralization by building a new surface on existing crystal remnants in subsurface demineralized lesions. This environment also favors the formation of fluoride rich enamel crystallites that have increased caries resistance.

The development and promotion of a robust caries prevention and remineralization regimen that discourages demineralization and encourages rem-

Sealants do not promote remineralization but they have been shown to be effective in arresting caries progression when properly applied to incipient demineralized occlusal lesions.

ineralization remains a challenge. Additional research is needed to identify new approaches to stimulate the beneficial effects of the remineralization process, reduce the incidence of dental caries, and optimize health.

References

1. Roberts MW. Dental health of children: where we are today and remaining challenges. J Clin Pediatr Dent. 2008;32(3):231-4.

2. Hugoson A, Koch G. Thirty-year trends in the prevalence and distribution of dental caries in Swedish adults (1973-2003). Swed Dent J. 2008;32(2):57-67.

3. Krol DM, Nedley MP. Dental caries: state of the science for the most common chronic disease of childhood. Adv Pediatr. 2007;54:215-39.

4. Naidoo S, Myburgh N. Nutrition, oral health and the young child. Matern Child Nutr. 2007;3(4):312-21.

5. United States Department of Health and Human Services. Oral Health in America. June 08. [Internet]. Available from www.surgeongeneral.gov/library/oralhealth.

6. Bloom B, Dey AN, Freeman G. Summary health statistics for U.S. children: national health interview survey, 2005. Vital Health Stat 10 2006(231):1-84.

7. Tomar SL, Reeves AF. Changes in the oral health of U.S. children and adolescents and dental public health infrastructure since the release of the Healthy People 2010 Objectives. Acad Pediatr. 2009;9(6):388-95.

8. Silverstone LM. The surface zone in caries and in caries-like lesions produced in vitro. Br Dent J. 1968;125(4):145-57.

9. Silverstone LM, Hicks MJ, Featherstone MJ. Dynamic factors affecting lesion initiation and progression in human dental enamel. part I. The dynamic nature of enamel caries. Quintessence Int. 1988;19(10):683-711.

10. Featherstone JD. The caries balance: the basis for caries management by risk assessment. Oral Health Prev Dent. 2004;2 Suppl 1:259-64.

11. Hicks J, Garcia-Godoy F, Flaitz C. Biological factors in dental caries: role of remineralization and fluoride in the dynamic process of demineralization and remineralization (part 3). J Clin Pediatr Dent. 2004;28(3):203-14.

12. Baehni PC, Takeuchi Y. Anti-plaque agents in the prevention of biofilm-associated oral diseases. Oral Dis. 2003;9 Suppl 1:23-9.

13. Gaffar A, Afflitto J, Nabi N. Chemical agents for the control of plaque and plaque microflora: an overview. Eur J Oral Sci. 1997;105(5 Pt 2):502-7.

14. Hicks J, Garcia-Godoy F, Flaitz C. Biological factors in dental caries enamel structure and the caries process in the dynamic process of demineralization and remineralization (part 2). J Clin Pediatr Dent. 2004;28(2):119-24.

15. Garcia-Godoy F, Hicks MJ. Maintaining the integrity of the enamel surface: the role of dental biofilm, saliva and preventive agents in enamel demineralization and remineralization. J Am Dent Assoc. 2008;139 Suppl:25S-34S.

16. Silverstone LM, Wefel JS, Zimmerman BF, Clarkson BH, Featherstone MJ. Remineralization of natural and artificial lesions in human dental enamel in vitro. Effect of calcium concentration of the calcifying fluid. Caries Res. 1981;15(2):138-57.

17. Yengopal V, Mickenautsch S. Caries preventive effect of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP): a meta-analysis. Acta Odontol Scand. 2009:1-12.

18. Zero DT. Recaldent—evidence for clinical activity. Adv Dent Res. 2009;21(1):30-4.

19. Burwell AK, Litkowski LJ, Greenspan DC. Calcium sodium phosphosilicate (NovaMin): remineralization potential. Adv Dent Res. 2009;21(1):35-9.

20. Rehder Neto FC, Maeda FA, Turssi CP, Serra MC. Potential agents to control enamel caries-like lesions. J Dent. 2009;37(10):786-90.

21. Hicks J, Flaitz C. Role of remineralizing fluid in in vitro enamel caries formation and progression. Quintessence Int. 2007;38(4):313-9.

22. ten Cate JM, Larsen MJ, Pearce EI, Fejerskov O. Chemical interactions between the tooth and oral fluids. In: Fejerskov O, Kidd EAM, editors. Dental caries: the disease and its clinical management. 2nd ed. Copenhagen: Blackwell Munksgaard; 2008.

