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JOURNAL of Cosmetic Dentistry



VOLUME 26 • NUMBER 1
SPRING 2010

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JOURNAL of Cosmetic Dentistry

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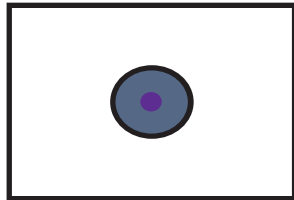
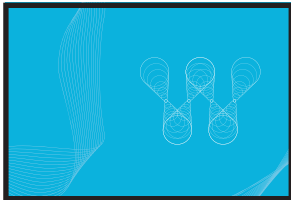
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TRAIN TO PARADISE

My friend, mentor, and colleague Dr. David Hornbrook taught me an important lesson about dreams and goals; it is called the “Train to Paradise.” Imagine yourself on a journey. Your destination is off in the distance—it is your passion, your “paradise.” That does not mean that you are beginning in a bad place; rather, it means that where you have set your sights is simply closer to the things you are passionate about. The key is not about setting higher goals—the “train” is more about how you go about achieving those goals. It is a tool to gain the most from your potential, a way to maximize your effectiveness. It is a way to share your passions.

Imagine yourself on that fast-moving train, which is headed wherever you want it to go. The train will be making stops along the way, picking up “passengers”—family members, friends, patients, colleagues, etc. The real key is the way you give others the “ticket” to join you; it is in the way you share your passion and enthusiasm. Enthusiasm is the contagious element that sparks others’ interest in wanting to join you on this train. For example, how better to convince a patient of the healthiest and best treatment plan for them than to show them the destination with passion and enthusiasm in your voice? That is what will make people pay attention and listen; that is what will get others to begin a journey on their own train to their own paradise. As we see ourselves gliding along those high-speed rails, it is to a new, better place filled with passion and dreams to be realized and shared by all around us.

The *Journal of Cosmetic Dentistry (JCD)* has been on that train, speeding along from strength to strength. I am grateful to my predecessor, Dr. Tom Trinkner, who on one of those train stops along the way, took me on board with him, passing on the honor and responsibility of being editor for the past six years. In addition, my grateful thanks to our dedicated publications staff—Tracy Skenandore, Denise Sheriff, Lynnette Rogers, and Juliette Kurtz; their endless support, energy, and passion help to make the Journal all it can be.

You, our readers and contributors, are the fuel that drives this train. Please keep the train moving by continuing to submit manuscripts and potential cover photographs; it is your fresh ideas that make the *JCD* the best peer-reviewed journal in the field. To my colleagues on the *JCD*’s editorial board—you are the guiding system that keeps the train on the tracks; my sincere thanks for all your time and effort. A special thanks also to Nelson Rego, CDT, and Dr. Ed Lowe for helping me make tough decisions that editors have to make.

And finally, I am thankful for my dear friend and colleague Dr. Lowe, who will become the *JCD*’s new “engineer” (editor). I know that he will take you to an even greater paradise and continue to “wow” you with an amazing journal for years to come.

Until the next stop, yours in excellence,

Michael J. Koczarski, DDS, Editor

Generate More High-Quality New Patients

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Produced for Cheryl Bishop Fall 2009

Cheryl, You Have Options!

When most adults think of cosmetic dentistry or smile makeovers, they usually think about porcelain veneers. While many patients benefit from the immediate gratification of veneers, others want the most conservative option available. That is why at the Burgess Center for Cosmetic Dentistry, we also offer two orthodontic options - Powerprox Six Month Braces® and Invisalign®.

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*— Dr. Eric Burgess,
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5,000	8	40,000	\$2,000	\$24,000	12.5	100	\$50,000	2:1	\$350,000	15:1

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PRESIDENT'S MESSAGE



NEW DAYS—NEW WAYS

For almost a decade, Americans went on a spending spree. Retirement plans, 401K's, and bank accounts flourished with or without much management. Life was good. Thoughts of fiscal responsibility were far from our minds as the financial sector ballooned with com-

plex instruments meant to keep us confident, but ignorant of their implications.

Cosmetic dentistry was all the rage. Every week, ABC's exceptionally popular *Extreme Makeover* program presented amazing transformations as medicine and dentistry changed peoples' appearance and health, encouraging every viewer to consider improvements of their own. The resulting interest drove patients to our doors and changed the way dentistry fit into people's priorities and lives. For the American Academy of Cosmetic Dentistry (AACD), this meant record levels of membership and a heightened interest in what our organization had to offer. The dental community embraced the prosperity cosmetics offered and almost everyone wanted to learn what we seemed to know.

We overlooked the possibility that something other than the soundness of our programs and organizational strength could pose a threat to our Academy. In many ways, we thought that the recipe for success was inherent in our product and that prosperity would go on forever.

Then reality hit the AACD. Our nation's economy called a "code blue" as we learned that two costly wars and an array of financial instruments that not even experts could fully explain could make our economy collapse like a house of cards. As Americans focused their attention on dealing with the resulting economic hardships, spending habits changed. Luxuries were eliminated; necessities took priority. *Extreme Makeover* remained on television but its *Home Edition* focused on changing the living conditions of the needy and worthy—not restoring their appearance.

These universal changes could not help but impact the AACD. Although we have felt the effects from this economic downturn less than others, we still recognized our obligation to review how we run our Academy and how we serve our members. Understandably, the circumstances under which we must now function have brought

many issues to the forefront that we had never had to confront before.

Interest in cosmetic dentistry reached a peak during the *Extreme Makeover* phase. It still exists, but it has changed. Cosmetics are now in the mainstream, and patients and dentists alike are addressing esthetic issues in a different manner. Cosmetic dentistry is no longer segregated from other aspects of dental care. Rather, it has been incorporated into all areas of dentistry. Patients expect their dentists to be cosmetically competent and to bring esthetic considerations and expertise into any of the treatments they provide.

That said, it is time for us to "up our game." The knowledge we have gained over the past 25 years is unsurpassed. Yet we must acknowledge that the world has changed. We must repackage our efforts to share this knowledge with the rest of our profession. And through it all, we must remain organizationally efficient. Going forward, we must implement the following priorities:

1. Member Value: Simply stated, when members feel that organizational benefits are worth the price of their dues, it is easy to keep membership levels high. Especially in times of economic difficulty, the perceived value of membership must equate to more than simply dues paid. Increasing member value must be a dominant commitment. We must prioritize and work hard to continually upgrade the benefit of membership in the AACD. Efforts to make our credential stand for something significant in dentistry must continue. Building significance beyond our Academy would be an accomplishment of historic proportions.

Member value is what will determine our success in the future. Nothing else comes close. People must see new ways in which our organization can help them prosper; new ways that put into practice our core values of inclusion, education, diversity, and community.

2. Leadership: Like many associations, AACD is challenged in finding individuals willing to participate in leadership and philanthropy. We work hard for volunteers for our Give Back a Smile™ program, which forms the heart of our charitable program. Applicants for Board and Committee positions, while strong, would certainly benefit from more involvement. Our organization needs every member to find his or her own way to participate by contributing in at least one area of service. If we assume that others will take on these tasks and that we as individuals are not needed, our Academy cannot fulfill its potential.

continued on page 12

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ABOUT THE COVER

Simple and natural—that was what we were looking for when my photographer friend Stuart Dee and I set out to shoot the images for the cover of the Spring issue. No artificial studio lighting with three lights and a potpourri of reflectors, and no typical studio backdrop.

With a location like Vancouver's Stanley Park at our disposal and using nature as our backdrop, we set out on a crisp and sunny March afternoon armed with a Canon 5D Mark II (Canon USA; Lake Success, NY), two Photoflex Multidisc reflectors, a portable change room, and a bag full of makeup and accessories. It was an hour before sunset, and we selected a background of wild grass on the side of a hill. The image was shot in RAW format with a shutter speed of 1/250, an aperture value of $f/2.8$, and a focal length of 200 using a Canon EF70-200 $f/2.8$ IS USM lens.

Why use a good professional photographer like Stuart, who has 30 years of experience shooting in exotic locations all over the world? Why not shoot the photo myself (after all, I think I am a pretty good amateur photographer)? When I put this question to Stuart, he made it crystal clear: *"Ed...my cousin is a pretty good dentist, however I choose to see you for cosmetic work because you see things that she doesn't."* Touché.

For information on the clinical case, please turn to the Clinical Cover Story on page 76.

Dentistry and clinical photos: Edward Lowe, DMD, AACD Accredited Member (Vancouver, BC, Canada). Ceramic artistry: Nelson A. Rego, CDT, Smile Designs by Rego (Santa Fe Springs, CA). Cover photography: Stuart Dee, Stuart Dee Photography (Vancouver, BC, Canada).



Preoperative



Postoperative



PRESIDENT'S MESSAGE CONTINUED

3. Critical Issues: Several important issues that have been simmering for years have recently risen again in the Academy, sparking passionate debate. These issues are a result of legitimate attempts by members to guide the AACD toward a more successful future. Most often, organizations rely upon their bylaws to help them sort through discourse or difficult dilemmas; however, these events have led us to understand that our governing documents need critical attention because they sometimes provide little guidance when certain important questions or issues arise. This year, several of these issues arose:

- Increasing the pool of candidates eligible to serve our Academy as Vice President, President-Elect and, ultimately, President by:
 - Expanding the two-year Board of Director (BOD) service requirement to include other areas of service, such as the American Board of Cosmetic Dentistry (ABCD), Board of Trustees (BOT), and/or other committees.
 - Eliminating the Accreditation requirement so that General members may be considered.
 - Broadening eligibility beyond dentists and laboratory technicians.
- Eliminating AACD membership requirement as a prerequisite for pursuing Accreditation.

Recognizing the need for extraordinary study of these critical issues, I chose to appoint an ad hoc committee, the Review and Advisory Commission, whose duty is to examine all of these issues. The Review and Advisory Commission will examine and deliberate all facets and perspectives of these propositions and any related issues and will put forth a comprehensive report to our Board of Directors and then to our membership at our Annual Scientific Session in Grapevine, TX. The Commission comprises AACD members who represent different eras and areas of our Academy. With this information, background, and thoughtful evaluation in hand, our membership will be in a better position to decide how to proceed, knowing that the issues have been thoroughly discussed and evaluated in an open, honest, and healthy forum.

With all the aforementioned challenges, you might think that I am worried about the future of the AACD. That is quite untrue. Although we face challenging times, we have an Executive Office staff that is the envy of other organizations. Although we have fewer members applying for leadership positions than we had hoped, we still have an excellent new generation of leaders coming up that will keep the Academy strong.

In past issues of our newsletter, the *Academy Connection*, I wrote about the excellent service of this

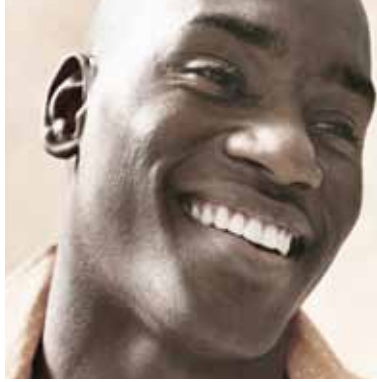
year's BOT and ABCD. I would also like to acknowledge the thoughtful dedication of our BOD. They have demonstrated a great passion and resolve to guide our Academy through the challenges presented. I cannot say enough about my pride in working with them. Having watched them learn and better understand the process, I have full confidence that what they experienced this year will serve them well for the rest of their tenure.

In closing, I would like to acknowledge that it has been an honor and privilege to serve the Academy as your president. This is my last President's Message for the *Journal of Cosmetic Dentistry*. I hope that I touched on subjects pertinent to the issues we faced this past year. Although we have gone through one of the worst economic times in our nation's history, we have the foundation set to focus on giving our members value, thus positioning our Academy for a great and prosperous future. I look forward to seeing you in Texas!

My best wishes to you and yours,



Michael R. Sesemann, DDS
President
AACD Accredited Fellow
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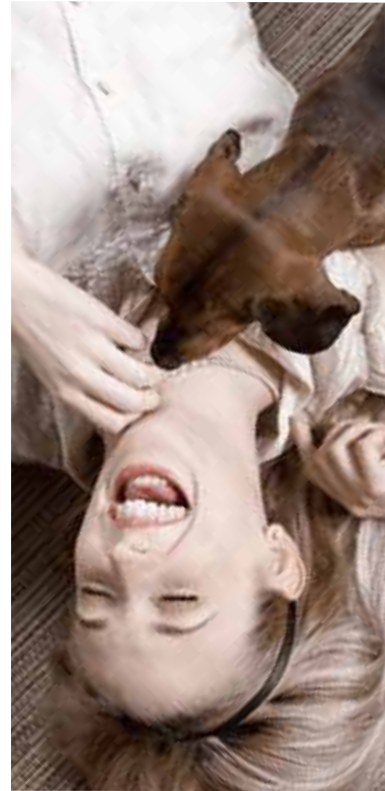
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FIVE WAYS TO SEE YOUR FUTURE AT AACD DIGITAL WORLD



by Gary Hult
AACD Professional Education
Committee Co-Chair
St Paul, MN
grhult1@mmm.com

INTRODUCTION

For the first time ever, at the 26th Annual AACD Scientific Session in Grapevine, Texas, April 27-May 1, 2010, the AACD will showcase new technologies from around the globe under one roof.

How long will it be before virtually everything done in the dental office or laboratory is controlled by digital technologies? How will this impact workflow processes, and how can you best prepare to integrate existing and future technologies into your business?

AACD Digital World is a comprehensive display area of existing and future digital technologies that will shape dentistry in the years to come.

FIVE WAYS IN WHICH ADVANCED TECHNOLOGIES CAN HELP TAKE YOUR PRACTICE INTO THE FUTURE

DIAGNOSIS AND TREATMENT

Digital technologies provide unique means to detect caries and access occlusal function. Digital radiography and cone beam imaging provide data input to digitally design treatment plans and share this information between the restorative dentist, laboratory technicians, and specialists via the Internet. Not only does this help to increase predictability during treatment and fabrication, but the convenience it creates also will increase the frequency of comprehensive planning and help to promote responsible esthetics (Fig 1).

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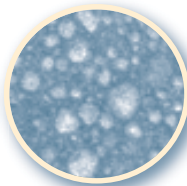
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Surface roughness of nano and microfill resin-based composites. A. Cotelan, P.H. dos Santos, A.K.B. Bedran-Russo. J Dent Res 88 (spec issue B): 592, 2009. (www.dentalresearch.org)

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DATA SCANNING

There has been a tremendous increase of digital scanning of poured casts and impressions or intraoral scanning as an alternative to traditional impressions. Digital technologies help to increase accuracy and consistency during workflow processes by eliminating the effects of inaccurate impressions, improper handling and pouring of impressions, inconsistencies of stone mixture, wear of stone casts during restoration fabrication, etc. Digital impression making can capture the most accurate information which, when processed digitally, can increase the accuracy of fabricated restorations to decrease seating adjustments and save time (Figs 2-5).

COMPUTER DESIGNING

The use of computer software to design restorations provides the laboratory technician with exceptional control. It is now possible to design very precise copings, bridge framework, and implant abutments in a variety of dental materials and full anatomy ceramic restorations. The software uses digitally captured information on preparations to accurately establish restoration margins and relationships to proximal and opposing dentition. It also allows the design of idealized coping thickness and support for porcelain overlay materials, and even designs specific thickness for the cement materials. The laboratory technician has incredible control, which increases the accuracy of fabricated restorations, saving time during restoration seating (Figs 6 & 7).

FABRICATION ENABLERS

Digital data and computer designing has a huge impact for computer assisted manufacturing (CAM). It also provides information that feeds into fabrication enablers to enhance the efficiency and accuracy of more traditional laboratory processes. Sophisticated wax and metal printing machines use the computer-designed information to create precise forms to allow accurate porcelain pressing and investment of metal copings and bridge framework.

CAM

Computer assisted manufacturing has taken over the manufacture of incredibly powerful computer chips, milling of intricate machine parts which require extremely high specification control, laser cutting of various soft to hard materials, etc. With the ability to capture data and use of computers to control design, it would be foolish not to utilize sophisticated technologies in dental manufacturing processes. Software programs today can precisely manage milling of various material restorations and enhance laboratory efficiency through continuous manufacturing without onsite supervision (Figs 8-10).

EVERYTHING DIGITAL

Computers make it possible to capture intraoral information to use in treatment planning, design restorations, and control the manufacturing of restorations, thereby minimizing variables that cause poorly fabricated, poorly functional, or non-esthetic, restorations. Digital technologies even facilitate training of dentists and laboratory technicians to elevate artistic skills to create preparations, place direct restorations, and hand-craft laboratory restorations. Continuous advances in digital technologies and educational training will create a future that benefits everyone. Patients will benefit from conservative, meticulously controlled, accurate, and responsible treatment planning resulting in better, longer-lasting restorations and improved oral health. Dental professionals will experience more convenience and reduced stress.

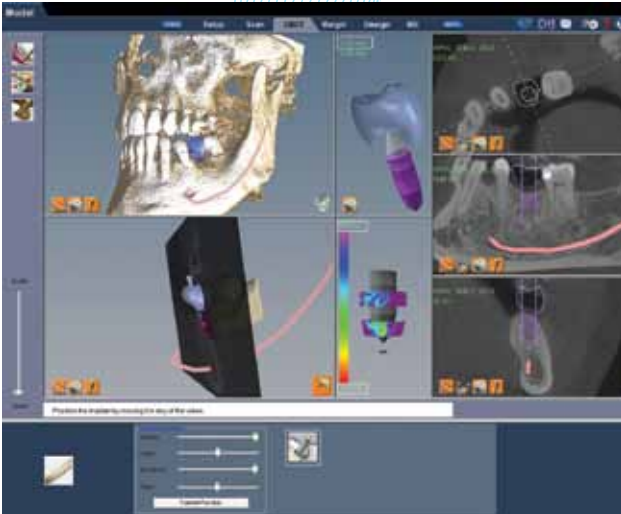


Figure 1: Implant position using E4D Compass software (D4D Technologies, LLC.; Richardson, TX).



Figure 2: iTero digital impression system (Cadent, Inc.; Carlstadt, NJ).

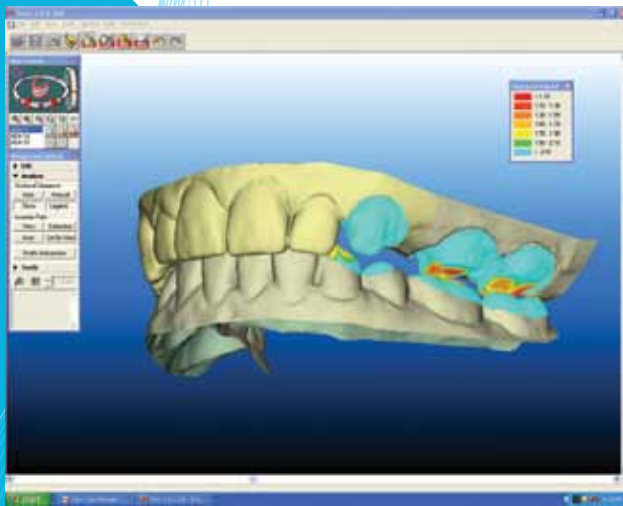


Figure 3: The iTero (Cadent) on-screen visualization of the scan in real time ensures that preparations are properly designed and that there is adequate occlusal clearance.



Figure 4: Lava chairside oral scanner (3M ESPE; St. Paul, MN). Lava "3D-in-motion" technology allows the dentist to capture and simultaneously view continuous 3D video images to create a digital impression. The system is flexible for prescribing porcelain-fused-to-metal and CAD/CAM restorations.



Figure 5: E4D Dentist's intraoral laser scanner (D4D Technologies, LLC).



Figure 6: Digital coping design using scans from E4D Flash 6 (D4D Technologies, LLC).



Figure 7: Lava ST Scan (3M ESPE). Precise, high-quality scanning and user-friendly software allows the laboratory technician to optimize designs for copings, implant abutments, and full contour, resulting in exceptional accuracy and fit of restorations.



Figure 8: CEREC AC (Sirona; Charlotte, NC) has high precision, ease of use, and exceptional speed, whether for single units, full arches, or anything in between.



Figure 9: E4D milling center (D4D Technologies, LLC).



Figure 10: Lava CNC 500 (3M ESPE). Computer automated milling machines continue to evolve to offer 3- and 5-axis milling and the ability to mill multiple materials. They can be programmed to run for 76 hours straight for greatest productivity.

SUMMARY

These technologies will have a tremendous impact on dental practices, as well as the working relationships dentists have with others—laboratory technicians, specialists, manufacturers and, most importantly, patients. AACD Digital World offers a tremendous opportunity to see a wide variety of such technologies. The knowledge you will gain will help you determine to what extent and in what time frame you want to incorporate them into your individual situations. But if do not attend the 26th Annual AACD Scientific Session, you may miss out on seeing your future.

If you are not registered yet, there is still time. First, book your flight to Dallas, come to the Gaylord Texan (just a six-minute drive) and register at the AACD conference registration desk. We welcome you to be a part of this highly anticipated event!



ON TARGET: PART III— TRANSFORMATIONAL LEADERSHIP LEADS TO INCREASED PRODUCTIVITY



by Cathy Jameson
Davis, OK
www.jamesonmanagement.com

Editor's note: This article is based on a lecture held at the 25th Anniversary AACD Scientific Session in Honolulu, Hawaii.

INTRODUCTION

Leadership is the key to productivity and is critical to the development and maintenance of a healthy organization. Is the answer to the question of how to control healthcare costs to turn this immense area over to the federal government, or could a possible answer be to improve the leadership skills of the owners/providers for the purpose of keeping healthcare in the private sector?

Those who are in leadership positions benefit, as do their organizations, from a continuous study of this imperative role

Leaders are not "born"—their skills are developed. Leaders can study and implement effective strategies in their organizations. In fact, those who are in leadership positions benefit, as do their organizations, from a continuous study of this imperative role.

TRANSACTIONAL LEADERSHIP

There are two basic types of leadership: Transactional and transformational. Transactional leadership focuses upon interactions either between people or between the organization and the work being provided by an employee. With this type of leadership, the leader dictates to the followers what they will do and how they will do it. The leader indicates requirements and the results that are to be accomplished. Rewards for

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fulfilling these requirements are outlined by the leader.

With transactional leadership the employee is rewarded for his or her work, depending on the quality of that work. This “contingent reinforcement” is either positive or negative, depending upon the situation and circumstances of performance.¹ Transactional leadership is hierarchical, meaning that there is a top-down type of authority. The requirements and ramifications of a position are told to the employee with little, if any, input from the employee.

TRANSFORMATIONAL LEADERSHIP

On the other hand, transformational leadership focuses on the development of the individual, not just as an entity that is a part of the whole. The importance of the individual is primary. Transformational leadership exemplifies the following characteristics:¹

- “Stimulate interest among colleagues and followers to view their work from new perspectives.
- Generate awareness of the mission or vision of the team and organization.
- Develop colleagues and followers to high levels of ability and potential.
- Motivate colleagues and followers to look beyond their own interests toward those that will benefit the group.”

With transformational leadership, employees are more motivated to accomplish tasks and to stretch beyond expectation. In an environment where talented people are challenged, respected, and trusted to perform above past capabilities,

unexpected growth is accomplished. When leaders’ expectations are high, employees rise to those expectations.

Through the integration of transformational leadership, an organization will not only survive but will also thrive, even in tough times.² Transformational leaders inspire and motivate employees to achieve excellence and to become leaders themselves. They empower workers and make sure that the individual goals of each person are aligned with their unique talents and abilities. These employees have the capability of becoming an asset to the organization as a whole.²

Transformational leadership focuses on the development of the individual, not just as an entity that is a part of the whole.

FOUNDATIONS OF TRANSFORMATIONAL LEADERSHIP

There are four foundational components of transformational leadership. They are called the “Four I’s: Idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration.”¹ Each has its own characteristics and benefits.