23. Cury JA, Tenuta LM. Enamel remineralization: controlling the caries disease or treating early caries lesions? Braz Oral Res. 2009;23 Suppl 1:23-30.

24. ten Cate JM, Featherstone JD. Physicochemical aspects of fluoride-enamel interactions. In: Fejerskov O, Ekstrand J, Burt BA, editors. Fluoride in dentistry. 2nd ed. Copenhagen: Munksgaard; 1996. p. 252-72.

25. American Dental Association Council on Scientific Affairs. Professionally applied topical fluoride: evidence-based clinical recommendations. J Am Dent Assoc. 2006;137:1151-9.

26. Haugejorden O, Nord A. Caries incidence after topical application of varnishes containing different concentrations of sodium fluoride: 3-year results. Scand J Dent Res. 1991;99(4):295-300.

27. Borutta A, Kunzel W, Rubsam F. [The caries-protective efficacy of 2 fluoride varnishes in a 2-year controlled clinical trial.] Dtsch Zahn Mund Kieferheilkd Zentralbl. 1991;79(7):543-9. German.

28. Borutta A, Reuscher G, Hufnagl S, Mobius S. [Caries prevention with fluoride varnishes among preschool children]. Gesundheitswesen. 2006;68(11):731-4. German.

29. Markovic D, Petrovic BB, Peric TO. Fluoride content and recharge ability of five glassionomer dental materials. BMC Oral Health. 2008;8:21.

If demineralization-prone conditions are not reversed, the tooth will continuously lose mineral and cavitated caries lesions can develop.

30. Chow LC, Takagi S, Vogel GL. Amorphous calcium phosphate: the contention of bone. J Dent Res. 1998;77(1):6; author reply 7.

31. Cai F, Shen P, Morgan MV, Reynolds EC. Remineralization of enamel subsurface lesions in situ by sugar-free lozenges containing casein phosphopeptide-amorphous calcium phosphate. Aust Dent J. 2003;48(4):240-3.

32. Morgan MV, Adams GG, Bailey DL, Tsao CE, Fischman SL, Reynolds EC. The anticariogenic effect of sugar-free gum containing CPP-ACP nanocomplexes on approximal caries determined using digital bitewing radiography. Caries Res. 2008;42(3):171-84.

33. Reynolds EC. Remineralization of enamel subsurface lesions by casein phosphopeptide-stabilized calcium phosphate solutions. J Dent Res. 1997;76(9):1587-95.

34. Reynolds EC, Cai F, Shen P, Walker GD. Retention in plaque and remineralization of enamel lesions by various forms of calcium in a mouthrinse or sugar-free chewing gum. J Dent Res. 2003;82(3):206-11.

35. Llena C, Forner L, Baca P. Anticariogenicity of casein phosphopeptide-amorphous calcium phosphate: a review of the literature. J Contemp Dent Pract. 2009;10(3):1-9.

36. Reynolds EC. Calcium phosphate-based remineralization systems: scientific evidence? Aust Dent J. 2008;53(3):268-73.

37. Karlinsey RL, Mackey AC, Stookey GK. In vitro remineralization efficacy of NaF systems containing unique forms of calcium. Am J Dent. 2009;22(3):185-8.

38. Beauchamp J, Caufield PW, Crall JJ, Donly K, Feigal R, Gooch B, et al. Evidence-based clinical recommendations for the use of pit-and-fissure sealants: a report of the American Dental Association Council on Scientific Affairs. J Am Dent Assoc. 2008;139(3):257-68.

39. Oong EM, Griffin SO, Kohn WG, Gooch BF, Caufield PW. The effect of dental sealants on bacteria levels in caries lesions: a review of the evidence. J Am Dent Assoc. 2008;139(3):271-8; quiz 357-8.

40. Paris S, Meyer-Lueckel H. Masking of labial enamel white spot lesions by resin infiltration--a clinical report. Quintessence Int. 2009;40(9):713-8.

41. Paris S, Meyer-Lueckel H. Inhibition of caries progression by resin infiltration in situ. Caries Res. 2010;44(1):47-54.

42. Makinen KK. The rocky road of xylitol to its clinical application. J Dent Res. 2000;79(6):1352-5.

43. Birkhed D. Cariologic aspects of xylitol and its use in chewing gum: a review. Acta Odontol Scand. 1994;52(2):116-27.