- **Idealized influence.** There is a culture of trust in this environment; employees are not afraid that when they make a mistake they will be fired, embarrassed, ridiculed, or otherwise punished. The employees want to do a good job for the leader because they “idealize” this person. However, they are also motivated to perform well because of their pride in their own

work and in their own growth and development.

- **Inspirational motivation.** The leader continuously lets people know that each aspect of their job is critical to the accomplishment of the whole and that the mission of the organization cannot be met without their input and participation. The leader is passionate about the purpose of the work that is the core of the organization, and the enthusiasm held for this work is evident in all activities.
- **Intellectual stimulation.** Education is a part of the organization’s culture. Employees see the leader continuing to learn and model a commitment to this continuous improvement. In the same light, the leader is always encouraging members of the organization to do the same thing, knowing that talented people will stay in a place where they are respected and encouraged to grow.
- **Individualized consideration.** While the needs of the organization cannot be compromised for the individual, the two can become compatible. The transformational leader will work to align the appropriate goals for a compatible work relationship between the individual’s goals and the needs of the organization. A talented person may be in the wrong position but this does not mean that their goals are incompatible with the organization. Often, a shift in role responsibility will allow a talented team member to thrive—rather than depart.

Employees want feedback—both constructive advice on how to im-

prove and positive reinforcement for work well done. Constructive advice and coaching for the purpose of improving performance are essential. However, the communication skills used for this kind of exchange must be based on a mutual desire for improvement and must be done from a place of care and respect.

The transformational leader understands and appreciates the fact that employees have a life outside of work and that this life of family, personal activity, and community involvement are essential to a person's happiness.

The goals of both the individual and of the organization must be valued and respected, and when a transformational leader fulfills the Four I's he or she has the opportunity to impact the lives of employees in a positive and constructive manner.³ In this atmosphere, employees respect their employer, are more likely to perform at a higher level, and give extra effort to ensure excellent results. In an environment of transformational leadership, people will demonstrate a higher level of "self confidence, high energy, personal conviction, power, and assertiveness."³

While financial challenges within the healthcare profession continue to gain momentum, outstanding leadership can make the difference as to whether or not an organization can continue to be profitable and stable. Transformational leadership can make this difference.⁴

In contrast, transactional leadership has been described as a dogmatic leadership style that is focused on cost containment, economic considerations, and completion of tasks.⁴ While all of these are essential in the everyday running of an or-

ganization, concentration on these factors to the exclusion of focus on the individuals could lead to disaster for the organization. The balancing of responsibilities for those in leadership positions is difficult and demanding. The transformational leader must pay attention to these daily activities that ensure the financial health of the organization, but the organization thrives when the leader commits to excellent and continuous communication, is competent in decision making, becomes inspirational to employees, and provides personal attention to team members.⁴

TRANSFORMATIONAL LEADERSHIP CHARACTERISTICS

Transformational leadership that accomplishes excellent results is grounded in certain dominant characteristics:⁵

- Nurturing the creativity of employees so that new and exciting ideas can evolve.
- Living the vision and mission of the organization in every interaction and in every decision that is made.
- Encouraging people within the organization to stretch beyond their own imagination.
- Inspiring and motivating people to look outside of themselves for the purpose of serving others both in and out of the organization.
- Serving as a vehicle for people to find ways to make a difference in the organization, in the lives of clients/customers/patients, and to make a difference in the world.

Transformational leadership characteristics provide a means

by which employees can find fulfillment in their work and in the organization that employs them. Leaders must be ever mindful of the need to provide feedback to employees showing evidence of the value that they bring to others. "The results of transformational leadership studies show that people are more engaged, more devoted, and less self-concerned employees, and that they perform beyond the level of expectations."⁶

Some researchers believe that transformational leadership skills can be learned⁷ and that there is evidence that organizations can perform an evaluation of the current leaders and determine the existing skill level.⁷ Then, a plan of education and development can be created. New people do not have to be hired; those already present can be taught. Transformational leadership "arouses awareness and interest in groups or organizations, increases confidence of individuals or groups, attempts to move concerns of subordinates to achievement and growth rather than existence."⁷

SUMMARY

In the rapidly changing world of healthcare, the ever-increasing demands for excellent leadership are evident. Healthcare providers will be required to excel in areas in which they have received no formal training: Business management, financial management, personnel management, leadership, marketing to a sophisticated public, strategic planning, establishing and sharing a vision of the ideal practice or organization, delegation of responsibility, accountability, compensation, and leadership of all of the above. In addition, providers must create an

JAMESON

environment that attracts the new "knowledge workers" and develop a situation that is not only interesting to them, but also fulfilling and rewarding—both personally and financially. In order to do this, development of leadership qualities and skills is imperative.

Leadership courses can be developed and taught, and these skills can be learned and implemented in practices. Doctors must not only provide optimum care for patients but must be able to communicate more effectively to these patients and to team members, as well. Attracting, hiring, and retaining quality team members is a consistently challenging task and one that must be addressed, whether in a large

corporate healthcare situation or a small private practice. Leadership may be the best answer to the issues facing healthcare today. So, again, is the answer to reducing costs of healthcare to turn healthcare over to the government, or is a possible answer to improve the leadership and management of the private practice in the private sector for the benefit of both provider and patient alike?

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- Dr. Gina Reinhardt & Dr. Leslie Moore

DIGITAL PHOTOGRAPHY: THE AACD SERIES—PART ONE



by
Edward Lowe, DMD
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www.mysmilemakeover.com

Editor's note: Dr. Ed Lowe demonstrates in a chairside setting the 12 AACD Accredited photographic views, and valuable tips on how to take them quickly and efficiently, in an AACD online CE course at www.aacd.com, which complements this article.

INTRODUCTION

"A picture is worth a thousand words." How often have we heard this cliché? One of the most rewarding things we can do as a cosmetic dentist is to change a person's life by taking their smile from ordinary (or worse) to spectacular. But it is a shame that beautiful clinical outcomes often are not accurately represented in journals, ads, and on Web sites by photographs that do not do justice to the dentistry.

It is very simple to take a good photograph if one has proper equipment, a little training, and some knowledge in the basics of photography.

It is very simple to take a good photograph if one has proper equipment, a little training, and some knowledge in the basics of photography.

We are exceptionally fortunate that digital photographic equipment has evolved to the level we see today. The ability to capture numerous images on a high-capacity flash memory card and the ability to immediately review the image on the liquid crystal display (LCD) viewer has liberated us from the confines of film and the inconveniences of the photo processing lab. This savings in time alone makes digital photography more affordable and less daunting than film photography. It is fun, and so easy that anyone can learn to obtain great images with just a little training.¹



Image courtesy Norman Camera, Kalamazoo, MI

Figure 1: Ring flash system.

I am very passionate about photography and I encourage everyone not to be apprehensive about what to do or how good his or her pictures are. I have taken a lot of bad pictures in order to acquire the skill and knowledge to take good ones. This article discusses how to simplify the taking of digital images. Once you have set up your camera for digital dental photography, very few adjustments are necessary to take all of the AACD Accreditation photographs.

I use a camera body that offers through the lens (TTL) viewing. This means that when you look through the viewfinder, what you see is what you will get in the final image. Small point and shoot cameras that are

not a digital single lens reflex (SLR) are not considered adequate for this caliber of photography.

THE CAMERA SYSTEM

A digital camera with a 100-mm macro lens and removable mounted flash is recommended for best results. This is a long lens and may be cumbersome for some dental assistants to handle; it takes a bit of getting used to. This kind of camera with lens and flash can be purchased at many photography stores or online. You can find a system that offers a camera body, lens, and ring flash for less than \$2,000 USD.

Many practitioners choose a ring flash for ease of use (Fig 1). Some are enthusiastic about the twin

point flash system. The ring flash exposes the subject to light from every angle, yet it tends to “flatten” details such as facial anatomy in your beautiful porcelain veneers. A twin point flash gives better reproduction of surface detail, but it is a little larger than the ring flash, more expensive, and somewhat more cumbersome to use (Fig 2). It is really a matter of personal preference.

Images of the required AACD Accreditation views are captured at one of three magnification ratios (1:10, 1:2, and 1:1). These magnification ratio numbers are carried over from analog (film) photography, so you must make any necessary conversions to produce photos at a magnification comparable to the images shown in this article and in the AACD’s current *Guide to Accreditation Photography*.³ Lens magnification conversion is needed for many digital SLR cameras without full frame sensors. Settings will vary with sensor and patient face size. Cameras with smaller sensors will require about a 1.5 times increase in the setting on the lens barrel. The numbers are closer to 1:15 for portraits; 1:3 for smile and retracted views 2 through 7, 11 and 12; and 1:1.5 for the close up retracted views. It is easy, as the ratios are etched or printed on the barrel of the lens (Fig 3).

OBTAINING OPTIMUM RESULTS

First, determine the focal length for each required AACD image. Look through the viewfinder at your subject’s smile. As you rotate the lens barrel while looking through the viewfinder, the focus of the image will change. It is easy because there are only three settings to think about. The first is for the portrait

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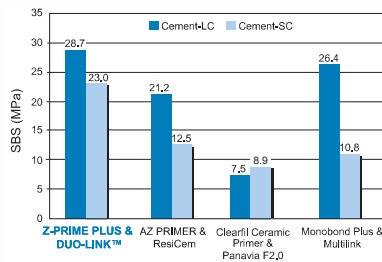
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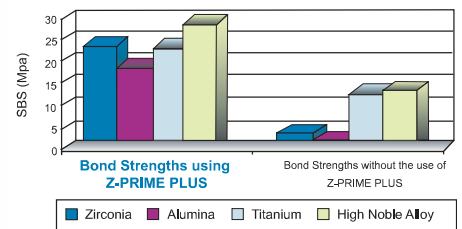


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Image courtesy Norman Camera, Kalamazoo, MI

Figure 2: Twin point flash system.



Image courtesy Dr. James Hastings

Figure 3: Magnification ratio 1:3 for views 2 through 7, 11 and 12.



Image courtesy Dr. Prashant Hatkar

Figure 4: Image taken at 1:3 magnification, ISO 200, aperture $f/29$, shutter speed $1/180$ seconds. Note good depth of field (image sharpness) back to the first molars due to low aperture setting ($f/29$).

photo, the second is for the normal smile and retracted views (1:3) (Fig 4) as well as the occlusal views, and the third is for the close-up retracted views.

Exposure is the process of recording light onto the digital sensor. More specifically, exposure is the amount of light over a specific period of time, as the light strikes the sensor (Fig 5a). The amount (intensity) of light is controlled by the aperture setting (discussed below), and the time is controlled by the shutter speed, measured in fractions of a second. The sensor's sensitivity is controlled by adjusting the International Organization for Standardization (ISO) number.

These three settings are called the *exposure triangle* (Fig 5b).

CAMERA SETTINGS

ISO: This number can be thought of as film speed. It controls the sensitivity to light of the camera's capture chip or sensor. The lower the ISO number (e.g., 100 or 200), the less sensitive the chip, the sharper the image, and more light is needed to obtain a good image. Conversely, a higher ISO setting requires less light, but the image obtained can be "noisy" or "grainy"; in other words, less sharp. For dental photography I recommend setting the camera to ISO 200. Many cameras will set the ISO automatically. This is not recommended for dental photography. If you have trouble with your camera's ISO setting, consult the vendor or the camera manual for instructions on setting the ISO by hand.

Aperture or f/stop: This important setting controls the amount (intensity) of light striking the sensor. Aperture settings, also called f/stops,

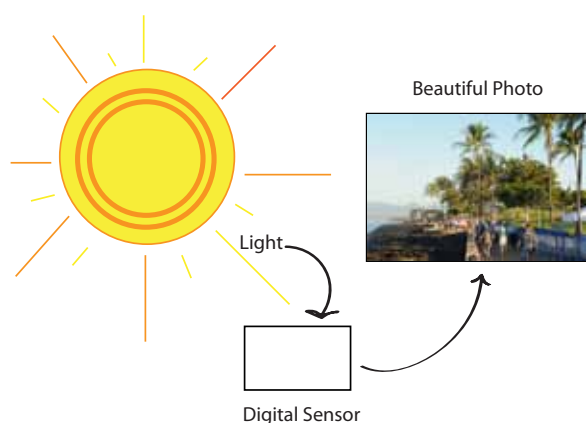


Figure 5a: Exposure.

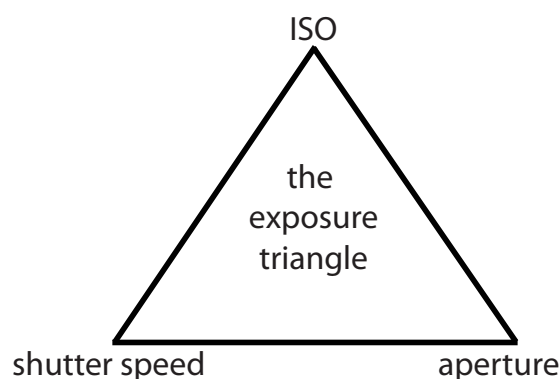
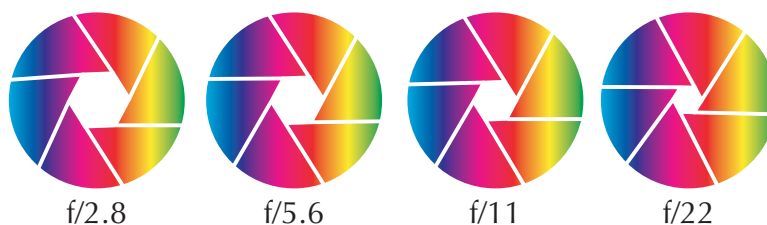


Figure 5b: Exposure triangle.



Sample f-stops. The smaller the number, the larger the lens opening.
(Not to scale.)

Figure 6: Sample f/stops. The smaller the number, the larger the lens opening.

are numbered from about $f/2.8$ to $f/32$ for most single lens reflex (SLR) digital cameras. It actually is an adjustable hole (aperture) in the lens through which the light passes (Fig 6). The f /stop affects depth of field, which is the amount of the subject that is in focus from front to back. The higher the f /stop number, the smaller the hole. A small hole means that less light will reach the sensor, resulting in a sharper image. The lower the f /stop number, the larger the aperture, allowing more light to reach the sensor; images will be less sharp.

Shutter speed: This is expressed in fractions of a second. In other words, $1/200$ of a second is simply written as 200.

The three settings discussed above are controllable variables. Light intensity is another controllable variable. As you will be shooting the AACD Accreditation views in artificial light rather than in sunlight, the flash can be adjusted to provide greater or less intensity of light, depending on your requirements. For a Canon 5D SLR, the flash is set at evaluative through the lens (ETTL) (Canon USA; Lake Success, NY) metering, with an exposure

setting of minus $1/3$. This may be different for Nikon and other camera/flash setups.

You may find that you need to experiment a bit to get just the right amount of light for correct exposure, by moving the flash setting up or down.²

White balance: This setting adjusts the camera so that colors in the image look natural. You will want to set your camera's white balance for flash illumination (Fig 7). If your images have a blue, red, or greenish cast, consult the camera's instruction booklet on how to manually set the white balance.



Figure 7: The miniature lightning bolt signifies that the white balance is set for flash operation.

View	ISO	Aperture	Shutter Speed	Lens
1 portrait	100-200	f/5.6	1/125-1/250	1:10 (1:15)
2 smile	100-200	f/18-29	1/125-1/250	1:2 (1:3)
3 smile right	100-200	f/18-29	1/125-1/250	1:2 (1:3)
4 smile left	100-200	f/18-29	1/125-1/250	1:2 (1:3)
5 retracted frontal	100-200	f/18-29	1/125-1/250	1:2 (1:3)
6 retracted right	100-200	f/18-29	1/125-1/250	1:2 (1:3)
7 retracted left	100-200	f/18-29	1/125-1/250	1:2 (1:3)
11 upper occlusal	100-200	f/18-29	1/125-1/250	1:2 (1:3)
12 lower occlusal	100-200	f/18-29	1/125-1/250	1:2 (1:3)
8 retracted close-up	100-200	f/29-32	1/125-1/250	1:1 (1:1.15)
9 retracted close-up right	100-200	f/29-32	1/125-1/250	1:1 (1:1.15)
10 retracted close-up left	100-200	f/29-32	1/125-1/250	1:1 (1:1.15)

Figure 8: Camera settings for the 12 AACD views.

RECOMMENDED CAMERA SETTINGS FOR THE 12 AACD VIEWS

Figure 8 shows the camera settings for the 12 AACD Accreditation views. Note that the numbers 1 through 12 correspond to the 12 AACD Accreditation views seen in the *Guide to Accreditation Photography* (they are listed out of numerical order here because it is easier to shoot them in this order, as there is less need to change the lens and aperture settings back and forth).

Taking high-quality digital photographs is simple and fun. I want you to get excited about photography and above all else, to take action and begin.

As my colleague Dr. Jim Hastings says, *“Photography is the one parameter in Accreditation over which the operator has complete control. Why not make it impeccable!”*

Part Two of this article will offer practical tips on how to quickly and efficiently take the 12 standard photographic views required for all Accreditation clinical case submissions.

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GIVING BACK MORE THAN A SMILE



by James M. Poyak, DDS
Scottsdale, AZ
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The AACD Charitable Foundation's Give Back A Smile™ (GBAS) program restores the smiles of domestic violence survivors at no cost.

We have received many success stories and thanks from GBAS volunteers and recipients. This section shares the triumphs of the GBAS program.

"There is tremendous happiness in making others happy, despite our own situations."

~ Author unknown

INTRODUCTION

Do you know how you feel when you give someone a gift, knowing how much he or she wanted it, and you see the appreciation in his or her face? Being able to share that experience with someone is one of those treasured moments in life. Doing so in my practice has made my work in dentistry even more rewarding.

Shortly after I joined the AACD, I read about their Give Back A Smile™ (GBAS) program and called to find out more about it. I learned how GBAS has helped victims of domestic violence who have incurred dental injuries as a result of that violence. According to the American Institute on Domestic Violence, "5.3 million women are abused each year, and 1,232 women are killed each year by an intimate partner."¹

Soon after placing the call, I received a packet with information about a GBAS applicant, "Patricia" (not her real name). When we contacted her, she was thrilled to be called after waiting on the list for three years. However, she also was apprehensive about what would be done and how she would get to our office; Patricia did not have a car. Fortunately, she was able to arrange for her brother, who lived in the area, to bring her.

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Figure 1: Patricia at her initial visit, showing the effects of the abuse: Caries, atrophy, and periodontal disease.



Figure 2: Retracted view showing the extent of the damage.

CASE REPORT

PATIENT BACKGROUND

Patricia presented with 19 teeth or, more accurately, two teeth and 17 roots, the remnants of the domestic abuse inflicted by her boyfriend. Unfortunately, abuse causes not only physical injuries, but also psychological ones. The physical scars can heal, but the psychological damage can last for years and have a significant impact on self-esteem. Patricia was no exception. When I met her, her eyes expressed exhaustion and a lack of enthusiasm (Fig 1).

DIAGNOSIS, FINDINGS, AND TREATMENT PLAN

Life had not been kind to Patricia's overall oral health. During the initial appointment, we performed a comprehensive examination and periodontal charting, and obtained a panoramic radiograph and di-

agnostic models. The radiograph revealed multiple abscessed teeth and remaining root tips. Patricia had 19 teeth or, more accurately, two teeth remaining that were not hopeless (Fig 2). The ridges were thin and narrow due to atrophy and periodontal disease. She had lost all posterior support many years ago. In addition, Patricia's appearance had aged prematurely due to the lack of supporting teeth, and she had been taking ibuprofen to relieve the pain from the abscesses for several months.

I discussed Patricia's overall condition with her and asked what her expectations were for a treatment outcome. She felt that the only solution was to extract all of the teeth and fabricate upper and lower dentures. Despite the trauma and damage to her teeth, I told Patricia that she still had two lower teeth

that could be retained and used as anchors.

After years of practicing dentistry, I avoid subjecting someone to full upper and lower dentures. According to a study by Yurkstas and Emerson,² the most efficient full dentures are only 12% as efficient as natural teeth. In an effort to avoid these statistics, a full maxillary denture and a partial denture retaining the lower right and left cuspids (Equipoise, Equipoise Dental Institute; Bergenfield, NJ) were planned.

TREATMENT

Treatment began by removing the hopeless teeth. After a two-month healing period, the endodontic therapy was performed on the lower right cuspid, followed by placement of the post and porcelain-fused-to-gold (PFG) crown. All laboratory work was graciously donated by Orchid Dental Ceramics (Niagara-on-



Figure 3: Retracted view of the full maxillary denture and lower partial denture.



Figure 4: Restored teeth and restored smile. Patricia's smile speaks volumes about how she feels about herself and the results of her GBAS treatment.

the-Lake, Ontario, Canada). The PFG crown was chosen based on the mesial rest seat and lingual design required on the crown for the clasp style of the partial.

At this point, Patricia was becoming very eager to eat and smile again. Impressions (System 3, Ivoclar Vivadent; Amherst, NY) were taken for both the upper denture and the lower partial and sent to the laboratory with an appropriate work prescription. After the usual series of appointments for framework try-in and centric and vertical records, we performed the esthetic try-in. At this point, some final esthetic changes were made and returned for processing and finishing.

Patricia's big day finally arrived! The dentures were seated and checked for fit at the borders and then the occlusion (Fig 3). Only minimal adjustments were required.

REWARDS

Patricia received her dentures that day, but she really was given so much more than acrylic, metal, and porcelain. She experienced the return of a huge dose of her self-esteem, and that is priceless. After I initially placed the lower partial and upper denture and checked the fit, I gave Patricia a mirror. Seeing the smile on her face and watching her reactions made the treatment incredibly worthwhile (Fig 4).

It is very moving to see how we can help someone change his or her life. Since the day I met Patricia, I have seen her personality and self-esteem blossom. I am thankful that I have a skill that I could share with her to help her overcome some of the physical damage of domestic abuse. Patricia expressed it best when she wrote, "[Dr. Poyak] gave me back part of me. So now I give

back a smile everywhere I go. Thank you. I love all of you guys. Thanks."

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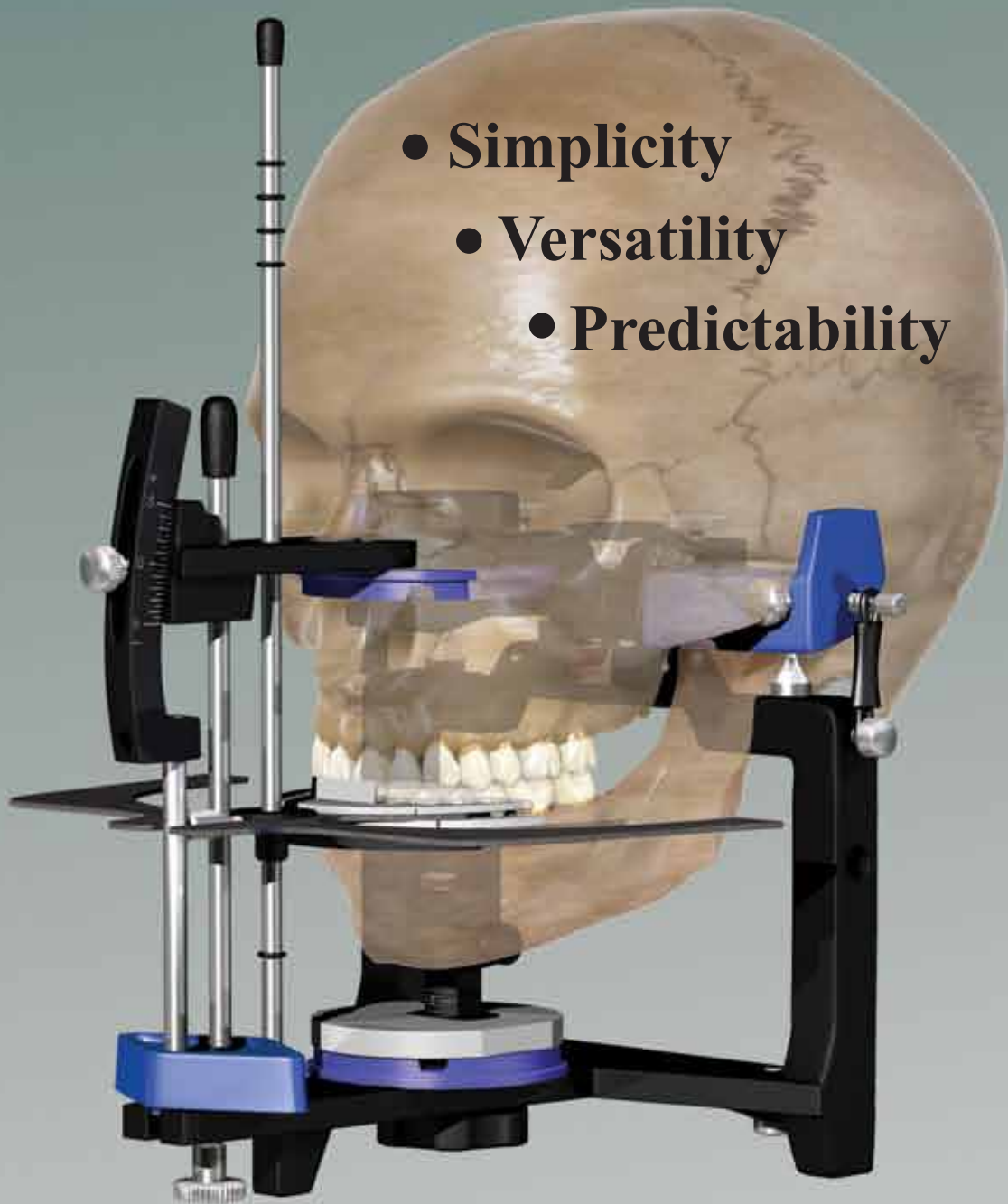


Correction

In the Winter 2010 (Volume 25, Number 4) issue of the *Journal of Cosmetic Dentistry (JCD)*, in the article, "Short-Term Orthodontics: A Vital Tool for Conservative Cosmetic Dentistry," by Dr. Ryan Swain, the clear composite brackets and the NiTi archwires mentioned on page 101 were produced by Six Month Smiles in Rochester, New York. The *JCD* regrets the error.

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ACCREDITATION ESSENTIALS

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INTRODUCTION TO ACCREDITATION ESSENTIALS



by James H. Hastings, DDS
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Placerville, CA
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"The minute you settle for less than you deserve, you get even less than you settled for."

— Maureen Dowd, Pulitzer Prize-winning columnist

The venture through AACD Accreditation can call for resolve in the face of adversity. The three-part examination is considered just that—an examination. It is a test of foundational knowledge, clinical competence, and patient management, as well as organizational ability. Determination to settle for nothing less than the best that one can produce is the mark of success.

A review of the Accreditation examination criteria (shown on page 42) illustrates that some case types call for more emphasis in some areas than others, yet many elements are common to all five case types. For example, Case Type V, Six or More Direct Resin Veneers, requires demonstration of excellence with direct resin placement as well as all elements of smile design.

Case Type II, One or Two Indirect Restorations, requires demonstration of clinical and diagnostic skills, as well as the ability to closely communicate with the technician who will fabricate the restorations. Smile design elements may not play as important a role in Case Type II, because this case type is more focused on perfectly matching an adjacent natural tooth. Depending upon the situation, restoring just one tooth may not call elements of smile design into play.

A discussion of Accreditation examination criteria is meant to illuminate for the reader the 45 different criteria that are used to score clinical case submissions, validating the fairness of the evaluation. The examination criteria are a method to make objective an essentially subjective process. The criteria are not meant to "teach the test."

With a more conservative and minimally invasive approach to dentistry, the ability to manipulate composite resin is more important than ever. It is not something to be taken lightly. If we aspire to be true artists in cosmetic dentistry, then this tool is compulsory in our armamentarium. This is what Case Type V demands of the Accreditation candidate. "Accreditation Essentials" section co-editor Dr. Ed Lowe offers several arguments in favor of becoming proficient in placing direct resin veneers:

"Mastering the art of direct resin makes us understand what goes into the fabrication of restorations, such as the subtle nuances of dental anatomy, shape, texture, and color." He adds that direct resin application teaches us about *"the arrangement of teeth and what makes one*

HASTINGS

smile more esthetically pleasing than another."

Dr. Lowe says, "We must possess the skills to handle situations such as:

- *mocking up a patient's smile in resin for a cosmetic preview and subsequent matrix fabrications for provisional restorations*
- *mocking up a patient's anterior teeth before taking an impression for the ceramist during the fabrication of "no-prep" veneers*
- *achieving direct composite resin restorations for a young patient whose dentition and skeletal growth has not fully matured and stabilized."*

He goes on to say: "Direct resin composite veneers make you think like a ceramist and the more you think like a ceramist, the better the esthetic outcome will be for your patient. How are we going to be able to communicate what

we want in a smile if we do not master the skill of designing and shaping teeth? We would be entirely dependent on our ceramists to create restorations with form, function, and esthetics. And we would be forced to sit on the sidelines and accept whatever they gave us in return."

In this issue of the *Journal of Cosmetic Dentistry*, we are pleased to present successful clinical case submissions from two fine cosmetic dentists: Dr. David Chan of Vancouver, Washington, who discusses his Case Type V; and Dr. Chiann Fan Gibson of Naperville, Illinois, who discusses her Case Type II. It is clear that neither of these Accreditation candidates is willing to settle for less than they deserve, as they have ably demonstrated here. Congratulations to both doctors on their successful efforts!

Dr. Scott Finlay, Accredited Fellow and Accreditation Examiner, offers the examiners' perspective on each case to assist the reader in honing his or her skills in self-evaluation.

Also included in this section is an interview with Dr. Larry Addleson, past Accreditation Chair (then Chairman of Education and Credentialing) and chairman of the AACD's first credentialing body, the Board of Governors, in 1999. Dr. Addleson was also AACD president in 2004-2005. He offers some unique insights into how the Board of Governors was created and how it began to shape the future of Accreditation.



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ACCREDITATION EXAMINATION CRITERIA

The items listed are designed to serve as a means of categorizing the examination findings and providing educational feedback for the Accreditation candidates. Although this listing is designed to be comprehensive, the criteria cannot encompass all potential clinical circumstances and should not be viewed as limiting examiner analysis and/or commentary.

10. WRITTEN REPORT / ORAL REPORT

11. Have the directions for providing the written report been followed including appropriate references?
12. Has Accreditation protocol been followed?
13. Are the photographic prints included and of good quality? Do they match the clinical digital images?
14. Does the written report demonstrate an understanding of the clinical disciplines necessary for successful completion of this case?

20. CASE SELECTION / DIAGNOSIS / TREATMENT PLANNING

21. Is case selection appropriate to achieve an optimal result in all views?
22. Is the choice of technique and material appropriate for the case?
23. Has function been considered in the choice of treatment (eg. occlusal forces)?
24. Have all necessary clinical disciplines been incorporated to achieve an optimal result (orthodontics, periodontal plastic surgery, etc.)?

30. PHOTOGRAPHY AND RADIOGRAPHY

31. Is the photography well done with proper exposure and composition?
32. Are all the required views shown according to the Accreditation Photography Guide?
33. Are x-rays appropriate to show marginal adaptation of all teeth required to be treated per the Accreditation protocol?
34. Is the photography free of excess moisture and debris?
35. Do the radiographs show problematic clinical issues (i.e. open, overhangs, pathology or other defects)?
36. Has digital photography protocol been followed?

40. ELEMENTS OF DENTAL ANATOMY

41. Is the emergence profile natural?
42. Is the labial anatomy (primary, secondary, and tertiary) appropriate? Are there three planes for the labial contour of the central incisor?
43. Have line angles been properly developed?
44. Is the surface finish, polish, and luster appropriate?
45. In the occlusal view, is the incisal edge position appropriate and is there a definite incisal edge?
46. Is the height-to-width ratio of the restored tooth (teeth) appropriate?

ACCREDITATION EXAMINATION CRITERIA CONTINUED

50. ELEMENTS OF COLOR/SHADE/APPEARANCE

51. Has underlying tooth color been properly managed to allow for an optimal cosmetic result?
52. Does the restoration have “show through” of tooth structure or the fracture line under the material?
53. Is the color (hue, value, chroma) selection appropriate/natural, not monochromatic?
54. Are effects of internal and surface color characterizations appropriate?
55. Is the degree of opacity realistic?
56. Is incisal translucency and halo effect appropriate?

60. PROSTHODONTIC ELEMENTS

61. Is margin placement and design appropriate? Are the margins visible?
62. Is there evidence of cement or resin at the margins?
63. Was an appropriate pontic design selected and was it developed properly to ensure optimal tissue health and contour?
64. Is the interproximal contact or connector proper in length and position?
65. Is the choice of luting material appropriate?
66. Is there evidence of iatrogenic damage to adjacent, opposing or treated teeth?
67. Is the tooth preparation inappropriate or excessive?

70. PERIODONTAL ELEMENTS

71. Is the periodontal health optimal?
72. Is gingival architecture appropriate (in all views) and in harmony with smile design?
73. Should gingival recontouring, shaping, and/or ridge augmentation have been done?

80. SMILE DESIGN ELEMENTS

81. Are incisal edges in harmony with the smile line?
82. Is the midline appropriate?
83. Is the axial inclination appropriate?
84. Are the incisal embrasures proper? Is there a natural progressive increase in the incisal embrasure size from the central to cuspid?
85. Are the principles of proportion and central dominance appropriately used?
86. Is the cervical/incisal tooth length symmetrical from right to left?
87. Are contra-lateral teeth in harmony in terms of size, shape and position?
88. Is the buccal corridor properly developed?
89. Are the cervical embrasures proper? No dark triangles?

ACCREDITATION CLINICAL CASE REPORT, CASE TYPE V: SIX OR MORE DIRECT RESIN VENEERS



by David K. Chan, DMD
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INTRODUCTION

With contemporary direct composite veneering systems, the clinician can now be an artist by conservatively and esthetically creating restorations that are lifelike and emulate the beauty of natural teeth. However, rehabilitating or enhancing a smile using direct composite veneers can be a great challenge for the cosmetic dentist. Proper placement of direct composite veneers requires the clinician to possess an exceptionally high level of understanding of the optical, mechanical, morphological, and polychromatic properties of the tooth.¹ When taken to the highest level of excellence, direct resin veneers can produce an esthetic outcome that is extremely conservative yet able to exist in harmony with the beauty of natural tooth structure.

When taken to the highest level of excellence, direct resin veneers can produce an esthetic outcome that is extremely conservative yet able to exist in harmony with the beauty of natural tooth structure.

PATIENT HISTORY

The patient, a 27-year-old male, was in excellent health and received routine dental care every six months. He had undergone orthodontic treatment in the past but had discontinued wearing his retainer. Particularly bothered by the decalcification spots and uneven edges in his upper front teeth, he wanted a conservative way to make his smile appear brighter, more attractive, and natural all at the same time (Figs 1 & 2).

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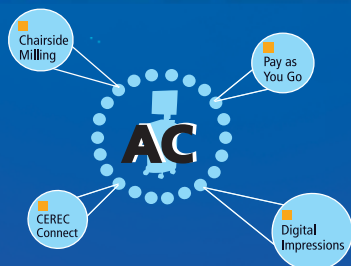
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Figure 1: Preoperative; the patient's broad smile displays hypocalcified areas and slightly negative buccal corridors. Postoperative; the patient's smile is brighter and appears natural.



Figure 2: Preoperative; hypocalcification spots, insufficient buccal corridors, and uneven incisal edges in the central incisors distracted from the patient's smile. Postoperative; by raising the value, filling in the buccal corridor, and removing the hypocalcification a more esthetic smile was created.

CLINICAL EXAMINATION AND DIAGNOSIS

The patient exhibited a Class I occlusion and oral soft tissues within normal limits. His home care was excellent. Radiographic and temporomandibular joint examinations also were unremarkable. Further examination indicated two failing restorations and mesial open contacts on teeth #5 and #12. There was evidence of moderate crowding in the mandibular incisors due to post-orthodontic relapse. There also was evidence of wear on the edges of the

crowded mandibular incisors, indicating possible signs of a constricted chewing pattern.^{2,3} The envelope of function was evaluated by having the patient simulate chewing with articulating paper between his anterior teeth; it was determined that he was not constricted. As the examination progressed, it was noted that the patient exhibited some posterior occlusal dysfunction in the form of interferences while going into maximum intercuspal position. It was suggested that the patient pursue a full-mouth equilibration and limited orthodontic treatment to de-ro-

tate the mandibular incisors. An anterior bite plane nightguard also was recommended to further protect the occlusion, due to the patient having a history of nocturnal bruxism.

A thorough clinical examination revealed the following:

- hypocalcification spots, predominantly in the maxillary arch (congenital or acquired during orthodontic treatment) (Fig 3)
- uneven incisal edges, #8 and #9
- excessive gingival display, #3, #4, #5, and #7

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Figure 3: Preoperative and postoperative 1:2 (1:3) left smile.



Figure 4: Preoperative; overall appearance is not esthetic, due to hypocalcifications, uneven tissue levels, and chipped incisal edges. Postoperative; a brighter and more youthful appearance.



Figure 5: Preoperative and postoperative 1:2 (1:3) right retracted view.



Figure 6: Preoperative and postoperative 1:2 (1:3) left retracted view.

- slightly underdeveloped buccal corridors (Fig 4)
- failing restorations with caries, #5 and #12
- open mesial contacts, #5 and #12
- moderate mandibular crowding, ##23-26.

TREATMENT PLAN

Based on the diagnostic observations, the patient had two primary options for esthetic treatment: Direct composite veneers or indirect porcelain veneers.⁴

Taking into consideration the patient's age, direct resin veneers were chosen as the treatment modality. Preservation of tooth structure was critical because no matter which material was used, the teeth would have to be treated again more than once during his lifetime.

The treatment plan was as follows:

- whiten teeth
- equilibrate to ensure a stable occlusal relationship

- create mounted study models with a semi-adjustable articulator
- create diagnostic wax-up, ##4-13, for veneers
- perform gingival recontouring, #3, #4, #5, and #7, to achieve a more balanced gingival display
- restore failing restorations and close open contacts (#5 with a mesial-occlusal-distal [MOD] composite, #12 with an MO composite)
- place direct composite resin veneers teeth, ##4-13 (Figs 5 & 6)
- provide an anterior bite plane appliance (occlusal guard).

Preservation of tooth structure was critical because...the teeth would have to be treated again more than once during his lifetime.

TREATMENT

The primary goal of the treatment was based upon smile design principles. To achieve this predict-

ably, digital photographs were used to evaluate the incisal position, lip line, buccal corridor display, and tooth and gingival contours.⁵

The material of choice was based upon the outstanding esthetics and strength of hybrid composite, along with the polishability of microfill composite⁶ (Fig 7).

To ensure a low-risk occlusal scheme and longevity of the proposed treatment, the patient had his dentition equilibrated.

The phases of treatment were implemented as described below.

WHITENING

The patient had his teeth whitened in the office and had an appointment two weeks later for shade selection when the shade of the bleached teeth had stabilized.

EQUILIBRATION

The patient was deprogrammed with a Kois deprogrammer and underwent a full-mouth equilibration with a football-shaped fine diamond and brownie points. This step was initiated to ensure a balanced occlusal scheme and the longevity



Figure 7: Preoperative and postoperative 1:1 (1:1.5) view demonstrating the overall esthetic improvements made.



Figure 8: Minimal tooth reduction was needed, as seen in the patient's left central incisor.



Figure 9: Line angles identified with pencil marks visually aid in maintaining the contours of the composite veneers.



Figure 10: Preoperative and postoperative occlusal views showing that the facial line angles were properly developed.

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of the restorations. Bilateral simultaneous contacts were obtained and all interferences eliminated.^{2,3}

A new set of study models were taken and mounted on a semi-adjustable articulator to be used for the diagnostic wax-up. The mounted diagnostic casts would later be used to verify occlusal stability, anterior guidance, and envelope of function prior to treatment. From the diagnostic wax-up, a putty matrix was fabricated to aid in the positioning of the incisal edge and lingual wall, and in the placement of the resin layers to the proper thickness.

GINGIVAL RECONTOURING AND RESTORATIONS

Teeth #3-5, #7, and #12 were anesthetized (lidocaine 1:100,000 epinephrine). Reducing the gingival display in teeth #3-5 and #7 enhanced the gingival symmetry. Once anesthesia was achieved, a periodontal probe was used to sound the bone around #3-5 and #7 to verify that the apical recontouring of the soft tissue did not violate the principles of biologic width. An electro-surgery unit (Ellman; Hewlett, NY) was used to remove approximately 1 mm of facial gingival from #3-5, and 1.5 mm from #7.

A rubber dam was placed over the maxillary arch to isolate #5 and #12. Teeth #5 and #12 were then prepared for MOD and MO composite restorations (Filtek P-60, 3M ESPE; St. Paul, MN) respectively. The patient was dismissed in order to allow the tissues to heal for three weeks before the next appointment.

PREPARATION AND LAYERING FOR RESIN VENEERS

One of the main goals of this treatment was to preserve as much natural tooth structure as possible

while enhancing the esthetics and raising the value of the teeth. Teeth #4-13 were anesthetized and prepared one at a time sequentially for direct resin veneers with a medium chamfered diamond bur (Brasseler USA; Savannah, GA), starting with #9. The hypocalcified layers of enamel were removed using the diamond bur to a conservative depth of approximately 0.4 to 0.5 mm facially and incisally (Fig 8). The previously fabricated putty matrix was used to confirm that there was adequate space to allow the proper thickness of resin layers. Size #00 retraction cord (Ultradent Products; South Jordan, UT) was placed in the gingival sulcus. Next, clear mylar strips were used in the interproximal areas to confine acid etching only to the tooth currently being treated. The tooth was etched with 37% phosphoric acid for 15 seconds, rinsed, and blotted with cotton pellets, leaving the surface moist. A thin layer of resin adhesive (Single Bond, 3M ESPE) was applied, air-dried for 10 seconds to evaporate the solvent, and light-cured for 20 seconds. The putty matrix was then placed over the maxillary anterior teeth and firmly adapted.

The first layer of composite used was Filtek Supreme Hybrid (WE). A very thin layer of this material was used to define the lingual border and spread incisally to define the incisal border.⁷ The composite was then polymerized and the putty matrix removed. A second layer of composite, Filtek Supreme Hybrid (B1B), was used to cover the entire prepared facial surface. Next, using a round composite instrument (PS Multiuse Stickless, HB9, Cosmedent; Chicago, IL), two vertical depressions were made in the incisal third of the B1B composite to simu-

late the mamelons and define incisal translucency.⁸ The final layer of composite used was a very thin layer of Renamel Microfill (Cosmedent) that covered the entire surface of the veneer. A #2 artist's brush was used to smooth, contour, and sculpt the composite prior to light polymerization for 60 seconds. To minimize the oxygen inhibition layer, Oxy-guard (Bisco; Schaumburg, IL) was used prior to the last resin layer being cured.

With proper planning and visualization of the anticipated outcome, these veneers can be minimally invasive and long lasting, and can rival the esthetics of porcelain restorations.

The above-described protocol was repeated for #7, #8, #10, and #4, #5, #12, and #13 with the exception that no depressions for mamelon simulations were placed in the B1B composite layer of the pre-molars. A modification of the previous procedure was used on #6 and #11 by substituting the final layer of composite with Renamel Microfill (IM) to give a slightly lower value in the canines. No depressions in the B1B layer used previously for simulating mamelons and incisal translucency were made in the canines.

CONTOURING AND POLISHING

Keeping in mind to maintain and refine the primary anatomy developed during the composite application phase, pencil marks of the line angles were made on the veneered teeth (Fig 9). This procedure allows visualization of the line angle's location so they can be preserved or altered.⁹ A red stripe flame and football-shaped fine diamond bur were



Figure 11: Fully contoured composite veneers before final polish.



Figure 12: The patient was very pleased with the treatment outcome.

used to refine the line angles and the three planes of facial contour. Sof-Lex discs (3M ESPE) were then used to remove any surface irregularities as well as develop the incisal and facial embrasures. A succession of narrow diamond strips was used interproximally to remove any composite flashing. At this stage, new diagnostic casts were made to allow visual confirmation that proper tooth contours were developed and addressed if any corrections were indicated (Fig 10). Next, with a prophyl cup and fine wet pumice (Preppies, Whipmix; Louisville, KY), the veneers were polished further with the application of light pressure⁷ (Fig 11). The final high-gloss polish was achieved with a FlexiBuff disc (Cosmedent) and Enamelize polishing paste (Cosmedent).

The occlusion was verified to ensure proper guidance and contacts. In order to confirm proper reflective zones on the veneers, digital photographs with a ring flash attachment were used to visualize these areas.

SUMMARY

With the current breed of composite systems available, direct resin veneers empower the clinician to offer a conservative esthetic option to his or her patients. Direct composite resin veneers help the cosmetic dentist develop a keen eye for tooth anatomy, enhancing his or her ability to manipulate resin and utilize smile design principles. With proper planning and visualization of the anticipated outcome, these veneers can be minimally invasive and long lasting, and can rival the esthetics of porcelain restorations. In this case the patient, an artist by trade, was overjoyed with the artistry of his new smile (Fig 12).

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EXAMINERS' PERSPECTIVE FOR DR. DAVID K. CHAN



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Accreditation Case Type V, Six or More Direct Resin Veneers, can be a daunting task. Many of those in pursuit of Accreditation consider it one of the most challenging case types. The application of direct resin restorations and the time-consuming, laborious commitment that is required to be successful may seem impractical to some. But if, by chance, preparation meets opportunity, skills acquired in working on this case type can be utilized across the broader application of both direct and indirect restorations. With Case Type V, the examiners measure the individual's understanding not only of the concepts of smile design and tooth form, but also his or her

ability to demonstrate the skills and knowledge to manipulate and layer a direct restorative material in a clinical setting.

Dr. Chan maximized his opportunity for success by presenting his treatment with clean, properly exposed photography. Understanding the concepts of responsible esthetics and the conservation of tooth structure, direct resins provided an excellent choice in this case and the examiners felt that Dr. Chan handled it well. Post-orthodontic decalcifications are classic indications for direct resins, allowing for localized reduction of affected tooth structure, while at the same time minimizing or eliminating the need for removal of healthy anatomy. Choos-

ing a case that meets the indications for treatment, yet minimizes gross changes to both soft and hard tissue architecture is obviously in the clinician's best interest. Heroic attempts to rejuvenate a grossly deteriorated smile certainly will be appreciated and valued by the patient, but are not recommended as a choice for Accreditation. Dr. Chan's patient presented with reasonable tissue architecture, with only minor gingival zenith imbalance and tooth contours that required resurfacing with limited augmentation and recontouring.

Accreditation criterion #67 emphasizes the importance of conserving tooth structure. It is no longer necessary to aggressively remove

gross amounts of healthy anatomy to create a natural and durable result. Dr. Chan's case is a nice example of maintaining otherwise healthy tooth structure by conservatively whitening the teeth, and preparing only to a depth required to remove the affected tooth structure.

Accreditation is about excellence, not perfection. Examiners have a great appreciation for the efforts that are invested in this type of case. Although the examiners unanimously passed Dr. Chan's case, there were some shortcomings; most of the faults were judged as minor. All of the examiners noted the monochromatic appearance of

the restored teeth, which failed to harmonize with the polychromatic appearance of the untreated teeth. There were also concerns about the excessive apparent connector length between the teeth and the resulting encroachment on the papillae. Preoperatively, there was significant scalloping of the tissue, with the height of the papillae reaching over 50% of the tooth length. Postoperatively, the heights of the papillae were significantly reduced, with the apparent contact zone between the centrals exceeding 60% of tooth length. A common fault found in Case Type V is the lack of development of line angles

and facial anatomy. This is often the result of over-polishing the resin, which eliminates many of the anatomical designs that may have originally been created. Some of the examiners also felt that the lack of definition of the line angles created teeth that appeared bulky and lacked the subtle texture of the untreated adjacent teeth.