44. Wennerholm K, Arends J, Birkhed D, Ruben J, Emilson CG, Dijkman AG. Effect of xylitol and sorbitol in chewing-gums on mutans streptococci, plaque pH and mineral loss of enamel. Caries Res. 1994;28(1):48-54.

45. Tanzer JM. Xylitol chewing gum and dental caries. Int Dent J. 1995;45(1 Suppl 1):65-76.

46. Imfeld T. Efficacy of sweeteners and sugar substitutes in caries prevention. Caries Res. 1993;27 Suppl 1:50-5.

47. Scheie AA, Fejerskov OB. Xylitol in caries prevention: what is the evidence for clinical efficacy? Oral Dis. 1998;4(4):268-78.

48. Scheie AA, Fejerskov O, Danielsen B. The effects of xylitol-containing chewing gums on dental plaque and acidogenic potential. J Dent Res. 1998;77(7):1547-52.

49. Makinen KK. Sugar alcohols, caries incidence, and remineralization of caries lesions: a literature review. Int J Dent. 2010;2010:981072. **jCD**



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AGD Subject Code: 257

The 10 multiple-choice questions for this Continuing Education (CE) self-instruction exam are based on the article, "Managing Early Stages of Dental Caries: Remineralization of Smooth Surface Incipient Enamel Lesions" by André V. Ritter, DDS, MS, Michael W. Roberts, DDS, MScD, and J. Timothy Wright, DDS, MS. This article appears on pages 84-93.

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1. **Which of the following combinations best assist in the remineralization of enamel?**

   a. Calcium, proteins and phosphates

   b. Proteins, phosphates and fluoride

   c. Phosphates, calcium and proteins

   d. Calcium, phosphates and fluoride

2. **Which of the following contribute to the demineralization of enamel?**

   a. Organic acids that raise the biofilm pH to over 7.0

   b. Dietary fermentable carbohydrates

   c. A biofilm with a neutral pH

   d. The bio-availability of minerals in the saliva

3. **The primary vehicle for delivering fluoride to demineralized enamel is:**

   a. acidulated phosphate.

   b. calcium phosphate.

   c. saliva.

   d. calcium fluoride.

4. **The remineralization process is favored over demineralization, when which of the following occurs?**

   a. Acidogenic properties of the biofilm are neutralized

   b. The pH of the biofilm is lowered to below 5.5

   c. The oral fluids have no calcium or phosphate ions available

   d. When high concentrations of calcium phosphate are on the enamel surface

5. **When the pH of the biofilm is above 7.0, which of the following occurs?**

   a. Demineralization of tooth structure increases

   b. White spot lesions progress to form a loss of the intact surface layer

   c. Bio-available minerals can be added back to partially dissolved enamel crystallites

   d. The acidogenic properties of the biofilm are activated

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AN OUTLINE FOR FULL-MOUTH RECONSTRUCTION

Gary Alex, DMD, Huntington, NY

1. Treat issues requiring immediate attention (pain, infection, broken teeth, etc).
2. Perform comprehensive examination and work-up (consult with specialists as required).
3. Fabricate diagnostic wax-up (we bill patient the cost of the wax-up).
4. Present case to patient.
5. Extract hopeless teeth.
6. Prepare teeth as treatment planned and fabricate provisionals using templates made from wax-up (alternative is to have laboratory fabricate provisionals).
7. Periodontal treatment/surgery as required (while the patient is in provisionals that can be removed for access).
8. Following healing from any periodontal treatment, reassess the teeth and supporting structures and modify treatment plan if necessary.
9. Create final preparations and impressions. Fabricate second set of provisionals or modify first set as required.
10. Carefully evaluate provisionals for esthetics, function, comfort, and stability. Make sure joints and supporting structures are also stable and comfortable. Work the case out in provisionals!
11. Send various photographs and solid model of the provisionals to the laboratory to use as a guide in fabrication of restorations.
12. Schedule various try-in appointments depending on the specific nature of the case. Place finished case once it is approved by both patient and dentist.

While there are **many** different schools of thought on how to sequence a full-mouth reconstruction, I like to first determine where I want the incisal edge position of #8 and #9 to be. This is crucial for esthetics and phonetics. I then determine where I want the lower incisal edges to be. The incisal edge position of the lower anterior teeth helps determine the lingual contours of the upper anterior teeth. I like to then set up an "ideal" lower incisal and occlusal plane and match the upper to this. It is extremely important to have properly positioned and contoured lower incisal edges and a correct incisal and occlusal plane established. Almost all my full-mouth cases are built in centric relation.

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