Understanding the vast scope of the challenges in this case, the examiners felt that Dr. Chan did reach his goal of providing his patient with an esthetically pleasing result.



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ACCREDITATION CLINICAL CASE REPORT, CASE TYPE II: ONE OR TWO INDIRECT RESTORATIONS



by Chiann Fan Gibson, DMD
Naperville, IL
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INTRODUCTION

With advances in cosmetic dentistry, the restorative dentist has the ability to restore anterior teeth with amazingly natural results. Porcelain veneers often are the preferred treatment by both clinicians and patients due to the conservative nature of tooth preparation. However, restoring maxillary central incisors remains challenging for clinicians, especially when one tooth is discolored and all-ceramic bonded restorations are selected as the treatment of choice. Dentists should base their choice of material on the requirements of the teeth being restored. Situations involving tooth discoloration, wear, or fracture may require a restoration that entails the removal of more tooth structure but does not necessitate a conventional complete-coverage crown.¹ Often it can be difficult to blend the discolored tooth to the rest of the natural dentition because the underlying tooth structure is likely to show through the veneer. With proper photography and communication with the laboratory, coupled with knowledge of materials and techniques, veneers can be created that are esthetic and natural looking.

PATIENT HISTORY

The patient was a 25-year-old female with no known medical contraindications or allergies to medications. She had noticed that her central incisors were disproportionate in contour and that they were becoming discolored in relation to the rest of her smile (Fig 1). There also were some surface fracture lines and flaring, which she disliked. She desired to achieve a more natural and beautiful smile with correction of her two front teeth (Figs 2 & 3).

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Figure 1: Preoperative portrait and smile, showing discoloration of #9 and the unharmonious blend of the two central incisors.

The patient mentioned that as a young adult she had bumped her mouth several times by accident. As a teenager, she had orthodontic treatment. Over the years, the traumatic injuries to tooth #9 had caused the tooth to discolor and the canal to calcify.

CLINICAL EXAMINATION AND FINDINGS

The patient had received routine dental cleanings, and her oral hygiene and soft tissue health were excellent. Her radiographic and oral cancer examinations were within normal limits. Endodontic consultation for #9 revealed that no endodontic treatment was warranted (Fig 4). There was no temporomandibular joint dysfunction. Previous dental treatment included orthodontia and home whitening. She wore a lower retainer that had been provided to her after orthodontic treatment.

DIAGNOSIS AND TREATMENT PLANNING

Diagnostic models and bite records were made using the Kois Dento-Facial Analyzer (Panadent; Colton, CA). Radiographs and the

12 required AACD images were taken. These were necessary for proper communication with the laboratory.

For color stability purposes, only light-cured resin cement should be used when luting veneers.

The patient's chief complaints about her smile were as follows (Figs 5 & 6):

- discoloration of #9
- flaring of the incisal edges of the centrals facially
- width of the two centrals being wider at the incisal edge
- "bottle-necked" appearance of her centrals cervically
- crack lines present on #8.

Oral hygiene and home care were excellent and the patient was happy with previous home whitening results.

The treatment plan included placing veneers on both #8 and #9. Placement of an opaquer on #9 was planned to mask the naturally darkened tooth. For color stability purposes, only light-cured resin cement should be used when luting

veneers.² Empress Esthetic veneers (Ivoclar Vivadent; Amherst, NY) were selected as the restorative material.

TREATMENT

PREPARATION

When the patient returned for restorative treatment, shade selection (shade 020, Chromascop shade guide, Ivoclar Vivadent) was done prior to any other procedures to prevent improper color match that might result from dehydration and elevated values. A photographic record of the shade matching was made for laboratory communication (Fig 7).

An impression was taken of the anterior teeth using Silgimix (Sultan Health Care; Englewood NJ) in an anterior stock tray. The provisional restorations would be fabricated using the impression as the starting point and contoured to the patient's esthetic goals.

Topical and local anesthetic was delivered for #8 and #9. Veneer preparation was done using diamond burs. Both teeth were prepared uniformly. Chamfer margins



Figure 2: Preoperative retracted view, showing discoloration of #9 as well as the irregular incisal edge contours and shape of the central incisors.



Figure 3: Postoperative retracted view, revealing a more harmonious contour of the central incisors as well as a beautiful shade match that blends well with the natural dentition.



Figure 4: Preoperative x-ray, showing #9 with calcified canal. No endodontic treatment was warranted prior to veneer preparation.

were created up to the free gingiva. Interproximal finish lines in the distal contact areas were broken and carried to the disto-lingual areas to aid in correcting width and contours. The incisal third was prepared to allow the correction of the incisal inclination. Occlusal clearance was verified. The preparations were refined and smoothed with a very fine round-end diamond bur. A1 opaquer (Cosmedent; Chicago, IL) was placed on the facial surface of #9 to blend it to match #8 via traditional bonding techniques (Fig 8). ND2/A1 was the natural die shade closest

to A1; this was communicated to the laboratory.

Retraction cord (Dux Dental; Oxnard, CA) size 00 and 0 was placed in the sulcus of both teeth. After five minutes, the top retraction cord was removed and a final polyvinyl silane impression was taken. The impression was examined to ensure that all required details had been captured. An opposing arch impression was taken again for the laboratory (previous impression taking had been done for diagnostic models and evaluation). A maximum intercus-

pation bite record also was taken for laboratory communication.

PROVISIONALS

A provisional restoration was made using the Silgimix mold. The provisionals were recontoured and shaped, starting from the patient's original contours, eliminating the incisal-facial flare, thinning out the width along the incisal third, and contouring the distal line angles of both central incisors so that the teeth looked thinner overall. As enough tooth structure was reduced along the incisal third facially, porcelain



Figure 5: Preoperative retracted right and left 1:2 (1:3) views, showing the two centrals with flaring, incisal edge wear, discoloration, and disharmony with the rest of her teeth.

fabrication could be done to correct the incisal inclination. Similarly, when the provisionals were made from her original contours, there was enough thickness of temporary material along the incisal third to allow it to be thinned with a Brasserler (Savannah, GA) ET-9 bur. These were minor changes that resulted in a huge visual improvement. The provisionals were fabricated with attention to creating less incisal flare facially and much more harmonious distal line angles.

Although the provisionals were fused together, the margins were carefully trimmed to provide optimal gingival health. Splinting multiple restorations can significantly enhance the primary stability of the provisional restoration.³

The approved provisionals were refined to closely represent the final restoration in appearance and occlusion. A layer of glazing liquid (Lasting Touch, Dentsply Caulk; York, PA) was applied to the surface and light-polymerized. Gluma (Heraeus; South Bend, IN) desensitizer was applied to the prepared teeth to disinfect and desensitize prior to the provisionals

being seated with TempBond Clear (Kerr; Orange, CA). The provisionals were photographed for the laboratory (Fig 9). Study model impressions were also taken of the provisional restorations.

The provisionals were fabricated with attention to creating less incisal flare facially and much more harmonious distal line angles.

TRY-IN APPOINTMENT

The patient was anesthetized (3.6 ml lidocaine 2%) and the veneer shade and contour were assessed with try-in paste. Variolink Veneer (Ivoclar Vivadent) high-value +3 try-in paste was used and compared to Variolink Veneer medium-value 0. The high value was selected to blend with the natural dentition. The patient viewed the veneers in natural light as well as in-office fluorescent lighting. The intraoral fit was examined. Approval for final cementation was given.

CEMENTATION

The Empress veneers had been pre-etched by the laboratory. However, the restorations were cleaned

with 37% phosphoric acid after removal of the try-in paste to remove any organic debris and to acidify the restoration for bonding.⁴ The veneers were silanated and then coated with two coats of All-Bond 3 bonding agent (Bisco; Schaumburg, IL). The restorations were then set aside.

The prepared teeth were pumiced and etched with 37% phosphoric acid with benzalkonium chloride for 15 seconds and rinsed thoroughly. Excess water was removed using a foam pellet, leaving the preparation visibly moist. A rewetting agent (Gluma) was placed and excess was suctioned off. Two coats of bonding agent (All-Bond 3 parts A and B) were placed on the prepared teeth. The teeth were gently but thoroughly air-dried until there was no visible movement of the material and the surface appeared to be shiny.⁵ The bonding agent was then light-cured for 10 seconds. Variolink Veneer high-value +3 cement was placed on both veneers. The veneers were seated using inward and upward pressure. The "tack and wave" technique was then used.^{2,4,6} Each restoration was polymerized "dead center" for one second with a 2.0-



Figure 6: Preoperative 1:1 view, showing crack lines on #8 as well as the "bottle-necked" appearance of both centrals.



Figure 7: Shade tabs 010 and 020. Shade 020 was chosen, but the laboratory was asked to create incisal edge translucency, internal characterization, and white spots to match the lateral incisors.

mm light guide. The light was then moved along the lingual and facial for three seconds each to effect a "rubbery" phase and make the cement easy to clean up. The goal here was simply to get the cement to its gel state without completely curing it, as the more cleanup that was done now, the less there would be to clean up with a handpiece later.² Excess cement was "picked away" using an explorer and scaler. A serrated saw (Brasseler) was used to remove cement through the contacts. Waxed floss was also used, being carefully pulled through to the lingual in the

direction of the veneer placement in order to prevent the veneer from shifting or popping off. A secondary oxygen inhibition layer remained because the restorations were not yet fully polymerized after the "tack and wave."⁴ Due to oxygen inhibition during polymerization, margins polymerized without glycerin gel show a rapid degradation compared to air-blocked margins.^{3,7} A glycerin gel was placed on the margins of the restorations prior to final cure. Each restoration was light-cured for 20 seconds from the buccal, lingual, and proximal aspects with the gel

in place. The water-soluble glycerin was rinsed off, x-rays were taken, and excess cement was removed. The occlusion was checked. The margins were finished with an extra-fine diamond finishing bur where needed. The adjusted areas were polished and smoothed with Porcelize (Cosmedent) diamond polishing paste using silicon points and a felt wheel.

CONCLUSION

Excellent esthetic results can be obtained with careful diagnosis, treatment planning, and execution. By listening to the patient's chief



Figure 8: Preparation of both central incisors, as well as opaquer A1 on #9 to mask the darker tooth.



Figure 9: Approved provisionals with measurements for length and width being established.



Figure 10: Postoperative retracted right and left 1:2 (1:3) views.

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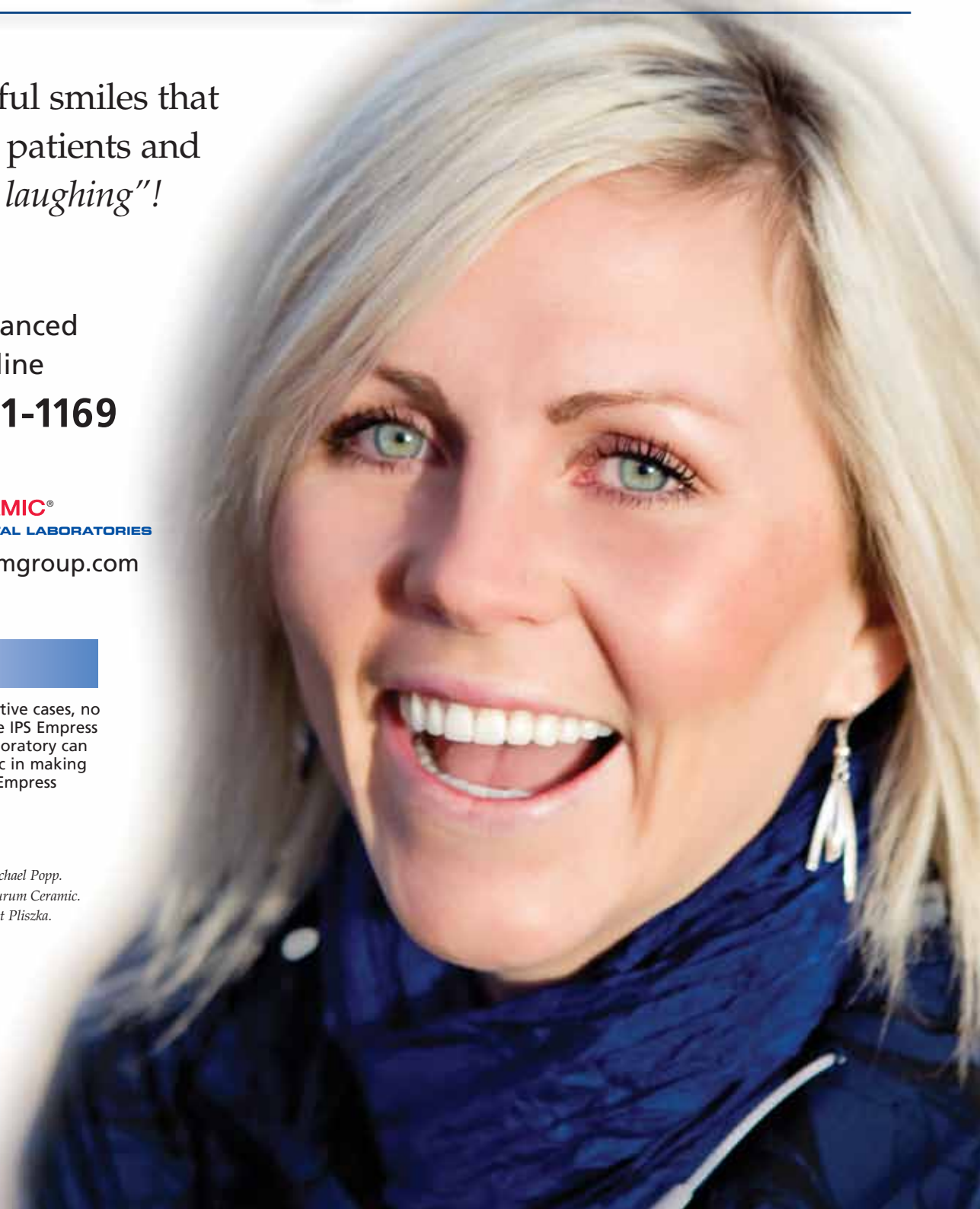




Figure 11: Postoperative 1:1 (1:1.1.5) view, showing the incisal edges blended to match the lateral incisors.



Figure 12: Postoperative 1:1 (1:1.5) portrait and smile.

complaints we were able to create the desired contours and esthetics. The symmetry, incisal characterization, and color were well blended to match her natural dentition harmoniously (Figs 10 & 11). The patient was very satisfied with her new esthetic and natural-looking smile (Fig 12).

Acknowledgements

The author thanks ceramist Paul Lindsey (Gold Dust Dental Laboratory; Tempe, AZ) for his expertise in fabricating excellent restorations, and Dr.

Marilyn Gaylor for her encouragement to pursue Accreditation.

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EXAMINERS' PERSPECTIVE FOR DR. CHIANN FAN GIBSON



by
 Scott W. Finlay, DDS
 AACD Accredited Fellow
 Arnold, MD
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With each Accreditation case type comes a unique set of challenges that are evaluated by the examiners. In Case Type II, One or Two Indirect Restorations, although the elements of an ideal smile design matrix cannot be ignored, the evaluation is weighted toward the individual's ability to mirror contralateral teeth; and to manage the contour, surface finish, and shade of ceramic to harmonize with the surrounding natural dentition. This endeavor acutely measures the clinician's ability to communicate and synergize with a critical team member in the restorative process: The laboratory technician. Dr. Gibson's case involved the common challenge of restoring a discolored and damaged single central incisor.

It is in the clinician's favor to select a case that supports the indication for the limited restorative treatment, but is otherwise absent of distracting elements or gross deficiencies in smile design. Dr. Gibson's case was an excellent choice in this regard. She enhanced her opportunity for success by presenting her case with crisp, clean photographic images that are consistent in composition and exposure, and free of any moisture and debris in the retracted views. The periodontal architecture that frames the restorative result indicates visually acceptable clinical health.

Although the examiners unanimously passed Dr. Gibson's case, there were a limited number of faults. Essential to the concepts of smile de-

sign, central incisors must look like "twins," whereas lateral incisors can resemble "cousins." Managing and balancing contours and line angles makes it possible to create symmetrical, light-reflective surfaces and helps to camouflage the restorations. It is one less visual distraction for the eye to question what does not "belong." All the examiners recognized the higher chroma of #9 compared to #8; however, only one examiner noted this as a major fault. The examiners also noted a discrepancy in the symmetry between #8 and #9; #8 appears wider than #9, with a very minor gingival zenith imbalance.

Communication between the operator and laboratory technician lies at the heart of a successful result.

Most dentists do not have the luxury of having the ceramist on site, and rely heavily on communication with digital photography. Hydration has a significant impact on photography. If the teeth are allowed to dehydrate prior to capture of the image, it is common to see the visual enhancement of areas of decalcification. If these dehydrated images are used preoperatively as communication to the ceramist, the resulting restorations created on the laboratory bench may exhibit excessive effects. In Dr. Gibson's case, areas of decalcification are more visible in the preoperative images than in the postoperative images. Two of the five examiners did note that the incisal effects of decalcification in the final restorations appeared excessive when compared to the balance of the teeth in the postoperative views. Overall, most of the examiners were impressed with Dr. Gibson's management of the case.

Dr. Gibson clearly demonstrated a level of excellence in creating an esthetically pleasing result. She should be very proud of the service that she has provided for her patient.



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THE MEANING OF ACCREDITATION: INTERVIEW WITH DR. LARRY ADDLESON CONDUCTED BY DR. JAMES H. HASTINGS



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Dr. Larry Addleson has been a member of the American Academy of Cosmetic Dentistry (AACD) since 1991. Since becoming Accredited in 1993, Dr. Addleson has served the Academy in many capacities: As a member of the AACD Board of Directors, Accreditation Examiner, Fellowship Examiner, Accreditation Chair, Fellowship Chair, and Chairman of Education and Credentialing.

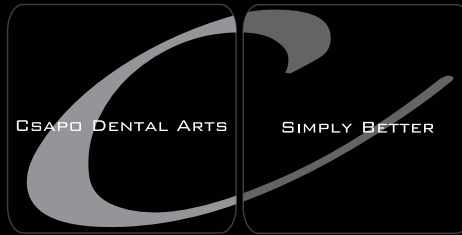
He was chairman of the first Board of Governors (now the American Board of Cosmetic Dentistry® [ABCD]) at its inception in 1999, through 2001. He was installed as our 18th president in 2004. Currently, he is a member of the AACD's Charitable Foundation Board of Trustees.

This interview is meant to offer readers a perspective on what membership in our Academy and earning the credential has meant to one of our most prominent members.

JH: *Dr. Addleson, can you offer readers a brief history on what prompted you to join the AACD?*

LA: Actually, I had no intention of joining the AACD or any other Academy. I was intrigued with and enjoyed cosmetics at the time and thought I was pretty good at it. A friend influenced me to come to the annual scientific session; I was stunned by the quality of dentistry I saw and realized that I wasn't as good as I thought. That same friend encouraged me to go through Accreditation. The process of taking a lot of photographs and doing self-review helped me tremendously. At each successive annual meeting I saw that my work was improving and I became very excited about my dentistry. At each meeting I met people who were trying to develop their skills, just as I was. At that time, there was no Web site or referral system—it was all about personal growth, challenge, and a desire to improve.

I was fortunate to pass all five cases on my first try, and later that year I was honored to be asked to become an examiner; that was a huge



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landmark. After achieving Fellowship in 1996, I was asked to be Fellowship Chair. Later, I was elected Education and Credentialing Committee Chair.

JH: *What have been some of the milestones in the field since you joined the Academy?*

LA: In 1991 cosmetic dentistry was in its infancy. During the mid-1990s more dentists became interested in providing cosmetic services to their patients and, at the same time, the body of knowledge was becoming more widespread. Private and public educational institutions began offering courses in the art and science of esthetics, and manufacturers began offering many materials that could compete with the old standard of porcelain fused to metal for crown and bridge, to enhance esthetics. More manufacturers and dentists became interested in the wider application of direct resin for anterior and posterior restorative services. The AACD grew, along with the profession and the public's interest in esthetics. Many of our members are prominent, well-respected clinicians and authors, and continue to add value to the profession and to the Academy.

JH: *How has the credentialing process changed since you became involved with it?*

LA: I felt it was important that the Accreditation process be independent from the political arm of the Academy. This was before the Board of Governors, the Academy's first credentialing board,

was created. At that time, the credentialing examination consisted of the same five case types as today, but there were some cumbersome restrictions. People couldn't even apply to take the examination until they had been an AACD member for two years. The five cases were to be assembled in 35-mm slide carousels, the technology of the day, and brought to the annual scientific session. You had to carry several carousels containing your five sets of "before and after" slides, along with three sets of case write-up books. The Credentialing Committee consisted of one chairperson appointed by the president, who served a term of two years; and examiners who were selected by the Accreditation Chair. The Accreditation Chair ran the process with the help of one AACD staff member. Candidates were assigned a time slot at the annual scientific session and were expected to present their cases in a dark room in front of a panel of five examiners.

Many candidates had no public speaking experience and it could be nerve-racking, to say the least. To further complicate matters, there was little examiner calibration, and often the examiners did not agree on a standard of excellence. After the candidate left the room, there was discussion on the merits or shortcomings of the case. I admit that, at times, the whole system was more subjective than objective. However, it seemed to work,

and each successive Accreditation Chair tried to improve the system, given the circumstances of the time.

JH: *Can you add anything more to the history of the credentialing process?*

LA: In those years there were understandable concerns about partisanship and favoritism. When dentists or laboratory technicians worked hard for several years to create, document, and present their best work, only to have it rejected, it's understandable that there would be some frustration and discontent. The Board of Governors was created to standardize the process and make it fair and unbiased. We tried to take an essentially subjective examination process and make it as objective as possible. At the same time, we wanted to maintain the same standards so as not to weaken or "water down" the credential. This was in fairness to those who had already become Accredited, as well as to those who had not yet been awarded the credential. The Board consisted of seven very bright and dedicated dentists who worked well together to rewrite the protocol and initiate its use. They created an examination process that is now similar to that of other professions, with a written examination, a blind submission of clinical cases, and an oral examination.

At the same time, criteria standards were developed and written and the *Guide to Accreditation Criteria* was created to clearly delineate

the standards for various elements of cosmetic dentistry. A scoring process was already in place and it continues to be used today. A photography guide had already been created and was later revised, showing the standard of photographic excellence desired. A calibration process was developed for the examiners, offering a clear understanding of and greater consistency in what is being tested and what is acceptable. Examiners are now calibrated at least twice a year: At the annual scientific session and just before each examination session. During examination of cases and scoring there is absolutely no talking allowed in the exam room until after all examiners have completed their scoring.

Today there is no waiting period for submission of cases. In theory, a person in the process can join the Academy, attend the next annual meeting, take the written examination, the required credentialing workshops, and be eligible to submit clinical cases upon successfully passing the written examination. When all five cases pass, the individual is then invited to the oral examination. If that is successful, the credential is awarded at the next annual scientific session.

JH: *Tell us what "blind submission" means.*

LA: Cases are submitted by mail and catalogued by the AACD Credentialing Department. Anything that might identify the submitter is deleted, so that none of the examiners

know whose work they are scoring. If, by chance, an examiner has mentored the submitter and recognizes the work, that examiner is excused from examining that case and another examiner sits in for that case evaluation. It is a very fair process.

The ABCD handled the difficult transition from 35-mm slides to a digital format. They set standards for digital imagery by removing the possibility of image manipulation, which at first was a major concern. Easy-to-understand-and-follow standards were developed for digital submission.

JH: *Thank you for the historical perspective. How would you compare examinations offered by other organizations in cosmetic dentistry?*

LA: It would be unfair to compare because I have not taken an examination from any other Academy or private institution. I'll say just two things about that: First, any educational process can only be beneficial, so other entities are offering valuable services. In fact, many of their speakers are members of the AACD, and many hold and respect the AACD credential. Secondly, I believe our examination process is the most rigorous and fair. Our credentialing board continues to consult with nationally known testing experts in developing our examination process to ensure its fairness and validity. Every year the written examination is redeveloped with new questions. After the written examination is given, all the

questions are re-evaluated by the Written Examination Committee, as well as outside testing experts. Questions deemed either too easy or too difficult are eliminated.

JH: *What have Accreditation and membership in the AACD meant to you?*


LA: Accreditation has transformed my life professionally and personally. I now have a premiere practice because of my growth through the Accreditation and Fellowship processes. These processes provided exposure to incredible educators at the annual scientific sessions, and afterward I was able to follow up with more extensive courses at their teaching facilities. I am now able to do the kind of dentistry that is required by Accreditation and Fellowship. My personal life has been transformed because of the fine people I've been privileged to meet, and also because I can give back to the profession by being active in the AACD. I could never give back enough to "repay" the Academy for all it has given to me. It's hard work and involves sacrifice, but it's incredibly rewarding because I feel I am contributing to a good cause and helping others achieve their full potential. The Academy is bigger than one person; in many ways, it is like my second family.

JH: *Dr. Addleson, thank you for your time. The Academy owes you and many others a debt of gratitude for your hard work and dedication.*



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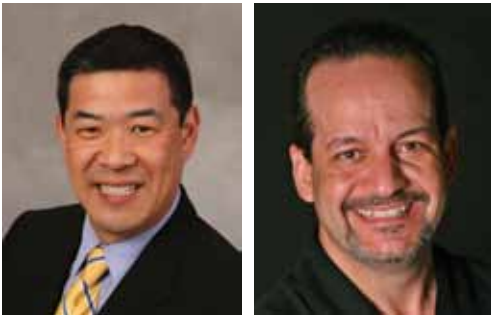
CLINICAL SCIENCE AND ART

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A CONSERVATIVE APPROACH TO THE RETREATMENT OF PEG LATERAL INCISORS AND EXCESSIVE MAXILLARY SPACING



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INTRODUCTION

In the past, the field of cosmetic dentistry seemed only to focus on the “smile” and “smile design.” Dentists spent an excessive amount of time creating caricatures of teeth based on the belief that all patients wanted that perfect “game show host” or “Miss Universe” smile. However, over time it was discovered that many patients did not want teeth that looked too white and too perfect to be natural.¹ This demonstrated a disparity between what dentists thought patients wanted, and what their patients actually found attractive.

Usually, when educated about the choices and consequences, patients tend to prefer a more conservative approach.

One of the major costs of this outdated philosophy of creating the illusion of perfect teeth was the non-conservative nature of the tooth reduction involved. Clinicians would rationalize aggressive preparation treatment plans by emphasizing the fact that “The patient didn’t want orthodontics,” but the fact is that no one really *wants* orthodontics. Completing an instant orthodontics case with creative tooth reduction and veneers that are actually three-quarter crowns to full-coverage crowns is not a conservative case. This is not to say that in some cases, this type of procedure is unjustified, but it is important that the patient is aware of the biomechanical risks involved for their teeth and periodontal tissues. Usually, when educated about the choices and consequences, patients tend to prefer a more conservative approach.²

As a general rule, when it comes to restoring cosmetic cases, if the patient is under 35 years old, the authors prefer an orthodontic/orthognathic approach that involves minimal restorative and prosthetic intervention.³ How-

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Figure 1: Preoperative full-facial view of the patient at the time of presentation.

ever, if the patient is older than 35 and presents with a mouthful of previous dental work or worn down teeth, a restorative prosthetic approach may be the better option.⁴ This approach also includes considerations for orthodontic, periodontal, and orthognathic procedures, as need be.⁵

For example, consider the case of a 68-year-old man who wanted a perfect smile and for whom the usual “work-up” was performed and orthodontics suggested. The patient said that if he did not make it through the two years of orthodontics before he received his new smile, he would be upset. In this case, the patient chose “full-mouth” rehabilitation with all-ceramic restorations, rather than orthodontics, knowing that there was a good chance the restorations would outlast him.

However, the following case demonstrates the manner in which a minimally invasive dentistry phi-

losophy was emphasized in order to effect a dramatic change in the patient’s smile. It represents a conservative, interdisciplinary approach, one that satisfied the esthetic demands and expectations of a young female patient.

[This case] represents a conservative, interdisciplinary approach, one that satisfied the esthetic demands and expectations of a young female patient.

CASE PRESENTATION

A 22-year-old female presented with concerns about the veneers on her lateral incisors because she felt they were not in harmony with her central incisors (Fig 1). She also believed the esthetics of her teeth were poor. The existing veneer on #10, which had cracked, also was irritating her gingival tissue. Her previous dentist had attempted to repair the

veneer with composite, but was unsuccessful. The veneer had been remade a few times, and the patient now was experiencing temperature sensitivity with the tooth.

The maxillary canine to premolar regions in the right and left buccal segments appeared “gummy” to her.⁶ Five months earlier, aligners (Invisalign; Santa Clara, CA) had been used to correct the mandibular anterior crowding and spaces between her maxillary teeth. Lingual wires were used to retain the maxillary six anterior teeth (i.e., ##6-11) and mandibular teeth (i.e., ##22-27). The lower anterior teeth appeared to have relapsed to a degree, and evidence of crowding was observed.

Additionally, the patient did not like the mesial inclination of her central incisors and the small black triangle that appeared as a result of tipping the teeth to close the spaces.



Figure 2: Frontal 1:2 retracted view, with teeth displaying dominant central and lateral incisors that are too large, as well as soft tissue irregularities.



Figure 3: Retracted 1:2 right lateral view.



Figure 4: Retracted 1:2 left lateral view.

MEDICAL AND DENTAL HISTORY

A comprehensive examination and review of the patient's medical history showed her to be in good health, with no significant findings.

The patient's upper and lower lips were full, exhibiting a normal smile line. Lip dynamics were normal on her right side, but low on her left side. This gave the appearance of a canted upper lip when she smiled. Her gingival health was good, with only minimal areas of recession and no pocketing greater than 4 mm when probed. The teeth had light

areas of staining and supragingival calculus.

The patient presented with a Class I malocclusion with a Class I skeletal pattern. There was a 2-mm overbite and 2-mm overjet present, and the dental midlines were coincident. The maximum opening was 1.5 inches, and centric relation was equivalent to centric occlusion. Maxillary and mandibular arches were aligned, with spacing distal to the canines. The muscles of mastication were asymptomatic, and the temporomandibular joint function was within normal limits, displaying no joint noises or deviations.

Radiographically, the roots of #8 and #9 were divergent from the orthodontic tipping of the teeth. A consequence of this lack of root proximity was a lower crest of interproximal bone, which contributed to an inadequate papillary soft tissue support and the black triangular space. It was assumed that the patient previously had a diastema and spacing of the maxillary anterior teeth due to the peg laterals.

The patient had had all four wisdom teeth extracted, and composite restorations were present on #2 and #3, ##12-15, #18 and #19, and ##29-31. A no-preparation porcelain

veneer also was present on #7, and a minimally prepared thin veneer was present on #10. A wavy wire retainer was attached to the lingual surfaces of ##6-11, and another was attached to ##22-27.

DIAGNOSIS AND TREATMENT PLAN

After a thorough examination that included digital photographs and radiographs, as well as an evaluation of stone casts, and several discussions between the restorative clinician, orthodontist, and laboratory ceramist, a treatment plan was developed to address the patient's concerns. The three main components of the treatment plan would incorporate restoration of the lateral incisors, soft tissue esthetics, and arrangement of the teeth.

The two lateral incisors presented with different challenges that required attention (Fig 2). Tooth #7 was low in value (Fig 3), and although it was of a proportional length relative to #8, its shade did not complement #6 and #8.⁷ The low value was most likely due to the choice of a very translucent pressed ceramic material to restore the unprepared peg lateral with a "no-preparation" veneer.⁸ The literature suggests that when the porcelain is thin, it is important to consider the substrate because color-matching to the underlying structure is required. This is significant because not matching the color could negatively impact the final result.

Tooth #10 was slightly higher in value than #9 and slightly longer than #7 at the cervical margin (Fig 4). It appeared that a high-value resin cement was used to insert the veneer on #7, as there was an increase in opacity observed at the cervical margin.⁸ The veneer had been replaced more than once, and in this iteration, the ingot used to make the

thin veneer appeared to be too opacous. A fracture on the mesial surface of the veneer on #10 also had been repaired with composite and appeared to have caused the apical recession of the interproximal papillae. The overhanging cervical edge of the veneer extended subgingivally, causing minor irritation of the marginal gingiva.⁹

The three main components of the treatment plan would incorporate restoration of the lateral incisors, soft tissue esthetics, and arrangement of the teeth.

Both lateral incisors failed to mimic the incisal translucency of the adjacent central incisors. They appeared flat and resembled the outcome typically expected when creating provisional restorations using a single shaded acrylic resin.

The gingival levels of the canine to second premolar on both sides of the maxillary arch were low due to delayed passive eruption.¹⁰ Although the buccal corridors were fairly well developed, they could be improved by correcting the gingival heights using esthetic surgical crown lengthening.¹¹ It was anticipated that the gingival height of #10 would approach that of #7 after the defective veneer had been replaced with the provisional composite restoration. Also, any final esthetic gingival recontouring would be done using a diode laser at the veneer preparation appointment.^{12,13}

The arrangement of the teeth needed to be addressed with orthodontic intervention. The mandibular anterior crowding and the spacing distal to the canines also required attention. The excessive mesial inclination of the central incisors created a more distally placed gingi-

val zenith. Lack of root proximation resulted in a tendency for the interproximal papillae to be positioned more apically from the more coronal contact point of the two central incisors, resulting in a tendency for a black triangle to emerge.

Although it could be debated that the incisal embrasure angle between the central incisors was a little obtuse, it must be recognized that these were the natural, unaltered, and undamaged central incisors of a healthy 22-year-old. Diversity in human tooth anatomy is what makes us individual, no matter what the perception.

An orthodontic consultation was arranged to address the spacing and crowding issues. It was decided that this problem would be resolved using fixed edgewise appliances.¹⁴

Therefore, the first step in the treatment plan was to remove the defective veneer on #10 and mock up a temporary composite resin veneer to allow revival of the gingival tissue. It would then be necessary to correct the gingival levels of the buccal corridors on both sides, using esthetic surgical crown lengthening on ##4-6 and ##11-13. Once these treatments were completed, the previous no-preparation veneer on #7 would be removed, #10 would be minimally prepared for thin, stacked veneers (IPS e.max Ceram, Ivoclar Vivadent; Amherst, NY), and both teeth would be provisionalized (Luxatemp, Zenith Dental; Englewood, NJ). The definitive restorations would be seated using resin cement (Variolink Veneer, Ivoclar Vivadent).

The patient's follow-up treatment plan included hygiene education and home care for optimal gingival health following treatment. Additionally, braces were suggested



Figure 5: Frontal 1:2 view after #10's veneer was removed and replaced with temporary composite resin veneer, and following crown-lengthening surgery.



Figure 6: Right lateral 1:2 view after crown-lengthening surgery.



Figure 7: Left lateral 1:2 view after crown-lengthening surgery.

to correct the inclination of the maxillary central incisors, close spacing, and correct the mandibular anterior crowding.

CLINICAL PROTOCOL

REMOVAL OF THE VENEER ON #10

The first restorative appointment was dedicated to removing the veneer on tooth #10. The patient first was anesthetized with 1 carpule of prilocaine with no epinephrine (CitaneSt Plain, Dentsply Int.; York, PA). Using a coarse chamfer diamond (856-016, Axis Dental; Coppell, TX), the veneer was carefully

removed, with attention given to not removing any additional tooth structure. The tooth had been slightly prepared before, so the existing preparation was smoothed out, and a gingival retraction cord (Gingibraid #0e, Dux Dental; Oxnard, CA) was placed.

A 3-mm diameter spot on the middle of the facial surface of the tooth was treated with a self-etching, light-cured filled adhesive (AdheSE One, Ivoclar Vivadent) for 30 seconds. After light-curing for 10 seconds, a dentin layer of A2 composite (IPS Empress Direct) was applied to the tooth to build up the

dentin layer. The enamel layer was developed using A1 and B1 composite shades, followed by Trans 20 for the incisal edge. The restoration was shaped with carbide finishing burs and polished with disks (Sof-Lex, 3M ESPE; St. Paul, MN). The tissue was allowed to heal for one week to determine how far the marginal gingiva would migrate coronally. This also was done to determine where the height of the gingival crest would terminate.



Figure 8: Frontal 1:1 view of the final, conservative preparations on the small peg lateral incisors. The preparations were completed after laser gingival recontouring.



Figure 9: The definitive final shade was taken using the shade guide.

ESTHETIC SURGICAL CROWN LENGTHENING

It was determined that the short clinical crowns on ##4-6 and ##11-13 were caused by altered passive eruption. As a result, the cemento-enamel junction (CEJ) could not be felt with a periodontal probe in the gingival sulcus. The bone-sounding measurements of the teeth from gingival crest to alveolar crest averaged 3 mm midfacial and 3 mm to 4 mm interproximally. This placed the patient in the normal crest biological width category.¹⁵ Patients fall into this category approximately 85% of the time, and the gingival tissue tends to be stable long term.^{16,17}

The initial lengths of #6 and #11 were 8 mm and 8.5 mm, respectively. The adjacent lateral incisors were 9 mm; the goal was to create canines approximately 10 mm long, first premolars approximately 8.5 mm long, and second premolars about 8.0 mm long. This increase in length would be obtained apically through the esthetic crown lengthening.

The goal was to move the bone 2.0 mm to 2.5 mm from the CEJ and place the marginal tissue 3.0 mm from the alveolar bone. To accomplish this, a sulcular incision was

made from the distal of the lateral incisor #7 to the mesial of the first molar #3 using a 15-c blade. A full-thickness muco-periosteal flap was reflected, exposing the osseous crest near the CEJ. The facial interdental papillae were not reflected with the flap, as no biological requirement existed for the removal of interproximal bone. The bone was thinned using a 7009 carbide bur and water irrigation.

The bone then was placed approximately 2.0 mm to 2.5 mm apical to the CEJ. The thinned bone was reshaped from line angle to line angle using a Wedelstaedt chisel (Hu-Friedy; Chicago, IL). The marginal bone also was thinned and recontoured using a fine bullet-nose diamond (856-016). After thinning the papillae with the 15-c blade, the tissue was replaced, and each papilla was sutured with Vicryl 5.0 (Ethicon Inc.; Somerville, NJ) using a P-3 needle.

The patient was dismissed with postoperative instructions and a chlorhexidine rinse. Sutures were removed two weeks later, and minor tissue adjustments with a diode laser were carried out six weeks after healing. Postoperatively, the

tooth lengths and tissue levels desired were gained to improve the appearance of the buccal corridor (Figs 5-7).^{18,19}

PREPARATION FOR PORCELAIN VENEERS ON THE LATERAL INCISORS

A preoperative impression of the existing teeth was taken with a clear polyvinyl siloxane (PVS) impression material (Peppermint Snap Clear Bite, Discus Dental; Culver City, CA) in a triple full-arch tray and set aside. The lateral incisor at #7 was not prepared, and the lateral at #10 was minimally prepared with an 856-016 fine bullet-nosed chamfer diamond (Fig 8). This was done only because the tooth had been prepared for the previous veneer. The preparation shades were determined to be ST9, and the final shade was a blend of Chromoscop 030, 040, and 110 (Ivoclar Vivadent), with incisal translucency to mimic that of #8 and #9 (Fig 9).

Maxillary and mandibular full-arch impressions also were taken using a light-body PVS wash material (Precision, Discus Dental) and a medium-body PVS matrix material (Precision) in a full tray. A face-bow relation also was taken (Kois

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Figure 10: Frontal 1:1 view of the provisional restorations after four weeks.



Figure 11: View of the model with platinum foil veneers. These frameworks were coated with a small amount of gold release agent. In order to achieve a tight adaptation and ensure the best fit, a swedger was used.



Figure 12: After multiple dentin bakes, building in of natural shades was complete.



Figure 13: A view of contours and cutbacks that were completed for incisal effects.

Dental-Facial Analyzer, Panadent; Colton, CA), in addition to a stick bite. This was done to relate the horizontal plane and a bite registration of the teeth in maximum intercuspal position. These items then were sent to the ceramist, along with a detailed prescription that included digital photographs, a shade map, and the final shade of Chromascop 110/040/030.

PROVISIONALIZATION

Both lateral incisors were spot etched with a 2-mm spot of phosphoric acid in the center of the tooth. After rinsing and drying the

teeth, self-retracting retractors were placed. The clear matrix was filled with temporary material (Luxatemp acrylic shade B1) in the areas of the veneer preparations and placed over the teeth. The bis-acrylic was allowed to set for two minutes before gently removing the matrix in order to ensure that the provisionals shrink-locked onto the teeth. The margins of the provisionals were trimmed using finishing burs and disks (Sof-Lex). The provisionals then were polished with brushes, and a surface unfilled resin (G-Coat Plus, GC America, Inc.; Alsip, IL)

was placed to impart a glazed finish (Fig 10).

LABORATORY FABRICATION

In the laboratory, the veneers were fabricated according to a platinum foil technique. The dies first were trimmed to the margin using a long fluted bur. This created a definite finish line without undercuts.

A .001-inch thick platinum foil then was folded around the die to serve as a platinum matrix, one shaped like the preparation. The gold color of the foil represented a gold film that was baked on (Aurofilm 2000, Metalor Dental; North

Attleboro, MA), making the foil slightly more rigid and easier to peel from the veneers once they were fabricated (Fig 11).

Using this temporary framework, the ceramist then built up and baked the ceramic while maintaining the shape of the preparation (Fig 12). This was essential, particularly given the small amounts of ceramic that were placed and baked at a time in order to avoid distorting the matrix when the porcelain shrank.

Translucent dentins were used to control the amount of light allowed to transmit through the restorations (Fig 13). This is critical when teeth have a lot of reduction, or in the mesial and distal areas where there is not much tooth structure to provide a base for the ceramic canvas to cover.

Once the full-contour baking and shaping of the dentin material was complete, the incisal portion was cut back just enough to allow room for the application of incisal effects and translucencies (Fig 14), after which the veneers were baked and then glazed in the customary manner. Prior to sending to the dentist for try in, the internal aspects of the veneers were etched in the usual way (Fig 15).

Because the platinum foil imparts the restorations with a gray cast, it was not possible to know how they ultimately would look until the foil was peeled from the internal aspect of the veneers. Therefore, if the shade was incorrect, the veneers would need to be remade.

FINAL PLACEMENT CEMENTATION

Once the veneers were returned from the laboratory, they were inspected for fit and color on the models. The provisionals were removed (Fig 16), the preparations cleaned



Figure 14: The internal incisal effects were layered in order to match the translucencies of adjacent teeth.



Figure 15: Frontal view of the final restorations on the model.



Figure 16: It is important to note the tissue health around #7 following removal of the provisional restorations.



Figure 17: Experimentation with the restorations at try in using different value gels ranging from -2 to +2.

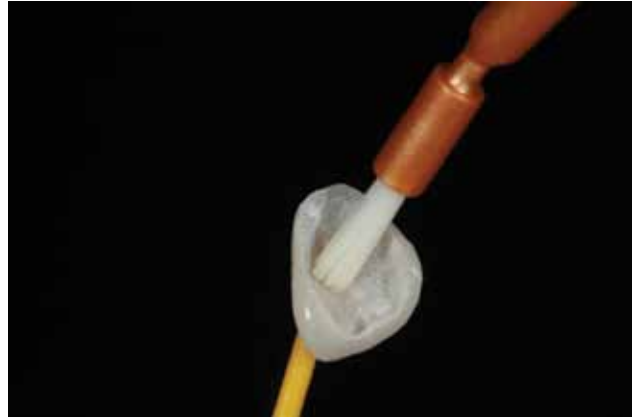


Figure 18: Silane was placed on the intaglio surface of the veneer.



Figure 19: A 35% phosphoric acid etch was applied to the preparations for 15 seconds and rinsed.



Figure 20: A bonding agent was placed on the preparations.



Figure 21: A resin cement was added to the internal surface of the veneers.



Figure 22: The veneers were placed on the teeth, and the excess cement was removed.

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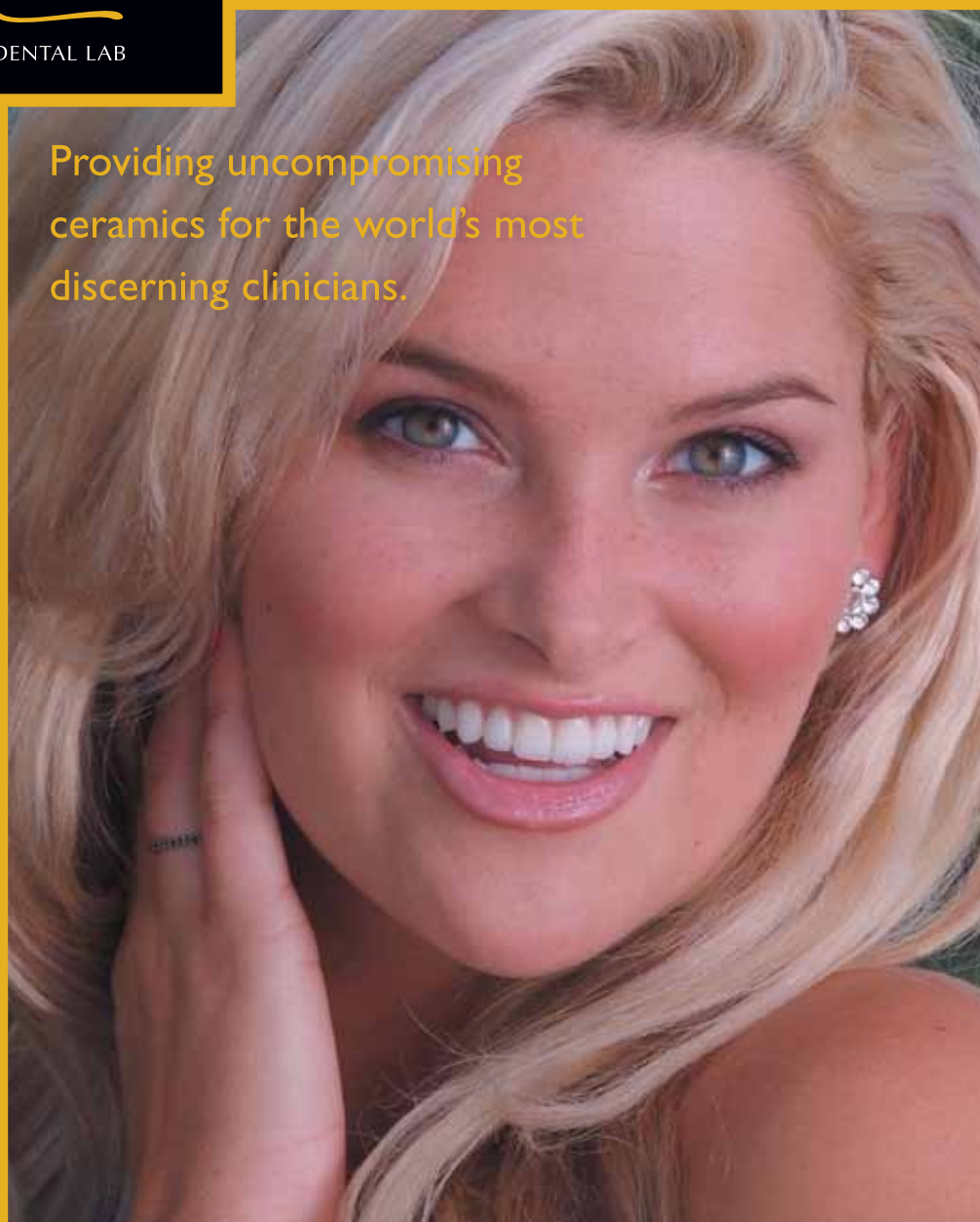
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Figure 23: The restorations were spot-tacked for five seconds using a 2-mm tacking tip.



Figure 24: Glycerin was placed around the margins after the excess cement was removed.



Figure 25: Excess cement was removed using a finishing carbide.

with hydrogen peroxide, and the definitive veneers tried in. The fit was verified, and veneer try-in gels (Variolink) were placed to equilibrate the minor shade variations between the veneers and the natural teeth. It was decided that a resin cement (Variolink Veneer) in shade +2 on tooth #7 and -2 on tooth #10 would be used (Fig 17).

The restorations then were removed from the mouth and their internal aspects treated with 35% phosphoric acid for one minute. After rinsing and drying, the veneers were treated with silane (Monobond Plus, Ivoclar Vivadent)

(Fig 18). The preparations also were cleaned using chlorhexidine and rinsed. A 35% phosphoric acid (Total Etch, Ivoclar Vivadent) then was applied to the preparations for 15 seconds and rinsed (Fig 19). A bonding agent (Excite, Ivoclar Vivadent) was applied to the teeth for 20 seconds (Fig 20), and the solvent was allowed to evaporate for 10 seconds before being light-cured with a light-emitting diode (LED) curing light (Bluephase, Ivoclar Vivadent) for five seconds.

The resin cement was placed into the veneers (Fig 21), and the veneers were placed onto the teeth (Fig 22),

with care taken to spot-tack the center of each veneer with a 2-mm tacking tip (Fig 23). By using a Butler gum stimulator (Sunstar; Chicago, IL) and micro brushes, almost all excess cement was removed. The veneers were flossed interproximally, and glycerin (Liquid Strip, Ivoclar Vivadent) was placed around the margins to ensure curing of the oxygen inhibition layer (Fig 24). The restorations were cured for 30 seconds on buccal and lingual surfaces using the Bluephase LED curing light, and the margins were polished using a #12 scalpel blade, an extra-fine football diamond, and 32



Figure 26: Right lateral 1:1 view following definitive cementation.



Figure 27: Left lateral 1:1 view following definitive cementation.



Figure 28: Retracted frontal 1:1 view of the definitive restorations.



Figure 29: A view of the maxillary and mandibular braces being used to correct the maxillary spacing and mandibular crowding.

bladed finishing carbides (Fig 25). Once the polishing was complete, the occlusion was checked, and any areas that required adjustment were polished with a porcelain polishing kit (Ceraglaze, Axis Dental) (Figs 26-28).

ORTHODONTIC PHASE

After the restorations were completed, the patient was referred to the orthodontist for full braces to correct the mandibular anterior crowding and maxillary central

incisor inclination and spacing (Fig 29). The orthodontics are necessary to finish this conservative case and improve the overall outcome and esthetics. The decision to perform the orthodontic therapy after placing the veneers, rather than before, was based on consultations and discussions with the patient and the referring orthodontist.

Finally, the patient was instructed to practice smiling in front of the mirror to help rehabilitate the uneven muscle pull and correct the

soft tissue asymmetry of the upper vermilion border.

CONCLUSION

The case presented here is just one example of a conservative approach to dental care that produced the desired results. It clearly demonstrates the manner in which we, as esthetic dentists, can employ a combination of conservative restorations to satisfy the patient's expectations, rather than emphasizing that "perfect smile." In particular,



Figure 30: In the final portrait view, the tissue display is even, the canines and premolars appear longer, and the overall smile is well balanced.

by embracing an interdisciplinary approach and solid treatment planning, successful results were accomplished in the spirit of responsible esthetics (Fig 30).

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Acknowledgement

Dr. Lowe thanks his colleague, Dr. Jonathan Suzuki of Vancouver, British Columbia, for his expertise in performing the orthodontic phase of the interdisciplinary treatment.



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² J. Sanz et al., "A Diode Laser as an Adjunct to Periodontal Surgery" J Dent Res 88(Spec Iss A): 847, 2009.

³ S.G. Ciancio et al., "Clinical Effects of Diode Laser Treatment on Wound Healing" J Dent Res 85(Spec Iss A): 2183, 2006.

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CORONAL RECONSTRUCTION OF A SEVERELY COMPROMISED CENTRAL INCISOR WITH COMPOSITE RESINS: A CASE REPORT



by Newton Fahl, Jr., DDS, MS
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Editor's note: The author received an honorarium from Hereaus Kulzer to develop this article.

ABSTRACT

This article presents the reader with factors to consider when restoring maxillary anterior dentition with direct composite resin veneers. In particular, the restoration of a severely discolored and fractured maxillary central incisor is demonstrated with the use of a direct approach and an integrated system of composite resins that replicate the internal structures of the tooth—specifically dentin and enamel. By observing a systematic layering technique, the reader will become familiar with the manner in which these materials can be manipulated to mimic the shade, properties, color, and form of natural dentition, while promoting responsible esthetics.

The decision regarding which modality is best suited for the patient can only be made following a comprehensive clinical examination that includes an esthetic evaluation and discussion with the patient.

INTRODUCTION

Diagnosing the extent of esthetic and functional compromise of an upper anterior tooth and recommending the ideal treatment is dependent upon judicious evaluations of the clinical situation. In cases of severely discolored and broken down teeth, full-coverage or partial-coverage porcelain restorations have been the standard

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Following parenteral use of phentolamine at doses between 5 to 15 times higher than the recommended dose of OraVerse (phentolamine mesylate), myocardial infarction, and cerebrovascular spasm and occlusion have been reported, usually in association with marked hypotensive episodes producing shock-like states. Although such effects are uncommon with OraVerse, clinicians should be alert to the signs and symptoms of tachycardia, bradycardia, and cardiac arrhythmias, particularly in patients with a history of cardiovascular disease; as these symptoms may occur with the use of phentolamine or other alpha-adrenergic blocking agents.

¹ Median time to recovery of lip sensation was reduced by 85 minutes (55%) for lower lip and by 83 minutes (62%) for upper lip compared to control.

² OraVerse is proven effective and safe in adults and children aged 6 or over and weighing 15 kg (33 lbs) or more.

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BRIEF SUMMARY OF PRESCRIBING INFORMATION

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1. INDICATIONS AND USAGE

OraVerse is indicated for reversal of the soft-tissue anesthesia, i.e., anesthesia of the lip and tongue, and the associated functional deficits resulting from an intraoral submucosal injection of a local anesthetic containing a vasoconstrictor.

OraVerse is not recommended for use in children less than 6 years of age or weighing less than 15 kg (33 lbs).

2. DOSAGE AND ADMINISTRATION

2.1 General Dosing information

The recommended dose of OraVerse is based on the number of cartridges of local anesthetic with vasoconstrictor administered:

Amount of Local Anesthetic Administered	Dose of OraVerse [mg]	Dose of OraVerse [Cartridge(s)]
½ Cartridge	0.2	½
1 Cartridge	0.4	1
2 Cartridges	0.8	2

OraVerse should be administered following the dental procedure using the same location(s) and technique(s) (infiltration or block injection) employed for the administration of the local anesthetic.

Note: Do not administer OraVerse if the product is discolored or contains particulate matter.

2.2 Dosing in Special Populations

In pediatric patients weighing 15-30 kg, the maximum dose of OraVerse recommended is 1/2 cartridge (0.2 mg).

(Note: Use in pediatric patients under 6 years of age or weighing less than 15 kg (33 lbs) is not recommended. A dose of more than 1 cartridge [0.4 mg] of OraVerse has not been studied in children less than 12 years of age.)

3. DOSAGE FORMS AND STRENGTHS

0.4 mg/1.7 mL solution per cartridge

4. CONTRAINDICATIONS

None

5. WARNINGS AND PRECAUTIONS

5.1 Cardiovascular Events

Myocardial infarction, cerebrovascular spasm, and cerebrovascular occlusion have been reported to occur following the parenteral administration of phentolamine. These events usually occurred in association with marked hypotensive episodes producing shock-like states. Tachycardia and cardiac arrhythmias may occur with the use of phentolamine or other alpha-adrenergic blocking agents. Although such effects are uncommon after administration of OraVerse, clinicians should be alert to the signs and symptoms of these events, particularly in patients with a prior history of cardiovascular disease.

6. ADVERSE REACTIONS

In clinical trials, the most common adverse reaction with OraVerse that was greater than the control group was injection site pain.

6.1 Clinical Trials Experience

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice. Dental patients were administered a dose of either 0.2, 0.4 or 0.8 mg of OraVerse. The majority of adverse reactions were mild and resolved within 48 hours. There were no serious adverse reactions and no discontinuations due to adverse reactions.

Adverse Event	OraVerse			Total (N = 418)	Control (N = 359)
	0.2 mg (N = 83)	0.4 mg (N = 284)	0.8 mg (N = 51)		
	N (%)	N (%)	N (%)		
Patients with AEs	15 (18)	82 (29)	20 (39)	117 (28)	96 (27)
Tachycardia	0 (0)	17 (6)	2 (4)	19 (5)	20 (6)
Bradycardia	0 (0)	5 (2)	2 (4)	7 (2)	1 (0.3)
Injection site pain	5 (6)	15 (5)	2 (4)	22 (5)	14 (4)
Post procedural pain	3 (4)	17 (6)	5 (10)	25 (6)	23 (6)
Headache	0 (0)	10 (4)	3 (6)	13 (3)	14 (4)

Table 1 lists adverse reactions where the frequency was greater than or equal to 3% in any OraVerse dose group and was equal to or exceeded that of the control group. An examination of population subgroups did not reveal a differential adverse reaction incidence on the basis of age, gender, or race. Results from the pain assessments in Study 1 and Study 2, involving mandibular and maxillary procedures, respectively, indicated that the majority of dental patients in both OraVerse and control groups experienced no or mild oral pain, with less than 10% of patients in each group reporting moderate oral pain with a similar distribution between the OraVerse and control groups. No patient experienced severe pain in these studies.

6.2 Adverse Reactions in Clinical Trials

Adverse reactions reported by less than 3% but at least 2 dental patients receiving OraVerse and occurring at a greater incidence than those receiving control, included diarrhea, facial swelling, increased blood pressure/hypertension, injection site reactions, jaw pain, oral pain, paresthesia, pruritus, tenderness, upper abdominal pain and vomiting. The majority of these adverse reactions were mild and resolved within 48 hours. The few reports of paresthesia were mild and transient and resolved during the same time period.

6.3 Post Marketing Adverse Reaction Reports from Literature and Other Sources

The following adverse reactions have been identified during postapproval parenteral use of phentolamine mesylate. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure. Acute and prolonged hypotensive episodes and cardiac arrhythmias have been reported with the use of phentolamine. In addition, weakness, dizziness, flushing, orthostatic hypotension, and nasal stuffiness have occurred.

7. DRUG INTERACTIONS

There are no known drug interactions with OraVerse.

8. USE IN SPECIFIC POPULATIONS

8.1 Pregnancy Pregnancy Category C

There are no adequate and well-controlled studies in pregnant women. OraVerse should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

8.4 Pediatric Use

In clinical studies, pediatric patients between the ages of 3 and 17 years received OraVerse. The safety and effectiveness of OraVerse have been established in the age group 6-17 years. Effectiveness in pediatric patients below the age of 6 years has not been established. Use of OraVerse in patients between the ages of 6 and 17 years old is supported by evidence from adequate and well-controlled studies of OraVerse in adults, with additional adequate and well-controlled studies of OraVerse in pediatric patients ages 12-17 years old [Studies 1 (mandibular procedures) and 2 (maxillary procedures)] and ages 6-11 years old [Study 3 (mandibular and maxillary procedures)]. The safety, but not the efficacy, of OraVerse has been evaluated in pediatric patients under the age of 6 years old. Dosages in pediatric patients may need to be limited based on body weight.

10. OVERDOSAGE

No deaths due to acute poisoning with phentolamine have been reported.

Overdosage with parenterally administered phentolamine is characterized chiefly by cardiovascular disturbances, such as arrhythmias, tachycardia, hypotension, and possibly shock. In addition, the following might occur: excitation, headache, sweating, pupillary contraction, visual disturbances, nausea, vomiting, diarrhea, or hypoglycemia. There is no specific antidote; treatment consists of appropriate monitoring and supportive care. Substantial decreases in blood pressure or other evidence of shock-like conditions should be treated vigorously and promptly.

14. CLINICAL STUDIES

The safety and efficacy of OraVerse when used for reversal of soft-tissue anesthesia (STA), i.e., anesthesia of the lips and tongue following a dental procedure that required local anesthesia containing a vasoconstrictor, were evaluated in the following clinical studies. OraVerse induced reversal of local anesthetic effects on the teeth, mandible and maxilla has not been assessed.

Two Phase 3, double-blinded, randomized, multi-center, controlled studies were conducted in dental patients who had mandibular (Study 1) or maxillary (Study 2) restorative or periodontal maintenance procedures and who had received a local anesthetic that contained a vasoconstrictor. The primary endpoint was time to normal lip sensation as measured by patient reported responses to lip palpation. The secondary endpoints included patients' perception of altered function, sensation and appearance, and their actual functional deficits in smiling, speaking, drinking and drooling, as assessed by both the patient and an observer blinded to the treatment. In the mandibular study, the time to recovery of tongue sensation was also a secondary endpoint. Patients were stratified by type and amount of anesthetic administered.

OraVerse was administered at a cartridge ratio of 1:1 to local anesthetic. The control was a sham injection. OraVerse reduced the median time to recovery of normal sensation in the lower lip by 85 minutes (55%) compared to control. The median time to recovery of normal sensation in the upper lip was reduced by 83 minutes (62%).

In Study 1 (mandibular), OraVerse accelerated: a) the recovery of the perception of normal appearance and function by 60 minutes (40%), b) the recovery of normal function by 60 minutes (50%), and c) the recovery of normal sensation in the tongue by 65 minutes (52%). In Study 2 (maxillary), the recovery of the perception of normal appearance and function was reduced by 60 minutes (50%) and the recovery of normal function was reduced by 45 minutes (43%).

Study 3, a pediatric, Phase 2, double-blinded, randomized, multi-center, controlled study was conducted in dental patients who had received 2% lidocaine with 1:100,000 epinephrine. Dental patients (n = 152, ages 4-11 years) received ½ cartridge of local anesthetic if they weighed ≥15 kg but <30 kg, and one-half or one full cartridge if they weighed ≥30 kg at a cartridge ratio of 1:1 to local anesthetic.

The median time to normal lip sensation in patients 6 to 11 years of age who were trainable in the lip-palpation procedures, for mandibular and maxillary procedures combined, was reduced by 75 minutes (56%). Within 1 hour after administration of OraVerse, 44 patients (61%) reported normal lip sensation, while only 9 patients (21%) randomized to the control group reported normal lip sensation. In this study, neither the patients' perception of their appearance or ability to function nor their actual ability to function was evaluated.

16. HOW SUPPLIED/STORAGE AND HANDLING

OraVerse (phentolamine mesylate) Injection 0.4 mg/1.7 mL is supplied in a dental cartridge, in cartons of 10 and 50 cartridges. Each cartridge is individually packaged in a separate compartment of a 10 cartridge blister pack.

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For Novalar Pharmaceuticals, Inc., San Diego, CA 92130

US Patent Nos.: 6,764,678; 6,872,390; 7,229,630

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17. PATIENT COUNSELING INFORMATION

Patients should be instructed not to eat or drink until normal sensation returns.

treatment for many years, based on their esthetic and strength characteristics. Delegating the artistic result to, and sharing the final esthetic outcome with, a talented ceramist help to alleviate the restorative dentist's stress and provide a more favorable prognosis. Functionally, ceramic crowns and bonded porcelain restorations have a proven track record substantiated by in vitro and in vivo observations that corroborate their indication.¹

Composite resins also have been advocated for decades as a means to conservatively restore minor, moderate, and even large defects. Their indication usually is predicated on the need to preserve as much sound remnant tooth structure as possible while using the synthetic resin composite materials to complete reconstructive adhesive augmentation. Since the challenges involving retention of such restorations are resolved by implementing sound adhesive techniques, what remains to be mastered in order to provide the utmost in esthetics and longevity with direct composite restorations is properly selecting composite materials, as well as the techniques for their application.

INDIRECT PORCELAIN VERSUS DIRECT COMPOSITE RESTORATIONS

When deciding between direct composite resin restorations and indirect porcelain restorations fabricated in a laboratory, dentists must address several considerations—some of which are clinical and others more artistic or creative in nature. Although 20 years ago it appeared that weaknesses in direct composite bonding involved the composite material itself,² manufacturers have made vast improvements to the formulations of direct composites that

have resulted in enhancements to their strength, esthetics, and reliability.³ However, direct composite resin restorations still require technique and artistic skills and have limited longevity.³ Although bonded porcelain veneers have demonstrated excellent esthetics,² they have traditionally required more tooth preparation than for direct composite restorations.³ And, despite the fact that porcelain veneers have shown the best overall survival,⁴ they also do not demonstrate a permanent life expectancy.³ At a time when patients and dentists alike desire minimally invasive approaches to treatment, the direct composite resin restoration may be more advantageous.

These composites can be manipulated to conceal or reveal underlying halo, mamelon, translucency, or characterization details to whatever extent is desired.

However, the decision regarding which modality is best suited for the patient can only be made following a comprehensive clinical examination that includes an esthetic evaluation and discussion with the patient.⁵ Long-term research has demonstrated a 94% survival rate for minimally invasive porcelain veneers,⁵ and although the use of minimally invasive or no-preparation porcelain veneers can be considered, so should what is best for each patient based upon clinical findings and preferences.

When patient satisfaction with indirect and direct veneers was analyzed, the choice of material (direct composite resin versus porcelain) was not found to significantly affect the patients' perception of esthetic enhancement.⁶ However, the results

of this research suggest that, when given the choice, patients prefer the option of the more conservative composite veneers.⁶

Indirect laboratory-fabricated porcelain restorations usually require at least two to three appointments. The responsibility for creating the esthetic results is outsourced to the laboratory. Therefore, the dentist and patient depend upon the ceramist's interpretation of key information (e.g., shade map, photographs of shade tabs) in understanding the esthetic qualities that are desired, as well as his or her talent in artistically applying ceramics to achieve the anticipated results.

Direct composite resin restorations, on the other hand, afford the clinician complete artistic and creative control over the realization of the restorations. Additionally, these restorations can be completed immediately, without the need for temporization or multiple appointments.

Therefore, as dentists explore the options that are in the best interests of their patients, they must develop a full understanding of the limitations, benefits, and science behind composite resin materials in order to produce highly esthetic restorations that can resist future deleterious effects.⁷ While the use of direct composite resin enables clinicians to exercise creative control over the restorative process, the successful delivery of esthetic restorations also requires that they have an understanding of natural tooth structure. Equipped with such knowledge, they can then undertake the task of developing their skills in applying appropriately formulated composites to mimic the esthetic properties of natural dentition.

REQUISITE KNOWLEDGE OF TOOTH STRUCTURE FOR COMPOSITE PLACEMENT

The perceived color of a tooth is a combination of an inner substrate (i.e., dentin) and an outer substrate (i.e., enamel); this is known as the composite tooth color.^{8,9} Each has intrinsic physical and optical properties. Dentin is approximately 20% more opaque than enamel,¹⁰ providing most of a tooth's hue, which falls in the red-yellow spectra.^{9,11} Enamel is a fiber optic layer that adjusts the perception of the underlying dentin color.^{9,12} The extent of translucency/opacity of enamel varies based on factors such as enamel thickness, genetics, and age, in addition to treatment factors such as tooth bleaching.¹³

These variations alter the perception of the underlying dentin color, changing its chroma and value. Highly translucent enamel allows light to be transmitted through it to reach a deeper, high-chroma dentin substrate and reflects most of its hue without much change in color saturation.⁹ This creates the appearance of an enamel of lower color value. More opacous enamel serves as a barrier that disperses, absorbs, and reflects light such that a minimal amount of color (i.e., hue, chroma) is perceived.⁹ Here, an enamel of higher value is created.

Recreating these structures and effects with direct resin requires the use of a composite system that will yield predictable results. Such a system should include shades, opacities, and translucencies that mimic the properties of dentin and enamel. For example, a composite that is to serve as an artificial dentin (AD) is a higher chroma, slightly lower value, opacous composite that mimics missing natural dentin

based on its optical and physical properties.⁹ Artificial chromatic enamel (ACE) composites are keyed to the VITA shade guide (Vident; Brea, CA) and exhibit a hue with a lower chroma and slightly higher value than the underlying AD composite.⁹ The artificial achromatic enamel (AAE) composites are not keyed to the VITA shade guide and are used to impart varying degrees of translucency and subtle hues (e.g., gray, blue, amber), as well as depth to areas such as the incisal third. These composites also may demonstrate milky-white semi-translucent effects in order to replicate the lingual enamel contours (i.e., lingual shelf) and create halo effects.⁹

It behooves the clinician to select a composite system that integrates the requisite AD, ACE, and AAE composites.

AAE composites, which range from translucent to opacous, are used as a final layer to modify or corroborate an existing value of the body enamel, as well as to seal the characterizations and maverick colors underneath.¹⁴ Opaquing agents can usually be used in combination with other enamel and dentin layers to modify the value of discolored underlying tooth structure.¹⁴

When selecting ACE and AAE composites, it is important to note that value enamels are usually of high, medium, or low intensity, and their selection depends upon the brightness and degree of translucency/opalescence intended over the lobe areas and incisal third.¹⁴ These composites can be manipulated to conceal or reveal underlying halo, mamelon, translucency, or

characterization details to whatever extent is desired. The AAE composites also can be applied to alter the perception of the chroma of underlying layers of artificial dentin and body enamel.¹⁴

SELECTING INTEGRATED COMPOSITE SYSTEMS

Understandably, the restoration of a single maxillary central incisor with a direct composite placement procedure still may prove elusive because of the difficulty in harmonizing form and color within a clinically acceptable time frame. As in all dental procedures, direct composite placement requires a methodical protocol in order for predictable and satisfactory results to be achieved.

Therefore, when faced with such cases, it behooves the clinician to select a composite system that integrates the requisite AD, ACE, and AAE composites. One such system is a new hybrid-based universal composite (Venus Diamond, Heraeus Kulzer; South Bend, IN) that combines low shrinkage and high strength.¹⁵⁻²⁰ It is ideal for placing efficient, straightforward, and reliable anterior and posterior restorations that are highly esthetic and lifelike. Further, this ultra-fine nanohybrid composite ensures noticeably better mechanical features. Other direct restorative systems that include a variety of dentin, chromatic, and achromatic enamels include—but are not limited to—IPS Empress Direct (Ivoclar Vivadent; Amherst, NY), Kalore (GC America Inc.; Alsip, IL), Estelite Sigma (Tokuyama America Inc.; Encinitas, CA), and Supreme Ultra (3M ESPE; St Paul, MN).

Available in 23 shades, a two-layer shade guide made from genuine materials facilitates accurate selec-



Figure 1a: Restoring a single maxillary anterior tooth with direct composite resin presents a major clinical challenge.



Figure 1b: Light blockage, which is noticeable through trans-illumination, accounts for a potential esthetic compromise.



Figure 2: A periapical radiograph was used to assess the soundness of the endodontic treatment, as well as any compromises not detected clinically.

tion of the most appropriate shade. The material's "color adaptive matrix" allows restorations to blend seamlessly with the surrounding dentition, and the material's physical properties contribute to its handling characteristics and high abrasion-resistance. Venus Diamond is indicated for restorations for Classes I through V, shape and shade corrections (i.e., diastema closure), core buildups, porcelain and composite repairs, and direct composite veneers, among others.

This article describes the restoration of a severely discolored and fractured maxillary central incisor using a direct approach and composite resins. Shade and material selection are described to promote cohesiveness of color and form.

CASE PRESENTATION

A female in her 30s presented with a fractured, endodontically treated, and discolored maxillary right central incisor (tooth #8) that showed a defective Class IV restoration (Figs 1a & 1b). The left central incisor (tooth #9) presented a defective Class III restoration

on its mesial aspect. Due to the lack of anatomical uniformity, there was a noticeable asymmetry between the two teeth. Radiographic examination confirmed that endodontic treatment had been adequately performed, with no need for re-treatment (Fig 2).

Direct and indirect restorative options were discussed with the patient, including restoration longevity and costs. A direct approach was favored over full- or partial-coverage porcelain restorations, so treatment planning for composite resin restorations was initiated.

SHADE AND RESTORATIVE MATERIALS SELECTION

Due to the large size of the restoration and the functional stress it would undergo, Venus Diamond nanohybrid composite resin was selected. Nanohybrid technology allows for high fracture toughness in stress-bearing areas, while providing more than adequate polishability, characteristics which are desired in the esthetic zone.

Artificial dentin and enamel shades were selected using



Figure 3: An ACE was selected to establish the hue and chroma.



Figure 4: ADs of higher chroma than, and equal chroma to, the ACE were selected for the Class IV and veneer portions of the restoration, respectively.



Figure 5: AAEs were selected for use in deep translucency areas and over the facial aspect as a value modifier.

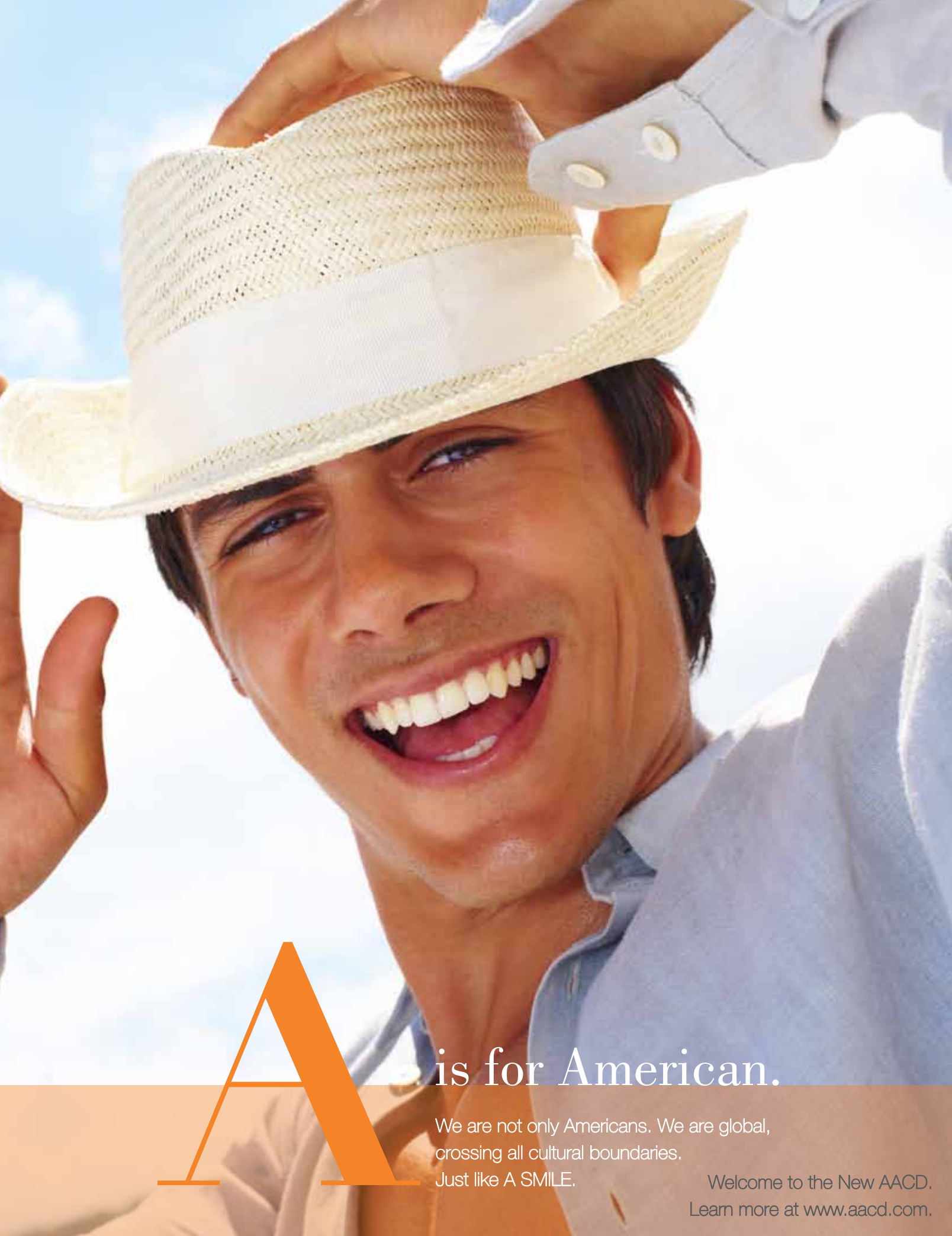
customized composite resin shade tabs. It has been reported that there is an overall poor correlation of color between a VITA Lumin shade guide and the actual VITA designation of a composite resin,²¹ and that composites undergo significant change in their color and optical properties after light polymerization.²² Furthermore, the changes are shade- and brand-dependent,²³ which makes it very cumbersome to use a VITA or any other shade guide that is not made from the actual composite resin.

This author suggests the fabrication of customized tabs that are 3 mm thick at the cervical third and 0.5 mm at the incisal edge to allow the visualization of color density and opacity gradient. These tabs are made from a putty impression material mold, which is filled with each corresponding shade of composite and light-cured. They can be conveniently glued to a plastic handle to facilitate manipulation.

The shades were selected according to the following criteria:⁸

- ADs to provide opacity, hue, and chroma
- ACEs, which are keyed to the VITA shade guide, to provide hue, chroma, and value to the restorations
- AAEs, which are not keyed to the VITA shade guide, to create effects ranging from translucency to milky-whiteness.

The left central incisor (tooth #9) was used for color reference, and the shade tabs were compared to the respective areas where the colors were observed (Fig 3-5). Due to the



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Figure 6a



Figure 6b

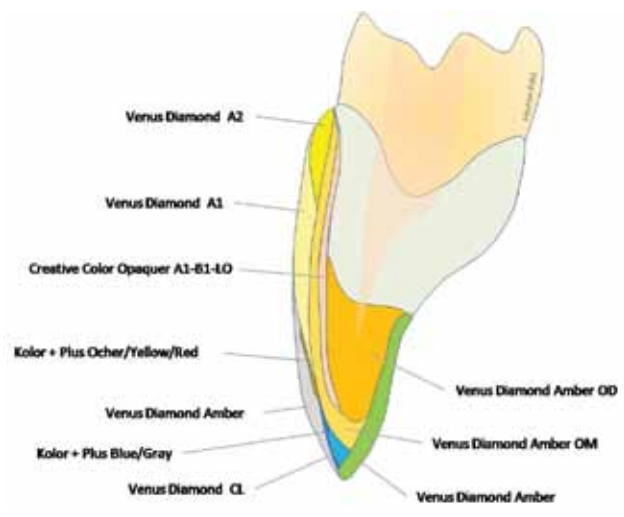


Figure 6c: Color map.

Figures 6a & 6b: A color mock-up was created on the discolored tooth in order to ascertain the correctness of the shades selected. Opacity and thickness of the color mock-up were evaluated at this time.

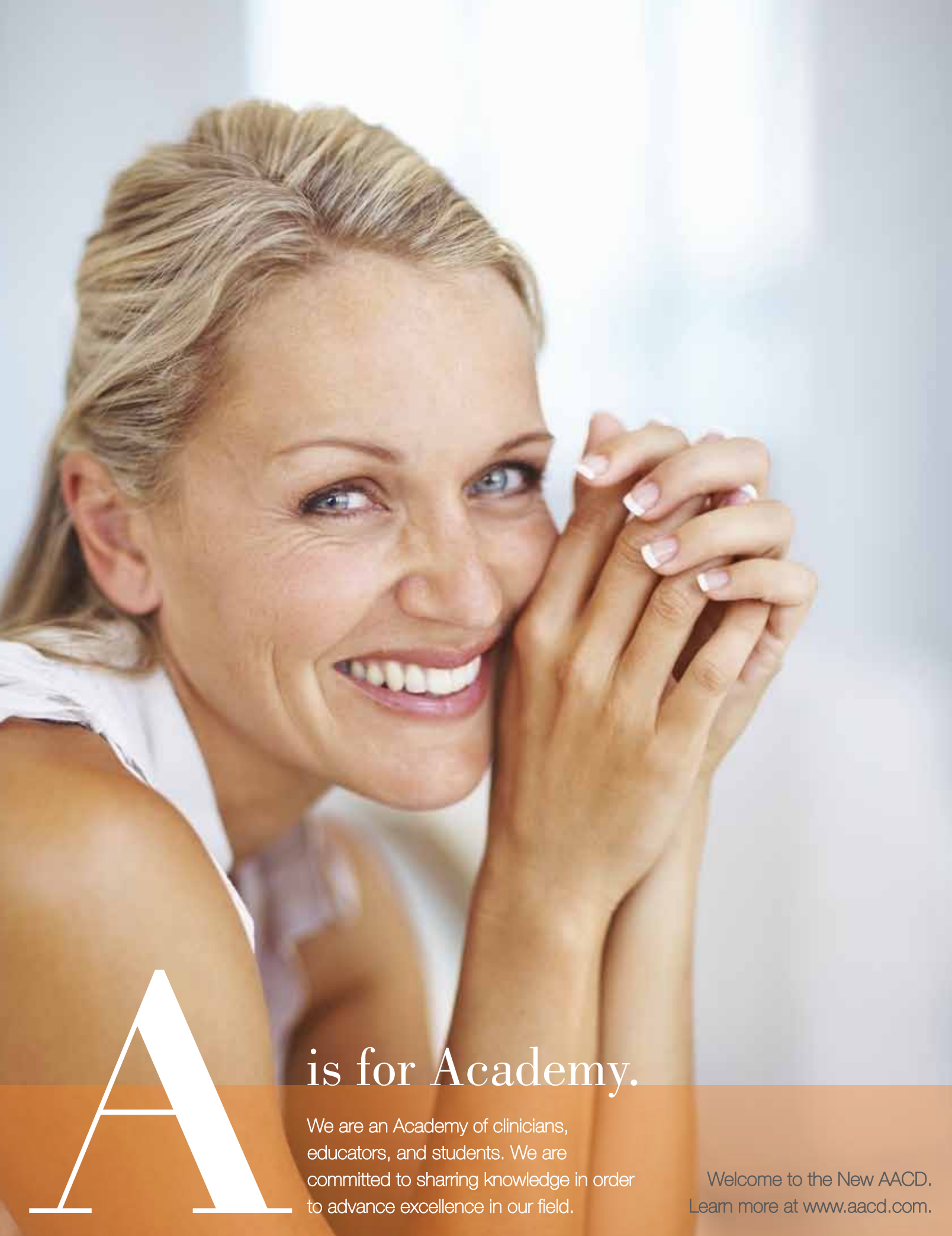
intense discoloration of the tooth, an opaquer (Creative Color, Cosme-dent; Chicago, IL) was selected to elevate the low value caused by the pigmented tooth substrate.

A color mock-up was made by layering each shade selected according to the shape and thickness necessary to achieve the intended value change, but still imparting the desired polychromatic nuances (Figs 6a & 6b). The opacity and thickness of the veneer mock-up were evaluated, and any modification deemed important was recorded for the final restoration. A color map (Fig 6c) indicated the layering of each increment according to shade and ideal thickness.

PREPARATION PROTOCOL

Prior to initiating preparation protocol, a silicone matrix was made based on a waxed-up model. This would be used to guide proper composite placement and ensure reproduction of form and occlusion patterns (Fig 7).

The defective restorations then were removed and cavity preparations completed. The right central incisor was prepared with a modified Class IV/veneer design,¹⁴ reducing the facial by approximately 1.2 mm (Fig 8). The Class III preparation consisted of removing the defective restoration and carious le-



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Figure 7: A silicone matrix was made based on a waxed-up model and would be used for proper reproduction of form and occlusal patterns.



Figure 8: The defective restoration was removed and discolored tooth substrate was revealed.



Figure 9a: A rubber dam was placed and cavity preparation further completed to preserve a maximum of labial enamel.



Figure 9b: The initial proximal preparation of tooth #9 revealed a fairly deep primary Class III carious lesion.



Figure 9c: A caliper was used to ascertain enamel thickness. Preservation of labial enamel in a Class III cavity depends on enamel translucency/opacity and thickness.



Figure 10: A 35% phosphoric acid was used to etch the dentin and enamel for 30 seconds.



Figure 11: A three-step adhesive was applied to dentin and enamel, then and light cured for 20 seconds.



Figure 12: An AD composite of higher chroma than the intended enamel chroma was applied and sculpted to conform to the histological boundaries of the natural dentin.

sion (Fig 9a). Following placement of a rubber dam, the cavity preparation was further refined (Fig 9b) and, upon completion of the Class III cavity preparation, the thickness of the remaining enamel wall was measured using a thickness caliper (Fig 9c).

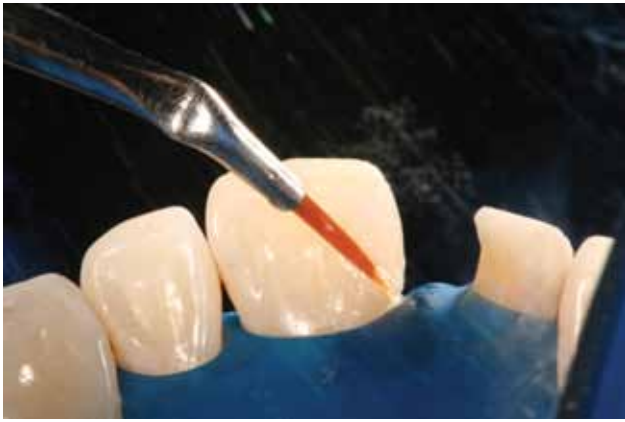
The thicker and more opaque the enamel is, the greater the chance that a halo will not result from optical discrepancies between the natural tooth structure and the synthetic materials. Enamel walls thinner than 1.0 mm on the labial aspect

should be evaluated for their translucency and removed altogether to avoid halos that could arise from optical discrepancies. Such preparations should include a longer labial bevel to conceal the tooth-composite transition.

COMPOSITE PLACEMENT TECHNIQUE

A silicone putty matrix (Zeta Labor, Zhermack; River Edge, NJ) fabricated on the waxed-up model was tried in to verify its precise fit. Then, prophylaxis was performed on both teeth using a mixture of pumice and

2% chlorhexidine. The preparations then were prepared adhesively with a total-etch technique (Fig 10), and a three-step etch-and-rinse adhesive was applied²⁴⁻²⁶ (Fig 11) and light-cured. Specifically, 35% phosphoric acid (Ultra-Etch, Ultradent Products; South Jordan, UT) was used to etch the dentin for 15 seconds and enamel for 20 seconds, after which the three-step adhesive was applied to the dentin and enamel and light-cured for 20 seconds using a light-emitting diode (LED) curing unit



Figures 13a & 13b: An ACE composite was applied to tooth #9 and contoured to final anatomy.



Figure 14: Both central incisors were checked with a digital caliper to verify the symmetrical mesio-distal widths.



Figure 15: A #212 clamp was placed to facilitate operative access to tooth #8.

(Bluephase 16i, Ivoclar Vivadent; Amherst, NY).

An AD composite (shade OD) in a higher chroma than the intended enamel chroma was applied to the Class III preparation of tooth #9 and sculpted to conform to the histological boundaries of the natural dentin (Fig 12). This increment of composite was light-cured for 10 seconds. An ACE composite (shade A2) then was applied and contoured to final anatomy (Figs 13a & 13b), after which it was cured for 10 seconds. Finally, an AAE composite (Amber) was applied and contoured to bring the central incisor to its

correct mesio-distal width, while also adding volume to the mesial lobe. This layer also was cured for 10 seconds.

The cured restoration was finished to its primary anatomy. The symmetrical mesio-distal widths of both central incisors then were checked using a digital caliper (Dentagauge, Erskine Dental; Marina Del Rey, CA) (Fig 14).²⁷

To facilitate operative access to tooth #8, a #212 clamp (Hu-Friedy; Chicago, IL) was placed (Fig 15). After refining the preparation, the core

was entirely in dentin, while the periphery was in enamel.

The prepared tooth was sandblasted with 27 μ aluminum oxide (MicroEtcher, Danville Engineering; San Ramon, CA) to clean the preparation and enhance adhesion (Fig 16).^{28,29} The enamel was etched for 20 seconds (Fig 17) and the dentin for 15 seconds, after which each was rinsed and excess water aspirated with high vacuum to bring the dentin to ideal moisture. A total-etch, three-step adhesive (Optibond FL, Kerr; Orange, CA) was applied to the dentin and enamel and light-cured (Fig 18).



Figure 16: The prepared tooth was sandblasted with 27 μ aluminum oxide to clean the tooth substrate and enhance adhesion.



Figure 17: The dentin and enamel were etched for 15 and 20 seconds, respectively.



Figure 18: A total-etch, three-step adhesive was applied to the dentin and enamel and light-cured.



Figure 19a: The matrix was positioned against the lingual aspects of both central incisors, and the composite was thinned out to an even thickness of approximately 0.3 mm.



Figure 19b: After the matrix was removed, any excess uncured composite flash was removed from around the gingival area on the palatal aspect.



Figure 20: The Class IV portion of the defect was initially restored with an AD composite increment built out to the labial level of the veneer preparation, flush with the tooth contour.



Figure 21: An opaquer was applied over the AD core and veneer preparation until a higher and even value that matched that of tooth #9 was achieved.

Then, a 0.5 mm thick layer of an AAE composite (Amber) was applied into the silicone matrix. The matrix was positioned against the lingual aspects of both central incisors, after which the composite was thinned out to an even thickness of approximately 0.3 mm and light-cured for 10 seconds from the labial aspect (Figs 19a & 19b). After the matrix was removed, any excess uncured composite flash was removed from around the gingival area on the palatal aspect, and the thin lingual shelf was further light-cured for 10 seconds from each aspect. This lingual shelf established the proximal contacts and, most importantly, determined the three-dimensional position of the facio-incisal line angle.

The Class IV portion of the defect initially was restored with an AD composite increment (shade OD), which was built out to the labial level of the veneer preparation until it was flush with the tooth contour (Fig 20). This artificial dentin layer was light-cured for 10 seconds.

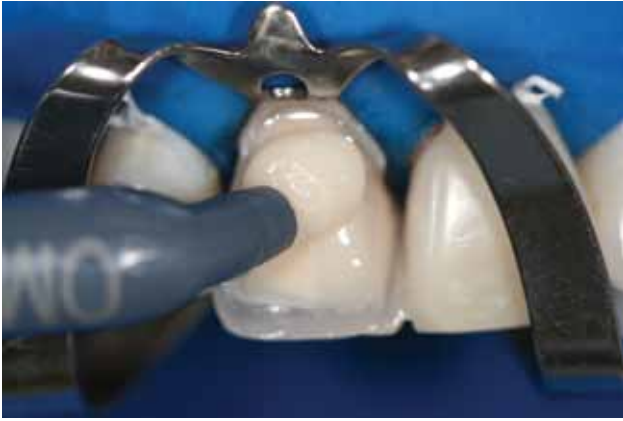
An opaquer (Creative Color Opaquer A1-B1-LO + Pink) was applied over the AD composite core and veneer preparation (Fig 21) until a higher and even value that matched that of tooth #9 was achieved. Due to tooth dehydration, the value of all adjacent teeth was higher at this point, making it impossible to gauge the correct amount of value change at this time. It was based on the pre-restor-



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Figures 22a & 22b: A higher value AD composite layer was applied evenly over the opaque, up to the incisal third.



Figures 23a & 23b: To impart translucency at the incisal third, a layer of an AAE composite was applied in between and slightly over the dentin mamelons.

ative color mock-up that the proper shade and thickness of the opaquer were determined.

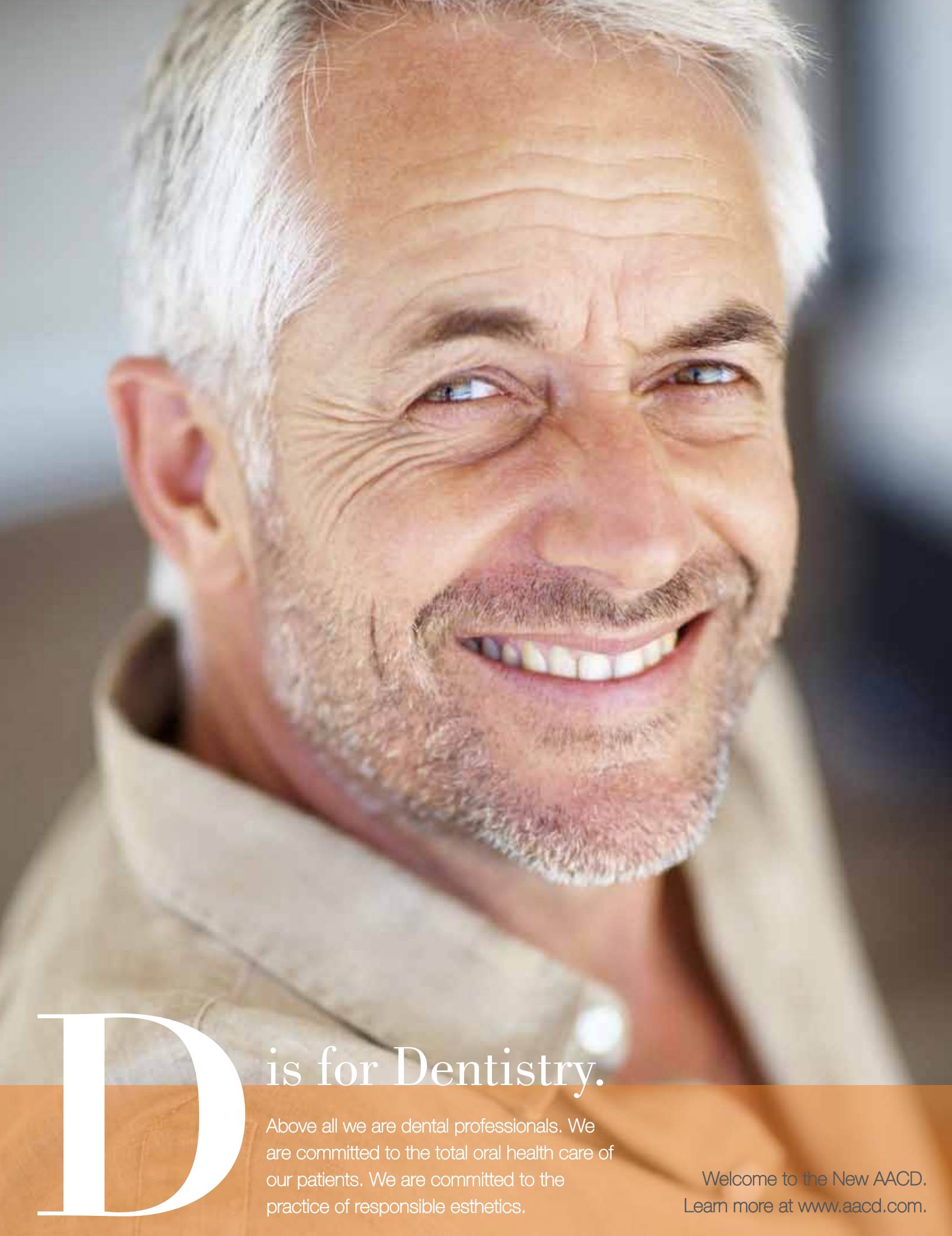
A higher value, lower chroma AD composite layer (shade OM) was applied evenly over the opaquer and up to the incisal third, then cured for 10 seconds (Figs 22a & 22b). This layer promoted an even substrate of elevated value while allowing for the sculpturing of mamelons.

Space was left for the subsequent layers of ACE and AAE composites. In order to impart translucency at the incisal third, a layer of an AAE composite (shade CL) was applied

in between and slightly over the dentin mamelons and cured for 10 seconds (Figs 23a & 23b). An ACE composite (shade A2) was applied and sculpted at the cervical third to establish a slightly higher chroma at that area and cured for 10 seconds (Figs 24a & 24b). An ACE composite (shade A1) was applied and sculpted at the middle third (Fig 25) to establish a slightly lower chroma in that area, after which that layer also was cured for 10 seconds.

Tints (Kolor + Plus, Kerr) were used sparingly at the transition between the middle and incisal

thirds to emphasize a higher chroma spot, as seen on tooth #9 (Figs 26a & 26b). Blue/Gray tints (Kolor + Plus) were used sparingly at the incisal third to enhance the perception of depth. Then, a final layer of AAE composite (Amber) was applied to cover the entire facial aspect and bring the restoration to final contour (Figs 27a & 27b). This achromatic enamel, also called value enamel because of its role in modifying or corroborating the brightness of a restoration, has the ability to diffuse the light to some extent, while permitting the colors



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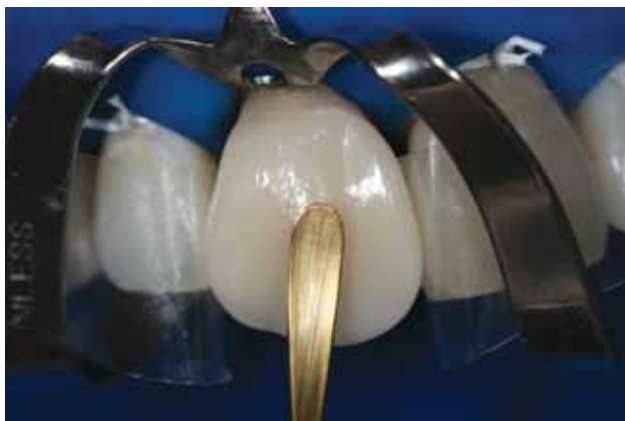
Figures 24a & 24b: An ACE composite was applied and sculpted at the cervical third to create a slightly higher chroma at that area.



Figure 25: An ACE composite was applied and sculpted at the middle third to create a slightly lower chroma at that area.



Figures 26a & 26b: Tints were used sparingly at the transition between the middle and incisal thirds in order to emphasize a higher chroma spot, as seen in tooth #9.



Figures 27a & 27b: A final layer of AAE composite was applied, covering the entire facial aspect and bringing the restoration to final contour.



Figure 28: The clamp was removed, and the central incisors were checked for symmetry.



Figure 29: A hydrosoluble oxalate gel was applied to cover the whole restoration, after which it was further light-cured for 20 seconds from each aspect.

of the underlying layers to selectively show through. This layer was cured for 10 seconds.

The clamp was removed, and the central incisors were checked for symmetry (Fig 28). A hydro-soluble oxalate gel was applied to cover the entire restoration, which was then light-cured further for 20 seconds from all aspects (Fig 29). After an initial evaluation of the primary anatomy, coarse Sof-Lex Pop-on XT discs (3M ESPE; St. Paul, MN) were used to establish primary anatomy, and both central incisors were checked with a digital caliper for correctness of height-width

proportion and bilateral symmetry (Fig 30).

The restoration was finished and polished with metal (Vision Flex, Brasseler USA; Savannah, GA) and plastic (Epitex, GC America, Inc.; Alsip, IL) strips (Fig 31). They were then buffed and polished with rubber rotaries (Venus supra polishers), and a final polish was imparted using an aluminum oxide paste (Enamelize, Cosmedent) and felt disc. Occlusion and disclusion were checked and adjusted accordingly. The three-month postoperative photograph depicts a harmoni-

ous integration of form and color (Figs 32a & 32b).

CONCLUSION

This article has described the restoration of a severely discolored and fractured maxillary central incisor using a direct approach and composite resins. Within the limitations of the techniques represented, it was possible to replicate the internal tooth structures—dentin and enamel—and mimic their natural properties. Key factors influencing composite and shade selection also were addressed to promote



Figure 30: Both central incisors were checked with a digital caliper for correctness of height-width proportion and bilateral symmetry.



Figure 31: The restoration was finished and polished with metal and plastic strips.



Figures 32a & 32b: The three-month postoperative photograph depicts a harmonious integration of form and color.

an enhanced understanding of the application of this restorative modality for the restoration of tooth form and color. Minimal tooth preparation and maximum conservation of natural sound tissues were observed, living up to the philosophy of responsible esthetics, while promoting the re-establishment of nature's biomimetic principles. However, a thorough discussion of all systems and their AD, ACE, and AAE shade designation was outside the scope of this article, and

the reader is encouraged to pursue further reading for a broader understanding of restorative composites classification.

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REMOVAL AND RECEMENTATION OF A CROWN DUE TO CHROMOGENIC BACTERIAL INFILTRATION USING A LASER TECHNIQUE



by Ronald M. Goodlin, DDS
AACD Accredited Member
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INTRODUCTION

One of the most difficult procedures in cosmetic dentistry is the restoration of a single anterior tooth. For example, consider a case in which, after several failed attempts to restore a Class IV fracture of the maxillary right central incisor using composite (Fig 1), a crown was fabricated from pressed ceramic (IPS Empress, Ivoclar Vivadent; Amherst, NY). Two custom stain appointments were required to duplicate the natural appearance of the tooth and create the desired effect of white enamel calcifications. The crown was tried in, and the patient gave verbal consent to proceed. The restoration was cemented according to a total-etch and bond technique using a resin cement (Variolink Veneer, Ivoclar Vivadent).

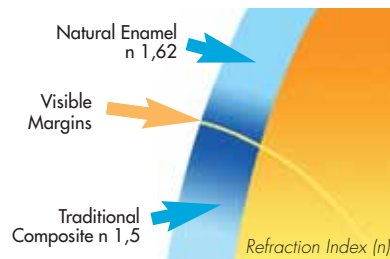
This type of discoloration results from tissue inflammation that leads to bleeding or leakage of crevicular fluids during cementation.

Four weeks after cementation, the patient returned to the office, at which time the crown was noticeably darker at the gingival third (Fig 2). The differential diagnosis was black staining due to infiltration of chromogenic bacteria, which caused the tooth discoloration.

This type of discoloration results from tissue inflammation that leads to bleeding or leakage of crevicular fluids during cementation. In this case, the discoloration resulted from the interaction of the hydrogen sulfide produced by *Actinomyces* bacteria and the iron compounds found in the blood or gingival exudate.¹ The most common causes of this gingival irritation and subsequent infiltration under the crown margin are insufficient cleaning of the tooth surface prior to cementation, or bleeding tissue or leakage of crevicular fluids during the cementation process.

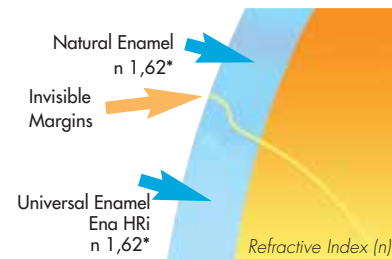
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Figure 1: View of the patient's fractured right central incisor.



Figure 2: Four weeks after cementation, the patient returned with a dark crown.

UTILIZING A LASER FOR TREATMENT

Upon presentation, the patient's tooth was asymptomatic and responded normally to heat, cold, and percussion sensitivity testing. A periapical radiograph was taken and was normal in appearance.

Historically, previous technique would have suggested the necessity to remove the existing crown using a conventional high-speed handpiece and diamond burs, removing the porcelain down to the tooth interface. Subsequently, new impressions would be taken and a new crown fabricated at great expense of time and financial resources.

However, an alternate technique was proposed. Hydrokinetic (i.e., water excited by laser energy) Yttrium-Scandium-Gallium Garnet (YSGG) laser applications have been used for various dental procedures for some time,² so it was postulated that it might be used to disturb the cement bond interface, resulting in the clean and undamaged removal of the restoration. This also would allow the tooth and restoration to be cleaned, treated, and recemented at the same appointment.

The clinical diagnosis was confirmed when black staining, due to chromogenic bacteria, was noted inside the crown and on the gingival third of the tooth.

TREATMENT TECHNIQUE

The patient arrived, and hydrokinetic energy from a YSGG laser (Waterlase, Biolase; Irvine, CA) at a setting of 4.0W, 65% air, and 55% water was applied. This is the setting I routinely use for this laser when removing decay during cavity preparation (Figs 3 & 4). The patient indicated the tooth was sensitive to the cold, so local anesthetic was administered.

Subsequently, the laser was applied without discomfort using an alternating horizontal and vertical criss-cross pattern for 30 seconds (a timer was used) on the labial surface, and for an additional 30 seconds on the lingual surface. This length of time was selected as it is generally the time required to remove 1 mm of decay in a Class I cavity preparation (Figs 5 & 6).

A small spoon excavator was applied to the lingual margin—

which is exactly how a restoration would be removed during the try-in stage—and the crown slid off the underlying tooth without difficulty. Inspection of the crown under magnification confirmed there was no visible damage to the porcelain.

The clinical diagnosis was confirmed when black staining, due to chromogenic bacteria, was noted inside the crown and on the gingival third of the tooth. It appeared that the resin cement had been ablated by the laser application, since there were no visible signs of resin cement either inside the crown or on the tooth. This was due to the fact that the laser energy disturbed the water content of the resin cement, thereby literally vaporizing it (Figs 7 & 8).

The crown was micro-etched with an air abrader (Danville Engineering; San Ramon, CA), using ultra-fine aluminum oxide to ensure there were no remnants of resin cement or bacterial infiltrate inside the crown. In preparation for recementation, the interior of the crown was treated with 9% hydrofluoric acid for 60 seconds, rinsed, and dried. A silane coupling agent was applied, allowed to air-dry, and reapplied. A universal



Figure 3: View of the laser settings.



Figure 4: The laser energy was applied to the crown.

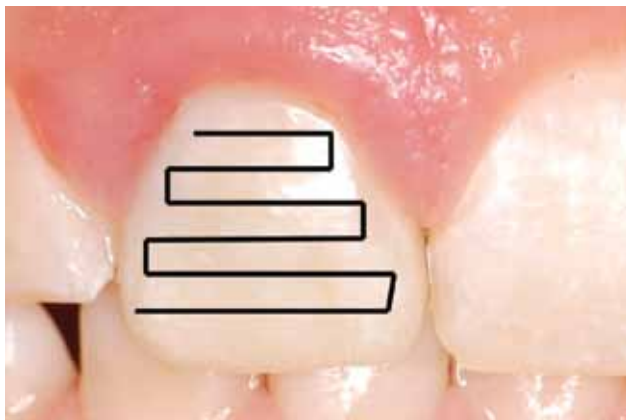


Figure 5: View of the vertical pattern of the laser path.

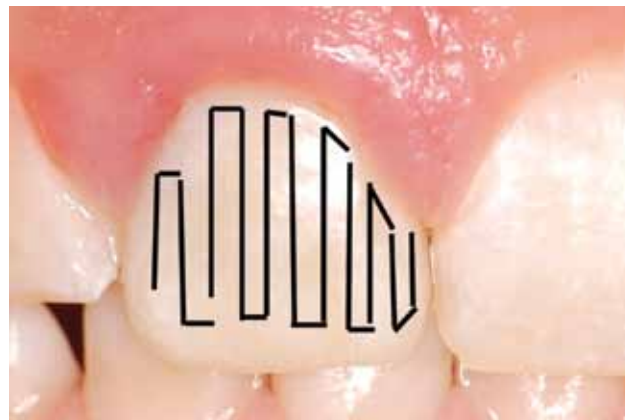


Figure 6: View of the horizontal pattern of the laser path

bonding agent (Scotchbond Multipurpose, 3M ESPE; St. Paul, MN) was applied, air-thinned, and light-cured (Fig 9).³

A #1 retraction cord (Ultrapak, Ultradent Products, Inc.; South Jordan, UT) was packed to prevent crevicular fluid leakage, and the crown was recemented. This step had been omitted during the initial cementa-

tion procedure and was thought to be the cause of the bacterial infiltrate (Fig 10).

The tooth surface was cleaned using a slurry of chlorhexidine, and 74- μ fine pumice powder was applied using a micro-brush and prophy cup to remove all traces of stain and any possible remnants of resin cement. A cotton pellet soaked

in sodium hypochlorite was rubbed onto the tooth for 10 seconds to clean the surface, after which the tooth was rinsed with copious amounts of water for 30 seconds. The tooth then was treated with a total-etch 35% phosphoric acid for 30 seconds, and a dentin-enamel bonding agent (Excite, Ivoclar Vivadent) was applied with constant rubbing for



Figure 7: View of the chromogenic bacteria on the tooth.



Figure 8: View of the chromogenic bacteria on the inside of the crown.



Figure 9: The crown was micro-etched and hydrofluoric acid etched, silane was applied, and the crown was bonded into place.



Figure 10: Prior to cementation, a #1 retraction cord was placed.

15 seconds. The acetone solvent was subsequently evaporated to prevent postoperative sensitivity using high-volume suction for 10 seconds at 1 cm away from the tooth, after which it was light-cured.

Resin cement (Variolink Veneer) was placed into the crown, and the crown was seated into place. The resin cement was wave-cured at the margin by passing a plasma arc curing light over the margin at a distance of about 2 cm (i.e., 1.5 inches) to cure the outer layer of cement, allowing easier removal of the excess from the margin area. The excess resin cement was removed. It had

been determined that bonding resin was not required to be placed on the porcelain interior of the crown interface prior to cementation, because the viscosity of the Variolink Veneer resin cement is enough to bond directly to the silane coupling agent (Ivoclar Vivadent).

Glycerine was placed on the margins to prevent an oxygen-inhibited layer, and the tooth-restoration marginal interface was light-cured using a plasma arc curing light for a series of 10-second bursts on both the labial and lingual aspects in order to reduce heat buildup and prevent any

possibility of pulpal necrosis.⁴ This also ensured the depth of cure of the underlying resin cement. The cord was removed, and a gingival retraction paste (Expasyl, Kerr; Orange, CA) was placed for three minutes to eliminate any bleeding from gingival irritation after cord removal. This was done as an additional precaution but is usually unnecessary during cementation procedures. Margins, contacts, and occlusion were then checked.

The patient was advised that the adjacent teeth were now dehydrated, and the natural tooth structure would rehydrate within



Figure 11: Postoperative close-up view of the recemented crown immediately after insertion. The adjacent teeth are desiccated and lighter in color.



Figure 12: Alternate postoperative close-up view of the recemented crown. Note that the dark stain is gone.



Figure 13: Full-facial view of the patient in natural smile. The patient was told the color would return to normal, as the natural teeth would rehydrate within 24 to 36 hours.



Figure 14: Full-facial view of the patient in natural smile one year postoperative.

24 to 36 hours, at which time the natural tooth color would stabilize (Figs 11-13). At that time, the colors of both the crown and adjacent tooth would be more homogeneous.⁴ Postoperative instructions were given to the patient, who was dismissed. After one year, there has been no recurrence of discoloration following removal and recementation of the crown (Figs 14-16).

CONCLUSION

The use of hydrokinetic YSGG laser energy was successful in disturbing the ceramic-bonded-to-tooth interface and enabling the removal of the bonded all-ceramic crown, without damaging the restoration or underlying tooth structure. I am not aware of any literature that explains the mechanism of destruction of the resin cement bond.

In situations where an all-ceramic restoration must be removed undamaged to correct underlying discoloration resulting from infiltration of chromogenic bacteria, or where the patient decides they dislike the color of the restoration, it can be removed using hydrokinetic laser energy, then cleaned or customized and recemented. There is no need to remake the case, thereby



Figure 15: One-year postoperative retracted view. Note that some gingival rebounding has occurred.



Figure 16: Alternate one-year postoperative close-up view of the recemented crown restoration.

saving the patient, dentist, and laboratory time, discomfort, and major financial implications.

It appears that this exact technique will be successful only when the laser light energy can penetrate the restoration to the cement interface.

It should be noted that unlike conventional frictional methods of tooth structure removal, the laser described combines laser light energy with a water spray that most often provides the ability to perform dental procedures, such as caries removal, without discomfort, negating the need to administer local anesthetic. However, because this patient presented with unusual circumstances, local anesthetic was ad-

ministered due to a combination of low pain threshold and high anxiety level.⁵ (Note: I have since used this technique successfully without local anesthesia to remove a veneer undamaged for a patient who had been referred by another practitioner after the patient herself had recemented the veneer using cyanoacrylate glue as an emergency measure.)

Finally, it appears that this exact technique will be successful only when the laser light energy can penetrate the restoration to the cement interface. This technique has been unsuccessful for removing a zirconia-based crown; it is assumed that it would not be successful for removing other cored or very thick restorations. Further studies are recommended.

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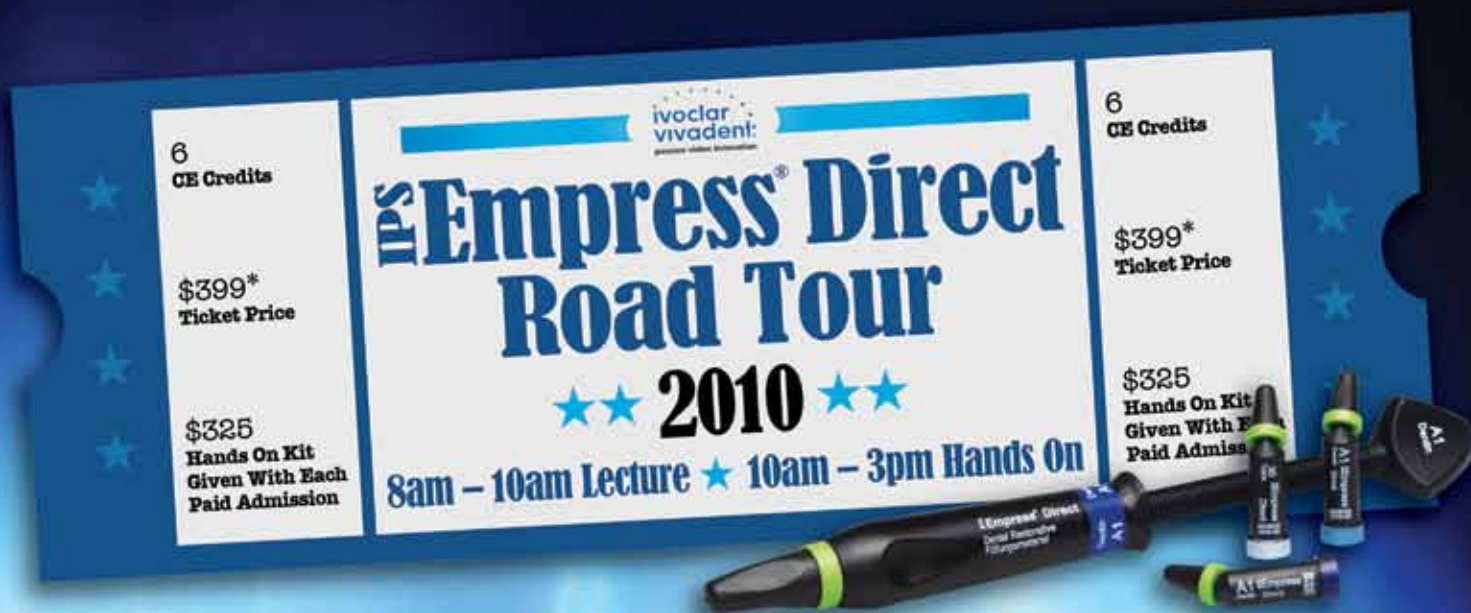
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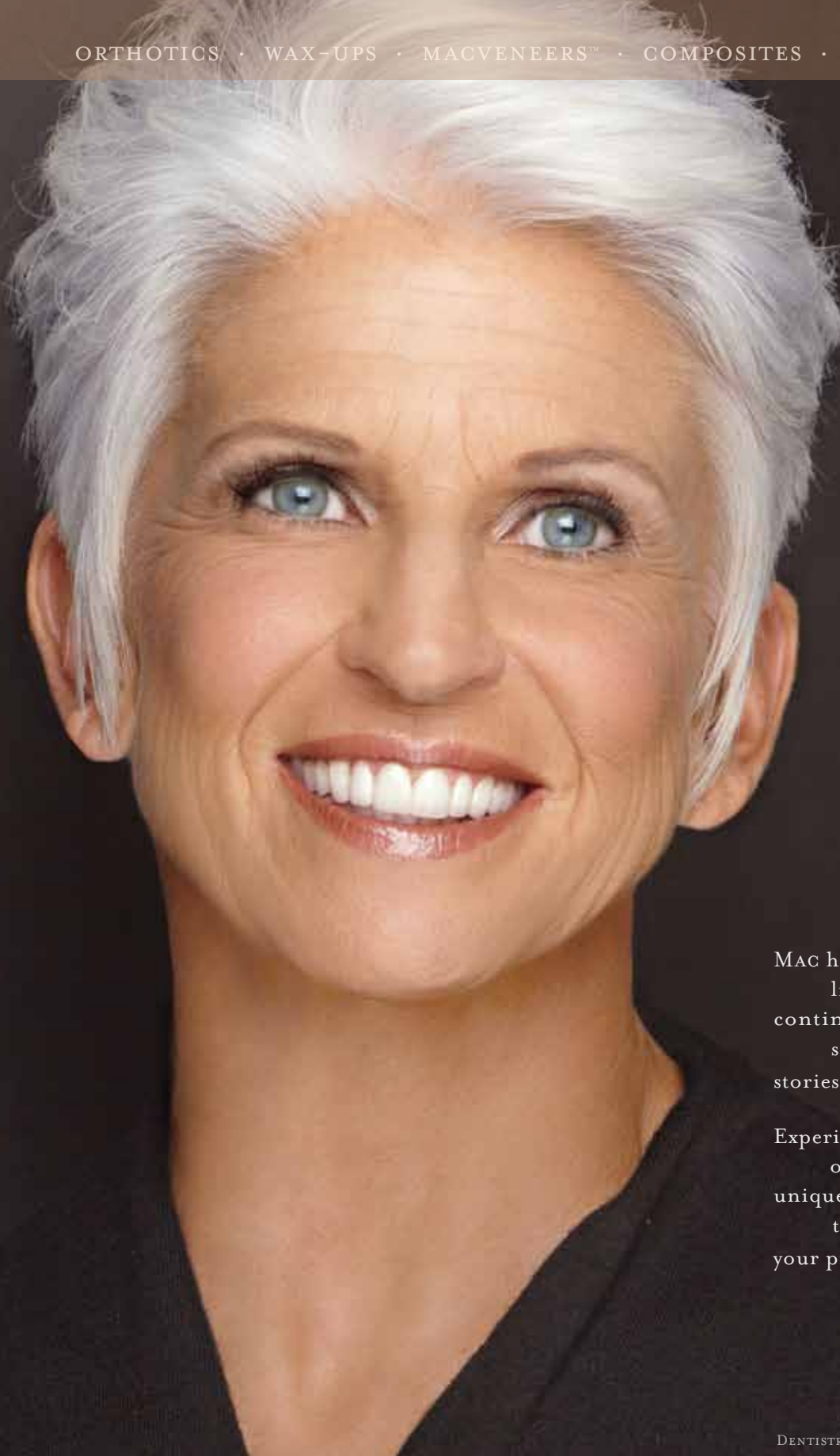
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